PaKSoM
2021

Proceedings of the
3rd Virtual International Conference
Path to a Knowledge Society-
Managing Risks and Innovation

Editors:
Stanković, M. and Nikolić, V.

November 15-16, 2021

PaKSoM 2021

3rd Virtual International Conference
Path to a Knowledge Society-Managing Risks and
Innovation

Proceedings

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Serbia, Niš, November 15-16, 2021

Editors:
Prof. Dr. Miomir Stanković and Prof. Dr. Vesna Nikolić
Technical Editor:
Dr. Lazar Z. Velimirović

Published by:
Complex System Research Centre, Niš, Serbia, and
Mathematical Institute of the Serbian Academy of Sciences and Arts

Printed by:
Copy House, Niš, Serbia

Number of copies printed: 100
The publishing year: 2022

Printing of this edition has been financially supported by
Serbian Ministry of Education, Science and Technological Development

PaKSoM 2021

3rd Virtual International Conference
Path to a Knowledge Society-Managing Risks
and Innovation

Organizer:
Mathematical Institute of the Serbian Academy of Sciences and Arts

Co-organizers:
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Table of Contents

Intellectual Capital and Performance of Non-profit Organizations

Bojan Krstić[1], Tamara Rađenović[2], Milica Jovanović[3]

[1]Faculty of Economics, University of Niš, Niš, Serbia
[2]Faculty of Occupational Safety, University of Niš, Niš, Serbia
[3]Innovation Center, University of Niš, Niš, Serbia

[1]bojan.krstic@eknfak.ni.ac.rs, [2]tamara.radjenovic@znrfak.ni.ac.rs, [3]jovanovicmilicaa90@mail.com

Abstract—**Non-profit organizations (NPOs) are focused on providing public services, which is why they are faced with certain specifics in their business, but also challenges in modern business conditions. Given contemporary challenges, NPOs need to adopt modern approaches and concepts. In this regard, NPOs are finding ways to identify and manage intangible assets as a key source of competitive advantage in the modern world. The aim of this paper is to point out the role of intellectual capital in the business of NPOs and to shed light on the impact of these intangible assets on the business performance of these organizations.**

Keywords – intellectual capital, management, non-profit organizations

I. Introduction

The non-profit sector is a set of organizations that meet several criteria: a) have an institutional presence and structure, b) are institutionally separate from the government, c) have a non-profit goal, d) self-government and a certain degree of voluntariness justifies the often used alternative term "voluntary sector" [1]. Before 1980, the backbone of the government in the provision of social services were NPOs (non-profits), which, in turn, enjoyed a kind of monopoly by gaining financial support through government donations [2]. However, from then until today, the non-profit sector has been subject to a number of changes that, among other things, have affected the interaction among NPOs, as well as their interaction with other organizations (public and profit sector) through public-private partnerships and other business contracts [3].

NPOs typically operate in a highly competitive environment characterized by increased and increasingly sophisticated demand for their services, the inclusion of the profit-oriented sector (profit sector) in their businesses, and increasingly rigorous state funding conditions. Thus, the management of the non-profit sector has become more complex. The competitive environment has forced NPOs to adapt existing management approaches and concepts, but also to adopt new ones in order to achieve the desired competitiveness, sustainability, and stability. This has encouraged these organizations to adopt the concept of intellectual capital management in order to strengthen their competitiveness. These organizations need to effectively manage their human and other intellectual resources because they are the key to innovation. Also, they need to measure the effects of the use of intellectual resources with an appropriate performance measurement system.

Unlike profit management techniques, intellectual capital in NPOs shifts the strategic focus to intangible resources, such as knowledge, skills, and competencies. This means that the realized strategic activities of a NPO will be stimulated by internal factors (intellectual resources), and not exclusively or predominantly by external factors (provided financial resources). Intellectual capital can easily fit into the essence of the functioning of a NPO, where the main goals are social, not economic (profit).

The primary purpose of commercial (profit-oriented) and NPOs differs significantly. It is reflected in the acquisition of profit, the increase in the wealth of owners, and, in the case of NPOs, in the provision of public services. Another differentiating feature of NPOs is that they cannot distribute their profits in the same way as commercial (profit) organizations do. The entire surplus of revenues over expenditures, they reinvest in their business (activities) in order to achieve the basic purpose of existence and their strategic goals.

The non-profit sector includes several organizational forms - social enterprises (SEs), non-governmental organizations (NGOs), associations and cooperatives in order to achieve something other than profit maximization [4]. The term NPO does not mean that these organizations are legally prohibited from making a profit (surplus), but its distribution is prohibited - a distribution that does not direct the surplus to their development, but to the personal consumption of employees and management. They operate as commercial businesses in order to satisfy specific social objectives of a certain group of beneficiaries [5]. In addition, these organizations are increasingly considering the social and environmental effects of their business [6]. It means that they need to meet expectations of wide range of internal stakeholders with potentially conflicting interests, as well as public expectations [7]. On the other hand, financial responsibility and economic sustainability are necessary prerequisites in order to accomplish the institutional mission [8].

The activities of these organizations are influenced by almost every human need or interest of society. The non-profit sector, therefore, includes various organizations that perform a very wide range of "jobs" or "programs" of public and private character. In the local and more widely understood community, there are a large number of non-profit activities aimed at providing certain services to members of society.

NPOs are differentiated based on the source of funds with which they do business, i.e. finance. Unlike commercial (profit-oriented) companies, which mainly generate income from the sale of products and services, the income of NPOs is generated from two sources. The first source is voluntary contributions from individuals (donors) or institutions (sponsors), and the second source is the sale of goods and services to customers. Unlike profit companies, which in terms of revenue, depend only on the customers of their products and services, NPOs generally depend on certain benefits - contributions (membership fees). According to the sources of funds, there are donor, donor-commercial, as well as commercial-donor NPOs. The non-profit sector encompasses a variety of organizations, ranging from charities, religious organizations, educational and research organizations, and many others. However, NPOs cannot operate at a loss (deficit) for a long period of time, which indicates that they, as well as commercial ones, should take into account revenues and expenditures, as well as cash inflows and outflows, because they are limited by funds provided by financiers - sponsors or donors. They also need to effectively manage the funds given to them, as well as the allocated assets they manage in order to fulfill their social role [9].

NPOs are based mainly on people, i.e. on their human capital, but also on other intellectual resources, which are mostly based on human resources. The unique characteristics of these organizations and the determinants of the modern environment indicate that human resources should be strategically focused on the creation, maintenance and use of organizational and individual knowledge in order for these organizations to be sustainable in a competitive environment. In other words, knowledge and learning activities, which facilitate and provide the basis for creating and realizing innovations, should become a key part of strategies and practices for managing human and other intellectual resources in modern NPOs.

III. IMPORTANCE OF INTELLECTUAL CAPITAL FOR NON-PROFIT ORGANIZATIONS

Intellectual resources as intangible assets of the organization are rare, valuable, difficult to imitate, non-substitutive resources. In addition, they depend on the context [10]. Bearing in mind that intellectual assets are based on the knowledge of people in organization, knowledge included in organizational routines and network relationships, it is applicable to any organization, whether it is profit-oriented or non-profit [11].

Intellectual capital emphasizes the creativity and innovation of the members of the organization, so that it supports the perspective

of intellectual performance as a carrier of growth of non-financial results, and then financial ones [12]. Therefore, intellectual capital can easily fit into the essence of the functioning of a NPO, where the main goals are social, not economic (profit). Unlike profit-oriented management techniques, the threat to the identity of a NPO can be prevented if a very useful, practical and current concept of intellectual capital is incorporated into their management practice.

Nick Bontis [13] emphasizes that intellectual capital consists of human capital (human intellect), structural capital (organizational routine), and client capital (market relations). Therefore, intellectual capital in NPOs includes three primary components - human, structural and relational capital, which are so connected to enhance the creativity and innovation of members of the organization, while supporting the development of the intangible perspective of the organization [14]. Human capital is based on the people within the organization. The quality of this segment of intellectual capital depends on employees and their competencies. Structural capital implies internal organizational connections and organizational routines. Capital of clients (consumers) - relational capital includes external relations of the organization. The quality of these intangible assets depends on the longevity of the relationship that the organization creates with its external stakeholders [13].

Bearing in mind that NPOs are labor-intensive and that the quality of services provided will depend on the quality of human resources, human capital management plays an important role for these organizations. This means that efficient human capital management is a key prerequisite for the superior performance of NPOs. The ability of a NPO to fulfill its mission will depend on this segment of intellectual capital [15].

In NPOs, structural capital is important because these organizations are created to meet the needs of a certain group of people with limited financial resources. In this context, the culture of some NPOs is designed around service delivery rather than strategic issues. Namely, often NPOs are focused on the efficiency and effectiveness of service delivery, and not on strategic knowledge management, so they insufficiently create the necessary new knowledge and use existing ones inefficiently. NPOs should not only acquire new knowledge,

but also eliminate knowledge that is outdated. Knowledge and organizational culture are fundamental, they function as an efficient, coordinated mechanism that provides human resources with a strong organizational identity, leadership style, orientation to employee development [16].

In order to create social value, which is their primary goal, NPOs must have the ability to develop an innovation strategy [17], which is seen as a part of structural intellectual capital. The study indicates that structural capital dominantly affects sustainability of NPOs compared to human and relational capital, having in mind that organizational routines, databases, software, procedures are in the possession of the organization [18].

Structural capital consists of innovation capital and organizational capital [19].

Organizational capital has a particularly important role in NPOs as it includes, among other things, organizational culture, values and mission, which will determine what kind of relationships organizations will build with external and internal stakeholders [20].

Innovation in non-profits is tied to their ability to introduce new services and processes that lead to increased business performance and competitiveness of NPOs. It is also important for these organizations to survive in a competitive environment. These innovations are the result of new knowledge, i.e. intellectual capital. Knowledge creation, development, and growth of intellectual capital and the process of continuous learning of NPOs takes place through effective and efficient execution of tasks (processes), quality assessment of achieved performance and continuous improvement of relations with key stakeholders. Therefore, these organizations need to effectively manage their human and other intellectual resources because they are the key to innovation, but also to measure the effects of their use with an appropriate performance measurement system [21]. In NPOs, innovation is seen as the capacity to develop new services that can satisfy different needs of end users [22].

Relational capital of NPOs can be viewed through relationships with the following stakeholders: 1) community, 2) environment, 3) suppliers, 4) customers, 5) financial institutions, 6) public institutions, 7) partners, 8) web presence, 9) institutional meetings, 10)

networks, 11) investigating external partners [23]. Relationships with stakeholders provide non-profits new resources, innovative abilities and new opportunities for social and economic well-being [24]. Creating long-term relations with stakeholders encourages productivity of employees and volunteers, relationships of trust and loyalty, knowledge sharing and improved competencies. Taking into account the nature of the functioning of these organizations, NPOs maintain various intensive relationships with: other non-profits, government agencies and institutions, with government agencies, business corporations and associations, potential donors, employees, volunteers, and end users. All this indicates the diversity and importance of the elements of relational capital in NPOs. The stronger these relationships with external stakeholders, the greater the opportunities for mutual exchange of information and resources, thus creating opportunities for improving organizational performance [25].

Research highlights that human capital has a key role for social and financial performance of non-profits. In addition, relational capital influences social performance, highlighting the importance of relationships' quality with stakeholders. The single elements of intellectual capital interact with each other, activating a circle that encourages the intellectual capital development [26].

Managing intellectual capital and determining the combination of key components that are specific to a particular NPO allows for mitigating the problem of limited resources and creating value in these organizations [27]. The model of managing human resources, intellectual capital and performance of organizations emphasizes that human resource management practices affect intellectual capital (human, structural and relational), and that these resources significantly affect the financial and non-financial performance of an NPO [28].

NPOs are an integral environment of the context of the knowledge society. There are many foundations that lead to the development of a knowledge-based society, which are equally important for NPOs. They are based on: improving the process of codification of knowledge and application of new technologies; strengthening the links between economic and scientific-research processes; increasing the level of innovation and continuous learning, attaching greater importance to improving the

quality of education, as well as the focus on growing efficiency in the use of intellectual capital as a key resource in the era of knowledge economy.

Managing all resources of NPOs, especially intangible ones, enables the fulfillment of the organizational mission, long-term survival and sustainability. Intellectual capital management is a managerial approach to measure sustainability of non-profits [18].

IV. Intellectual Performance Management in Non-profit Sector

Managers in NPOs should choose, in accordance with the specifics of organizations, the concept of intellectual capital and the meaning of intellectual asset for their organizations. The benefits of managing and reporting on intellectual capital in NPOs can be observed based on the number of investors or donors attracted due to successful management of intangible assets, but also in the form of internal benefits from the management of these valuable assets [29]. In this way, more efficient management of the entire resources of the organization is provided.

The main impact of changes faced by modern NPOs was reflected in the introduction of 'new public management', which was a kind of program of reforms in the public sector, with the aim of its reconstruction according to the principles and practices of the private sector [30]. However, this has also significantly changed the core values, management approaches, practices and methods that traditionally characterized the non-profit sector [31]. There are two important assumptions in the new public management. First, market efficiency and the importance of competition for the strategy of improving the future performance of the organization are assumed. Second, as a concept, the new public management emphasizes that profit-making management practices and technologies are superior (more efficient) than those in the public sector. However, management is a generic set of practices, methods and techniques, which can be transferred and used in different sectors. The new public management requires entrepreneurial leaders who emphasize efficiency, economy and effectiveness [32]. The driving force of the new public management, in the 1980s, was the transfer of joint functions to NPOs, which were previously performed by various and numerous state agencies, organizations and institutions. The need for this existed due to the dominant

attitude that not all state organizations (agencies) are able to most adequately meet the requirements of the client and the public. This has resulted in a large increase in the number, but also in the volume of activities of NPOs. Since the number and scope of activities of these organizations have significantly increased in the meantime, they also compete with each other for resources (volunteers, employees, financial resources).

Although profit management techniques were considered superior, the term "management" was often not seen affirmatively by people who were part of the non-profit sector, as it meant business, while those involved were proud to be "free" of commercialism [33]. However, NPOs often "share territory" with profit-oriented organizations, sometimes as competitors and sometimes as associates [34]. NPOs no longer enjoy a monopoly as the only service provider in the non-profit sector, but compete for limited resources and state support with profit-oriented organizations.

As profit-oriented organizations provide more and more social services, and NPOs act as profit ones, the gap between these organizations is narrowed [35]. Therefore, there is a growing emphasis on the application of profit management practices and concepts in NPOs that encourage effectiveness and efficiency. Namely, NPOs today are increasingly forced to adopt control, monitoring and evaluation processes, business process reengineering, quality management systems, benchmarking and other techniques, because they are responsible for financial resources which they spend on providing public services [3].

Due to differences with the profit sector, it would not be wise for managers of a NPO to adopt a management technique without carefully assessing its validity, usefulness, and efficiency [36]. In fact, management techniques in the profit-oriented sector, if applied incorrectly, can lead to changing goals and irrational spending of resources, which can create a serious threat to the identity of an NPO. And what is even more problematic, management techniques characteristic for the profit-oriented sector can lead to poor choices of strategic priorities in NPOs. Such elections could jeopardize NPOs, because they are forced to adapt and abandon those directions of action that would enable them to improve the demands of society through their actions [34]. It is therefore wrong to assume that

profit-oriented management techniques could or should simply be "copied" by non-profits, without a critical analysis of their adequacy for the non-profit sector. Strategic management techniques enable NPOs to keep the focus on their core value, mission, identity, uniqueness, and at the same time, build their capabilities and competencies, to improve their business and social responsibility performance, while constantly providing relevant information to key stakeholders.

Intellectual capital management is an important strategic technique in the process of managing the overall performance of NPOs. Intellectual capital is also recognized as an important resource that an organization needs to develop in order to gain and maintain a competitive advantage. Intellectual capital is especially important for NPOs because it is a source of future innovation and strategic business transformation [37]. Managing NPOs is different and more demanding than in profit-oriented or public organizations. In addition, the management of human and other intellectual resources is complicated because more special knowledge and skills are required to effectively manage the combination of employees and volunteers in NPOs, as well as all other elements of intellectual capital [38].

Intellectual capital management in NPOs requires three phases: 1) determining the strategic elements of the organization's intellectual capital; 2) defining appropriate indicators for measuring and monitoring determined components of intellectual capital; and 3) incorporate an intellectual capital management system into organizational routines [23].

The structure of human resources in NPOs is more complex than those in profit ones and also requires highly qualified managers. There are two different categories: volunteers and paid workers on the basis of employment contracts. It is important for managers to be able to manage these categories of workforce so that they coexist harmoniously in the execution of activities. It is especially important to manage volunteers who work for an NPO. In fact, they do not cost an organization and they work motivated and guided by an ethical, personal goal. In the non-profit sector, the work of certain specific categories is often used (such as the disabled, young people without jobs, etc.).

There are several strategic benefits that come from managing the intellectual performance of non-profits (Fig. 1):

- Knowledge flows inside and outside the organization and helps to maximize the value creation process. IC (intellectual capital) components maintain and transfer knowledge, and interact in order to properly allocate resources for commercial and social objectives (C&S);

- The IC framework (Human capital – HC; Structural capital – SC; Relational capital - RC) provides a better understanding of the flow of strategic resources and leads to improved strategic planning;

- A joint strategic plan that takes into account the core value of the organization helps to achieve strategic alignment between the performance of the organization and the value creation process [39].

Knowledge, as well as organizational culture, helps in the relationship between internal and external stakeholders. Adequate management of relationships with multiple stakeholder groups with different expectations contributes to the improvement of communication channels between NPOs and their stakeholders [16].

Research shows that there is a direct relationship between the human and relational capital of these organizations. This means that organizations with developed skills and previous work experience, i.e. with quality human capital, have developed skills for creating quality relationships with local and global stakeholders (relational intellectual capital) [27]. Relational capital has a particularly important role in NPOs because they function primarily on the basis of external funding, volunteer support, and public

trust. Therefore, it is necessary to effectively manage this component of intellectual capital, in order to avoid the loss of valuable external relational resources that are created through relationships with stakeholders, and then the loss of financial resources of donors and sponsors. Reputation, as a key segment of relational capital, is the cornerstone of these organizations.

In addition to this, it is important to increase investments in intangible assets. The increased importance of innovation, as well as more efficient growth of investment in intellectual capital, create new foundations for greater competitiveness of NPOs.

Intellectual capital is an important strategic tool for defining the direction in relation to the organizational mission and goals in NPOs. Intellectual capital not only enables non-profits to build their values, identity, and maintain uniqueness, but also helps them focus on strategic priorities by highlighting perspectives on intangible resources and non-financial performance relevant to future competitive success.

Figure 1.   IC framework for NPO

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Do the Expectations of University Students Reflect the Reality of the Labour Market in Slovakia?

Lucia Bartková[1], Marianna Šramková[2]

[1,2]Institute of managerial systems, Faculty of Economics, Marej Bel University,
Francisciho 910/8, 058 01 Poprad, Slovak Republic

[1]lucia.bartkova@umb.sk, [2]marianna.sramkova@umb.sk

Abstract—**The paper deals with the expectations of students of the Faculty of Economics of the Matej Bel University in Banská Bystrica, Slovakia, regarding wages, remuneration and forms of work in Slovakia. The aim was to find out how much the students' expectations reflect reality. The starting point was the research of secondary data on the labour market in Slovakia and own empirical primary research carried out on a sample of 132 students. The information was collected through a questionnaire. As follows from the results of research, future graduates have unrealistic and overestimated expectations, especially in terms of wages and remuneration for work and their gender equality, which need to be adjusted until entering the labour market. In terms of the form of work, they demand more freedom and a change in the organization of work and the system of remuneration of performances, which needs to be adapted by employers.**

Keywords - human sources, salary, remuneration, home work

I. INTRODUCTION

The position of man in the work process has been formed for several centuries, from the perception of man as a work unit, a component that can be replaced at any time, to a person integrated into the work process. Work is not just a means of subsistence now it satisfies higher needs. A quality employee is gradually becoming an integral part of achieving organizational goals, the prosperity of the company in the market and requires due attention. On the other hand, even an employee is no longer just a "simple contractor", but also has certain requirements, expectations, and ideas to be loyal to the organization and to deliver the required performance. In practice, we often encounter a corporate strategy aimed at choosing the right new employee and its benefits for society, but less attention is paid to the needs, interests, and expectations of the employee in the work process itself.

II. THEORETICAL BACKGROUND

The functioning of organizations and companies depends on employees, so human resource management is an integral part of the management of any company. Human resources become a key resource and the most important asset of the organization because people decide about the provision, distribution, use and development of all other resources (financial, material or information) and their skills and motivation to work contribute to achieving strategic goals of the organization [1]. On the other hand, appropriate care about employees is the core of corporate social responsibility [2]. We can define human resource management as an activity whose attention is focused on employees and which, together with other functional areas of management, contributes to achieving the goals of employees and the company in order to gain competitive advantage [3]. The aim of human resource management is to achieve a competitive advantage through the strategic deployment of capable and dedicated employees, based on an integrated system of cultural and personnel practices [4-7]. Fulfilling this main goal also requires considering the requirements and influences of the society in which the

company operates, while minimizing their potential negative impact. Assistance to employees in achieving their personal goals is also expected, especially if these goals affect their performance and satisfaction [8]. Effective performance of basic human resource management tasks requires a wide variety of different activities known as personnel functions, and flexibility in management [9]. These functions fulfil the content of human resource management, which is changing dynamically. This is reflected in various approaches to the development of individual activities, as well as their practical application [10]. The differences concern both the substantive content of the individual functions and the range of human resources management. In our article, we mainly focus on the function of remuneration and subsequently on the forms of work.

Remuneration refers to wages, salaries, or other additional forms of monetary compensation as well as various non-monetary and intangible remuneration that the employee receives as a compensation for the performed work [8]. The remuneration system consists of interrelated policies, processes and procedures of the organization towards employees according to their contribution, responsibility, ability and market value. From the point of view of employees, the remuneration system should treat them as a stakeholder and partners, meet their expectations, ensure that they are treated fairly and be familiar with the remuneration policy in the organization [11]. Authors Livian and Pražská defined three basic divisions in the remuneration system [12]:

- direct monetary remuneration – wages/salary, including various supplements and wage benefits, bonuses, remuneration and commissions,

- indirect monetary remuneration – employee shares, insurance, loans provided to employees of the company, food allowances, clothing,

- non-monetary remuneration – provision of a company car and telephone, various social benefits, services (use of recreational facilities, various forms of consulting, childcare, etc.).

Among the forms of remuneration that the company provides to employees only for performance for the company are employee benefits.

TABLE I.   EXTERNAL AND INTERNAL FACTORS INFLUENCING THE SYSTEM OF REMUNERATION.

External factors	Internal factors
economic situation	size of a company and sector where it operates
situation on the labour market	work conditions, required qualifications, degree of responsibility
degree of competition	performance, personal potential of employees
legislative restrictions	experiences
social habits and expectations	seniority

Each organization or country can differentiate these benefits in different ways. In Europe, employee benefits are mainly divided into three groups [13]:

- benefits of a social nature (pensions provided by the organization, life insurance paid in full or in part by the organization, loans and loan guarantees, nurseries),

- benefits related to work (meals, more advantageous sale of the organization's product to employees, education paid by the organization),

- benefits associated with position in the organization (company car, business mobile, entitlement to clothing and other costs of representation of the organization, free accommodation).

The creation of a remuneration system for a particular company is influenced by several factors from internal and external environment of the organization, as illustrated in Table 1.

Other benefits that employers can provide to their employees include flexible working hours. The Slovak Labour Code characterizes working time as a period of time in which the employee is available to the employer, performs work and performs duties in accordance with the employment contract [14]. Flexible working time is a way of distributing working time evenly or unevenly. The employer may introduce it by collective agreement or in agreement with the employees' representatives. Within the framework of flexible working hours, there are set the so-called basic working hours, when the employee is obliged to be at the workplace. Optional working time is the time when the employee does not have to be at the workplace if he or she has worked time. It is a very popular corporate benefit that helps employees reconcile their personal and professional lives.

According to the Slovak Labour Code, the employer may agree with the employee on a different, shorter working time than the normal weekly working time. As a result, the employee works less per day, but at the same time, he or she is still employed on a permanent basis. The Code also regulates that such an employee should not be favoured or discriminated in comparison with another employee with regular full-time work. However, part-time work in Slovak Republic is not as common as in other EU countries. Only about 4% of all employed people have part-time work. It is incomparable e.g. with the Netherlands, where about 50% of all workers are employed in this way. Part-time work is typical especially for women, who thus have more time to take care of children and the household in addition to work. Moreover, students who do not yet have the opportunity to work full time due to study obligations often use it. For them, flexible work means the opportunity to devote themselves to other activities and hobbies besides studying and working [15]. The reason why so few Slovaks use the possibility of part-time work are low wages and often the inability to support oneself and one's family with part-time job salary. It is no coincidence that in economically developed countries with a high average wage, there are several times more people employed part-time.

Recently, the employee can also use a specific type of work, in Slovakia so-called home work (home office or remote work). It is a type of work that is not tied to the employer's workplace, but to another agreed place of work, most often the employee's residence, throughout the working hours. The Slovak Labour Code defines such type of work and distinguishes work from home (home work) and telework. Home work is work performed by an employee for the employer under the conditions agreed in the employment contract at home or at another agreed place. Such place is called remote workplace. Telework means work according to the conditions agreed in the employment contract at home or at another agreed place using information technology (teleworking) during working hours, which the employee most often schedules himself. Home work or teleworking is not considered as work performed by the employee occasionally or in exceptional circumstances by the employer's consent or, in agreement with him. It is work performed permanently from remote workplace.

There is also occasional work from home (so-called temporary home office). This is work from home, which, unlike home work, is not regular. The employee performs it from home only occasionally (e.g. two days a week) or in extraordinary circumstances (e.g. very bad weather), either with the permission of the employer or in agreement with him. Employers often offer to their employees the opportunity to work from home occasionally as a corporate benefit. Such a home office may be stipulated, for example, in a collective agreement or may be agreed with the employee individually within the employment relationship by an amendment to the employment contract. In such a case, it is a standard employment relationship performed at the workplace (as the place of work is the employer's workplace specified in the employment contract) with the benefit of occasional work from home (the employee's household is mentioned as the place of work in the supplement to the employment contract). Of course, such a way of working can be agreed only for some professions, especially those that do not require the presence of an employee at the workplace [15].

However, more attention should be paid to the needs, interests and expectations of the employee in the work process. Employees are the most important asset of the organization and the strongest stakeholder in relation to the organization at the same time [16]. Also, HRM should be proactive and therefore strategic: it concerns itself with soliciting higher forms of employee commitment and motivation [17]. Therefore, meeting the needs of employees is the most appropriate practice because quality of the HRM counts rather than the quantity [18].

III. RESEARCH AND DISCUSSION

The aim of the primary empirical research was to find out what salary, remuneration and form of work are expected by university students. We conducted the research on a sample of 132 respondents, which consisted of students of the affiliated department of Faculty of Economics – Institute of Management Systems in Poprad, Slovakia. A questionnaire containing 16 questions distributed to respondents in September 2021 was used as the research method.

According to the research, most respondents already have experience with employment, 96% of respondents have already worked during their studies. That experience and practice are

required in the job offers of companies from applicants, even from recent school graduates, very often. Therefore, it is positive that students already have such experience at university. An amendment to the Labour Code applies in Slovakia legalizes companies to employ temporary workers from the age of 15. However, as follows from the data of the job portal Profesia.sk, the offer of brigades suitable for high school and university students decreased in 2020. While in the years 2017-2019 the offer exceeded 5400 advertisements, in 2020 the brigade concerned only 3584 offers [19]. Although there are fewer opportunities in the labour market, it is important for students to gain work experience during their studies, as this is one of the basic requirements placed by employers on jobseekers.

In the research, we focused on what salary future graduates expect. Respondents stated that they expect an average net salary of € 1.050. As follows from the analysis of the portal Platy.sk [20], the Slovak median gross salary in 2020 was 1.081 euros. This means that the exact half of Slovaks have a basic salary less than 830 euros in net (if they have no children and claim a non-taxable part of the tax base). Given these data, university students and future graduates will have to adjust their salary expectations at the moment of entering the labour market and initially be satisfied with lower wage conditions. On the other hand, the most common reason for termination of employment by employees in the Slovak Republic is dissatisfaction with salary [21]. Therefore, a dialogue between the candidate and the employer about expectations of salary and its progress on both sides is appropriate.

At the same time, the majority of respondents (54%) expect that the salaries of men and women will be balanced. However, students expecting balanced salaries will also have to adjust their expectations. A joint analysis of the portals Platy.sk and Profesia.sk reveals that while the total average gross salary of women in 2020 was € 1.230, the total average gross salary of men in 2020 reached 24.6% more, namely € 1.632 [22]. These differences are due to several factors. Women are often employed in sectors such as health care and social work, education, but also others, which are remunerated below average in Slovakia. Another factor that affects the pay gap between women and men is maternity leave. In Slovak Republic, the care of a newborn baby is almost always on the mother. While women have been on maternity leave for several years, their

male colleagues are gaining experience in working life, which is often linked to salary progress. However, women often ask for less money in job interviews. The reason may be a lower initiative, women often have less self-confidence in the labour market and salary negotiations make them a bigger problem. Knowing these facts can help today's students and future graduates prepare for this fact and prepare a better negotiating position for a job interview.

When preparing for wage negotiations, it is good to be aware of some things [23]. It is important to determine person's value, find out the average salary in a particular position and prepare a specific number that a person will require, ideally range of the salary. Various wage comparators can be used to determine the average wage in a specific position. When the candidate accepts an offer with lower salary than he or she expect, he or she should communicate openly with the employer and, if necessary, agree on a date when both will consult the salary amount on the basis of mutual satisfaction. The candidate's self-confident appearance and adequate body language are also important.

Rewards are also related to financial valuation. As many as 80% of the respondents in primary research stated that they expect to receive year-end remuneration in their future employment. At the same time, 33% of respondents expect to receive gifts from their employer (e.g. for birthdays). As another form of employee benefits, respondents in our primary research expect a business phone (56%), a business computer (55%), a company car (31%), a good job position, vocational training, food, accommodation, or transport to work.

For comparison, a survey of the portal Platy.sk on a sample of 1.314 respondents in December 2020 focused on year-end rewards, the thirteenth or fourteenth salary, vouchers for purchases or a nonfinancial gift [24]. The results of the survey showed that 21% of employees receive the year-end remuneration, less than 14% have the thirteenth salary and less than 9% the fourteenth salary. However, the majority of respondents (28.2%) did not receive any rewards. The mentioned financial benefits are most widespread among people who work for private foreign corporations. Most in sector of management, production and finance and accounting. Employees in the trade mainly obtain year-end nonfinancial gifts or vouchers.

Almost 19% of respondents in the secondary research said that financial rewards had decreased compared to the previous year – they got reduced rewards or they did not get any reward at all. Only less than 5% of people answered that financial rewards increased in 2020 according to 2019. The rest did not change. Again, we can say that university students' expectations for year-end rewards are too high and will have to be adjusted when entering the market, as based on practical results we can see that year-end rewards are not automatic and even decrease over time.

As for the form of work, most of the respondents we surveyed will look for a full-time job, but 26%, which is almost a third of the respondents, will also look for a part-time job. People who are unable to guarantee employers eight hours of work five days a week are interested in part-time work. As follows from the data published on the job portal Profesia.sk, until the onset of the pandemic, the share of more flexible offers increased slightly year-on-year [25]. However, in the first half of 2021, the number of part-time offers reached only one third of the first half of previous year. Among the individual sectors, in 2021 the most part-time opportunities were in trade, administration, ancillary works, transport and forwarding, and in gastronomy.

However, employers still prefer the traditional course and organization of work - they evaluate better those employees who work the usual eight hours than those who are able to achieve the same or comparable (and often better) work results in a shorter time. On the other hand, part-time workers are still disadvantaged [26]. For example, in the case of two part-time jobs, the employee pays higher contributions than if he or she had paid them from one salary per full-time job. The disadvantage of part-time work is also the loss of career prospects or access to social benefits that the employer provides to its employees. For part-time work of less than 15 hours per week, for example, it is also possible to terminate the contract without giving reasons and the notice period in these types of employment is 30 days. Despite the relatively low level of protection compared to an employee working more than 15 hours a week, entitlement to severance pay is assessed in the same way as for other employees. It is therefore important to take steps by the state and amend the Labour Code to make the form of part-time employment more attractive, both on the part of employers and on the part of job seekers [15,27].

According to the results of our primary research, 57% of respondents expect flexible working hours from their future employment as well as one-shift operation (up to 93%). At the same time, we can state that more than half of the respondents (59%) expect to be able to work from home as a graduate.

As follows from the analysis of secondary data, the number of job offers in Slovakia that do not require coming to work at all is growing. In the second quarter of 2019, the job portal Profesia.sk registered 134 job offers that did not require coming to the workplace. Of the total supply, this number represented approximately 0.2%. However, the situation has changed significantly as a result of the pandemic. In the same period of 2021, there are 13 times more such offers. Employers published 1777 telework offers in the second quarter, it is 2.2%. These were not advertisements that provided the opportunity to work some days from home, but permanent home work, which did not require coming to the workplace at all [28]. These are most often IT jobs, followed by telecommunications, translation, marketing and journalism. The higher number of offers for telework is also complemented by the offer of work not tied to one place, but with the possibility to work from home sometimes. While before the pandemic there were about 7% of such offers, in the first quarter of 2021 it was 13.4% [29].

On the other hand, as follows from the analysis of secondary data, most employees do not require full remote work, rather they consider partial, respectively hybrid form [30]. They demand more freedom and flexibility from employers, including in working time, work organization and remuneration systems in terms of a greater focus on results than on time spent at work. However, remote work creates new needs of employees' self-development, especially in the field of self-management (time management, stress management, wellbeing), digital skills, communication and building interpersonal relationships, building flexibility and adaptability to change, cognitive skills development (problem solving, creativity, flexible thinking) and language skills [31]. At the same time, employees expect that their employers will meet their needs, and some

employers have already started to provide a contribution to support work from home.

IV. CONCLUSIONS

The aim of the primary empirical research was to find out what salary, remuneration and form of work are university students expect. According to the results of the research, most students have already worked during their studies at the university, what is a positive fact because the requirement of experience and practice is one of the basic requirements in the offers of employers.

Regarding wages and remuneration, based on the answers of the respondents in our research, we can state that their expectations are too high, which may cause them to be frustrated entering the labour market in the future. University students expect the net salary, which is a reality only in the Bratislava region (the richest region in Slovakia around the capital city). In the rest of the territory of the Slovak Republic, the median salary reaches the level of salary expected by respondents from the research, but in gross, not net as our respondents expect. As the analysis of the secondary data shows, even year-end remuneration is not actually awarded to the extent that future graduates expect. It is therefore important that students make an overview of real offers on the labour market while studying at university to correct their own expectations and demands for future employment.

We also see a deviation of the expectations of university students from reality regarding the issue of equal pay for men and women. More than half of students expect balanced salaries, which, however, does not correspond to reality, as men in Slovakia earn on average a quarter more than women. It is therefore important for female students to be aware of this fact and to prepare for the future wage negotiations in order to enter the labour market. They should already have information about the salaries offered by the organization at the time of job interview and information about the salaries that men have in the positions they are applying for. During the job interview, it is necessary to appeal to one's qualifications, expertise and skills. A candidate should not be defeated by manipulative questions about motherhood and career. As for the form of work, almost a third of respondents will look for a part-time job. The offer of such employment opportunities in Slovakia is growing, but only very slowly. We therefore recommend that the state should change the Labour Code that will make the form of part-time employment more attractive for both employers and employees.

Most of our respondents also expect the opportunity to work from home. The offer of full or partial remote work in Slovakia is growing, mainly due to a pandemic. It is questionable whether employers will continue to offer this form of work once the situation is resolved. According to secondary data, most employees do not even require full remote work, but rather a partial, hybrid form of work. It is important for them to balance work and leisure, focusing on the result instead of working time, building trust and more flexibility in the organization of work. It is therefore important for employers to review the system of organization and remuneration of work towards shifting more freedom and responsibility to employees in order to achieve satisfaction on both sides. Employers also should contribute to employees to deal with new needs connected with remote work. Based on the above, we can say that we have met the goal of the paper.

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Role and Relevance of Statistics in Data Mining Business Environment

Marina Milanović[1], Milan Stamenković[2]

[1,2]Faculty of Economics, University of Kragujevac, Kragujevac, Serbia

[1]milanovicm@kg.ac.rs, [2]m.stamenkovic@kg.ac.rs

Abstract – **The digital revolution in all segments of life and business has conditioned the accelerated creation, storage and flow of huge amounts of complex data and, at the same time, brought new challenges in terms of their transformation into useful knowledge. Consequently, one of the biggest changes in the sphere of modern economy, initiated, but also guided by technological development, refers to the growing role of data as a source of knowledge and, therefore, the basis for generating economic value. In truth, research and analysis of data, in function of extracting useful (and mostly hidden) knowledge from data, in the form of certain regularities regarding the nature, development tendencies and interrelations between economic phenomena, is not a novelty. However, the exponential growth of the available data requires the development of new scientific approaches and methodological frameworks for data search, processing and analysis, in order to fully exploit their potential. Starting from the fact that statistics traditionally deals with data analysis, in this paper, the importance of statistics, from the perspective of exploiting the potential of available data in a new, data mining environment, whose key definition is computer-aided work with large amounts of data, is pointed out. In addition, through the consideration of application dilemmas, the necessity of valid use of statistical methods in data mining research is emphasized.**

Keywords – data, statistics, data mining

I. INTRODUCTION

The modern world is characterized by extremely dynamic and unpredictable changes. The need for adapting to these changes has affirmed the role of knowledge as a critical factor in overall social and economic development. In such circumstances, the success of business systems, state institutions, national economies and, generally, the world economy is based on various forms of creation, maintenance, improvement, dissemination, and use of knowledge. In this sense, knowledge has the status of crucial strategic economic resource and a key source of competitive advantage. Accordingly, the modern economy, in which the long ago formulated statement of Francis Bacon – "Knowledge is power" is fully affirmed, is called economy based on knowledge.

It is a well-known fact that all spheres of human activity, over the last decades, have been strongly affected by the development and intensive application of information and communication technologies (ICT), which have transformed the economy at the macro and micro level. One of the biggest changes in the sphere of modern economy, initiated, but also led by ICT development, refers to the growing role of data as a source of knowledge and, therefore, the basis for generating economic value. In particular, technological progress, through automation and computerization of almost all processes and activities, has led to the creation and storage of huge amounts of multidimensional raw data and opened new possibilities in terms of their transformation into valuable information and useful knowledge.

Data have become an integral part of every economy, industry, organization, business function and life of individuals. Due to the significant participation of data in realization of business processes and consideration of the alternatives in decision making process, in the literature, the modern economy is often referred to as the data–driven economy. Namely, data are the center of development of the economy and knowledge society [1]. As resources, data are often compared and equated with gold and oil [2]. In 2011, the McKinsey Institute published a

report emphasizing the role of large amounts of data as a backbone for improving innovation, competitiveness and productivity [3]. McAffe & Brynjolfsson point out that, from the standpoint of improving business performance, data-based decisions are simply better than intuition-based decisions, so that data have the potential to revolutionize management in terms of spreading a new decision-making culture [4]. In other words, large amounts of data create great business opportunities.

However, in order for the benefits of owning and using large amounts of data to be truly and fully exploited, certain adjustments of real needs and analytical potentials (i.e. human abilities, knowledge and skills, as well as technological preconditions and capacities) are necessary for their processing and analysis. More precisely, rapid growth of available data has created the need for new methodological solutions that will enable research and discovery of meaning in large (often very heterogeneous) data sets through the extraction (often very small pieces) of useful information. Essentially, this problem can be expressed through the question: How to extract value (i.e., information or knowledge) from available data. As one of the possible solutions for overcoming the gap between the available amount of data and degree of their utilization, a multidisciplinary approach for understanding, searching, processing and analyzing multidimensional data, called data mining (DM) has emerged.

Logically, since statistics traditionally deals with data analysis, the availability of large amounts of data (which significantly exceed human cognitive abilities and perceptual mechanisms) has put statistics, as a scientific discipline, in front of new temptations and challenges, opening the following question: Are new approaches in data analysis, which are supported by ICT solutions, a complement or substitute for statistical data analysis?

II. DATA MINING ENVIRONMENT CONCEPT

The term DM is derived from the similarity that exists between searching for useful information in large amounts of available data and excavation (i.e. mining) activities in order to extract specific resources hidden in the ground. Both processes require the search for an extremely large amount of raw material in order to find valuable nugget(s). The idea underlying the above analogy is very simple. Progress in digital data acquisition and storage technology

has resulted in the creation of "mountains of data". They represent a metaphor for sources (mines) of valuable and quality information for business entities. Thus, the connection between the terms *data* and *mining*, in the context of DM phrase, indicates the extraction of knowledge from huge amounts of data.

DM is defined in different ways. From the rich treasury of definitions, the following two are listed, which clearly indicate the conceptual determinations of DM:

(1) "Data mining is the discovery of interesting, unexpected, or valuable structures in large datasets" [5]; and

(2) "Data mining is the set of methods and techniques for exploring and analyzing data sets (which are often large), in an automatic or semi-automatic way, in order to find among these data certain unknown or hidden rules, associations or tendencies" [6].

Although it is not possible to perform DM analysis without automatic processing, it should be emphasized that human factor has a crucial role in conducting DM analysis. Software solutions are auxiliary (but indispensable) tools that do not automatically solve DM problems.

DM, as a young multidisciplinary scientific research field, is connected with a whole range of different, well-founded fields. From the whole spectrum of different contributions to the development of DM, it is possible to single out three generic roots, related to the development of statistics and artificial intelligence (as academic disciplines), but also to the practice of processing large amounts of data with the application of decision support systems and database management technologies [7]. For the purpose of DM analysis, any partial approach from the perspective of individual DM roots is not sufficient. In this context, computer-aided analysis and work with a large amount of data (i.e., a large number of observation units and variables as well) through a combination of methods from different fields, can be denoted by the phrase *DM environment*. In this regard, it is quite clear that DM requires an understanding of both statistical and computational issues [8] and concepts.

III. STATISTICS IN MODERN ENVIRONMENT

Statistics, as a scientific discipline with a very long history, represents a synonym for data

analysis. However, large amounts of data have caused profound and serious changes in the field of data analysis, and thus in the application of statistical methods in terms of their adaptation to new approaches arising from the development of ICT.

ICT innovations and development have brought many benefits and risks in the modern world. In this context, Miron Straf, a member of the American Statistical Association, points out that there is no more suitable scientific discipline than statistics that can take a leading role in facing the challenges of technological change [9]. It is indisputable that all scientific disciplines have a certain role in technological development, but the question that arises is why the role of statistics is special. Discussing this, the mentioned author points out, among other things, that statistics deals not only with the application of certain technological solutions, but also with monitoring and measuring various aspects of technological development in all areas of science, economy and society at all levels of organization (local, national and international). Accordingly, statistics improve discoveries in other sciences, so that it can become an integrative force between them.

The rapid development and wide availability of computers (and statistical software, as well) have enabled not only to affirm the role of statistics through a relatively simple way of its usage in the domain of all scientific disciplines and other areas of life and business, but, at the same time, have contributed to the development of statistics itself. In fact, in order to meet the aforementioned challenges, in parallel with technological development, statistics has also developed in the following directions:

- expending the content and increasing the dispersion of statistical activities,

- finding new and adapting existing methods for working with large amounts of data, and

- training of statistically educated stuff with the acquisition of new knowledge and skills required of new generation of statisticians, including their active participation in research and projects of a multidisciplinary nature.

The importance of statistics, which helps researchers and users to come (from data) to relevant discoveries and knowledge about variable phenomena in the function of understanding the modern environment, is indicated by the often quoted visionary statement of English writer H. Wells: "Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." Precisely, the above statement illustrates the reality. The statistical way of thinking has become the backbone for making valid decisions and improving that process in conditions of uncertainty in all areas and at all levels of human activity.

IV. STATISTICS AND DATA MINING

Statistics and DM represent areas of data analysis that are related to the transformation of data into useful information and knowledge. Essentially, both areas of analysis have the same objectives whose achievement is based on learning from data.

For statisticians (and economists, as well), the phrase DM, for a long period of time, had a pejorative meaning (e.g., recording, fishing, sniffing, etc.) with a clear negative connotation. There are two key reasons for this attitude:

- first, through the DM procedure data are examined from different perspectives, which results in a large number of models, so that a particular model that will adopt well to the data can always be found;

- second, the analysis of a large amount of available data may lead to non-existent relations being found among the data or insignificant regularities being described as unexpected, interesting and significant [10].

These early negative criticisms, directed towards DM, can be sublimated in the form of the following statistical catchphrase made by economist Ronald Coase: "If you torture the data long enough they will confess all" [11]. On the other hand, as each DM process is characterized by software–supported complex and extensive calculations, computer scientist often declare themselves as "owners" of DM [12]. Actually, it is indisputable that many ideas in the field of data analysis originated from computer science, but the fact that statistics play a vital role in all phases of DM analysis (from data preparation to validation of results) cannot be ignored either. Also, many DM methods are basically statistical methods.

According to the specific properties of DM (which primarily refer to the abundance of data, the power of computer calculations and the

functioning of DM algorithms exclusively in conditions of large amounts of data), the application of statistical methods in DM environment, especially methods of statistical inference, is accompanied by certain difficulties. These are problems associated with over-fitting of the models to the data, insufficient use of sampling methodology and testing of statistical hypotheses in conditions of large amounts of data, including the problem of multiple comparisons [13]. Basically, all these problems can be viewed through the prism of testing statistical hypotheses and declaring / classifying "really false, erroneous and insignificant" discoveries (i.e., regularities, relations, etc.) as statistically significant.

The statistical concept of hypothesis testing has been the subject of discussion and serious debates in academic community (mostly among statisticians) for decades. Their misapplication and incorrect interpretation of the obtained results are cited as the most common problems in statistical tests [14], probably due to a lack of understanding of the concepts, conditions, limitations and logic of hypothesis testing, as well as widespread use of this procedure (initiated by the development of computer technology) especially by users who don't have the necessary knowledge of statistics. However, the most important problem relates to decision on the null and alternative hypothesis, because with increasing sample size each null hypothesis will be rejected. As the outcome of testing is known in advance, the very philosophy of hypothesis testing has become questionable. In fact, in the DM environment, the effectiveness, i.e. usefulness, of classical statistical hypothesis testing procedure is significantly reduced. With a significant increase of number of observations (which is the immanent property of the DM environment), the p-value tends to zero, so that, with a sufficiently large number of observations, each null hypothesis will be rejected. In other words, each test result, with a sufficiently large amount of data becomes statistically significant.

In DM, one hypothesis is rarely tested. It is mainly a family of similar hypotheses, so that, in direct connection with the previous one, there is also the problem of multiple testing and comparison. This problem occurs during the selection of interesting variables and rules, or comparison of the efficiency of several different algorithms. In each of the above cases, the selection of a variable, rule, or algorithm, is the result of m comparisons, i.e., repetitions of the

corresponding test. Successive application of the same test on the same data systematically increases the type I error rate α, so that many variables or rules become (statistically) significant, although in essence they are not. Therefore, it is necessary to formulate different way of comparison. The simplest way to solve the problem of multiple comparisons is to use the Bonferroni procedure, which is based on m tests with the level of test significance α / m, as a result of which it becomes more difficult to reject the null hypothesis.

Given the previously discussed problems in hypothesis testing procedure, it is quite logical that the question regarding the justification of using this statistical method in DM context arises. According to the authors' opinion, hypothesis testing should not be excluded from DM, but under condition of valid and correct use of this group of statistical methods. In other words, DM analysts must be familiar with the limitations of testing and all fundamental aspects of statistical inference, because DM algorithms cannot be a substitute for the philosophy of statistical thinking.

In order to gain full insight into the relationship between statistics and DM, as well as the variability of aspects of observing this relation, it is interesting to point out a series of articles in which the authors seek to answer various research questions: Can DM be part of statistics?; Is DM essentially statistics, or is it more than statistics?; Is DM the application of statistics in the form of exploratory data analysis?; What is the next "generation" in the application of statistical methods?; Is DM statistical déjà vu?; Is DM complement or substitute for statistical analysis?; Should DM be included in statistics' "curriculum"?.

In searching for answers to the formulated questions, special attention deserve the papers written by the famous statistician David Hand, who points out that DM uses many ideas and methods from statistics (especially from the domain of exploratory data analysis), but DM is also "something more" and "something different" from statistics itself [15], [5], [16]. In addition, the same author states that DM is not "a cure for everything", and that working with a large amount of data brings with it a number of specific dangers and problems [17], [18] in overcoming which statisticians can make a great contribution. However, it should be noted that most statisticians agree with opinion that

statistics is becoming relatively less influential in the era of IT revolution, stating that one of the key reasons for this situation is the marketing problem of statistics [19]. Therefore, it is obvious that statistics is facing a serious struggle and competitive competition with other methodologies and areas in the domain of DM. Accordingly, Ganesh emphasizes that the statistics' "curriculum" should be expanded (i.e. supplemented) by the elements of computer-based data analysis [12]. Due to the aforementioned, as well as the fact that many DM methods are basically, by their nature, statistical, it is not surprising that the main statistical software packages (e.g. SPSS, SAS and STATISTICA) are usually promoted as DM tools. Although both DM and statistics deal with deriving regularities from the data, it is absurd to claim that DM is a statistical déjà vu, because despite the great importance of statistics in DM, there are many DM aspects that are not statistical [20].

Having in mind the previously stated views on the connection between DM and statistics, what is important for both disciplines is that the time of mutual ignoring and negative criticism between statisticians and DM analysts has passed. In this sense, Smyth points out that statistical and algorithmic aspect are equally important in DM and also states that statistics is essential and valuable component in any DM application [21]. Viewed from another angle, DM initiates and provides exceptional opportunities for development of new methodological solutions in statistics (e.g. re-sampling methods). Full utilization of the potential of their integration requires mutual adjustments with certain modifications of the basic paradigms and operational principles of both approaches in data analysis.

V. CONCLUSION

Summing up the study it is possible to formulate the following most important conclusions:

- Within a wide group of methods that find application in the DM environment, a significant role belongs to the statistical methods. In order for statistics to contribute to solving and overcoming the challenges associated with working in the DM environment, it is necessary to make adequate adjustments to traditional statistical methodology, ensure the development of new statistical methods and incorporate statistical

thinking, concepts and ideas into DM methodological framework. Without statistical thinking, DM will not be effective in knowledge discovery from data, while, on the other hand, statistics will not be so successful in working with large data sets without DM elements.

- Data mining has become a significant multidisciplinary research area with great application potential in the field of economics. Models created through the valid and adequate application of statistical, but also other methods on large data sets, can serve economists as a suitable basis for predicting economic phenomena and making quality business decisions.

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Impact of Innovative Entrepreneurship on the Economic Growth in India

Gurdip Batra[1], Dr. Satpal[2]

[1]School of Management Studies, PunjabI University, Patiala, India
[2]University School of Law, Rayat University Mohali, Panjab, India

[1]batra.gurdip2@gmail.com, [2]drsatti708@gmail.com

Abstract— **Entrepreneurship is an engine and booster of economic growth in every country. Its positive impact can be reported in every sphere of economic lives of people. It gives birth to more economic activities that provide economic benefits to people in the form of generating more employment, increasing capital formation, improving standard of living, increasing per capita income, removing regional disparities and more innovations.**
Objectives: The main objective of the present study is to examine the impact of entrepreneurship on economic growth in India. The overall objective of the study is to establish the impact of entrepreneurship on economic growth in India. The Specific objectives of the study are; to examine the impact of entrepreneurship on generating more employment, increasing capital formation, improving standard of living, increasing per capita income, balanced growth, removing regional disparities, product improvement, more innovations etc.
Research Methodology: this study has employed primary data gathered through structured questionnaires from two hundred people by raising on five point Likert Scale pattern(Strongly Agree (2), Agree (1), Neutral (0), Disagree (-2), Strongly Disagree (-1).
Tools of analysis: This study utilized Correlation and Regression Analysis in order to analyze data to get research results using SPSS-20 version.
Findings & Results: This study revealed that entrepreneurship impacted economic growth to maximum extent by influencing employment, standard of living, per capita income, by removing regional disparities and more innovations

Keywords - employment, capital formation, standard of living, increasing per capita, income removing regional disparities

I. INTRODUCTION

This world is full of risks. Thus risks are all pervasive. Here everybody wants to start a new business in order to become prosperous. Entrepreneurship is a media through which he can fulfill his desire. It is synonymous with resourcefulness, ingenuity and ability to take all types of risks in order to start a new business. Sometimes these qualities are known as "entrepreneurial traits".

The word entrepreneur has been derived from French word "Entreprendre" which means "to undertake". Thus entrepreneur is a person who undertakes risks of a new business. An enterprise is formed by a person who is known as entrepreneur and process of creating called "entrepreneurship".

Entrepreneurship is driven by a person who is ready to take all types of risks to earn profit in the future. That is why he is known as self-motivated, self-employed and desirous to get his predetermined goals. He takes all management decisions and finds new ways in order to sell his new and existing products and services [1-3].

II. FEATURES OF ENTREPRENEUR

Entrepreneurship is characterized by the following features as shown in the following figure:

Figure 1.   Features of entrepreneur [1]

Figure 2.   Importance of innovative entrepreneurship
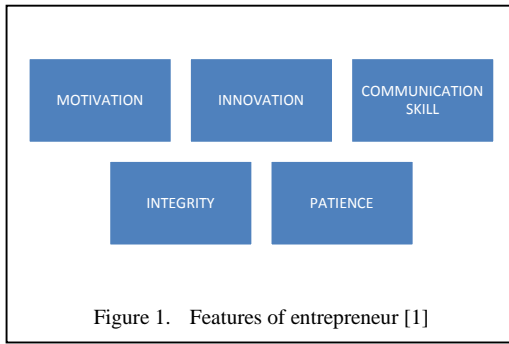
A. Motivation

Entrepreneur motivates his all subordinates all times for taking better decisions for betterment of business.

B. Innovation

Entrepreneur is very keen to find new ideas in order to adopt and evolve more efficient and effective systems in his business. That is why it is also known as continuous effort for synergy in organizations.

C. Communication Skill

Entrepreneur communicates all messages in an effective and efficiently so good decisions can be taken timely and accurately.

D. Integrity

Entrepreneur integrates all activities for better coordination in order to get predetermined goals.

E. Patience

Entrepreneur keeps patience in all ups and downs. He takes all decisions by considering all situations effectively and efficiently.

III.   INNOVATIVE ENTREPRENEURSHIP

Entrepreneurship plays an important in every economy. His role can be judged from promoting social change to driving innovation. He is regarded as national asset as a source of promoting remuneration to the greatest possible extent. There are some advanced countries like U.S, Japan, Britain etc which are worldly known because of their forward thinking, research and development and entrepreneurial persons. However his importance can be reported by the following points in Fig. 2.
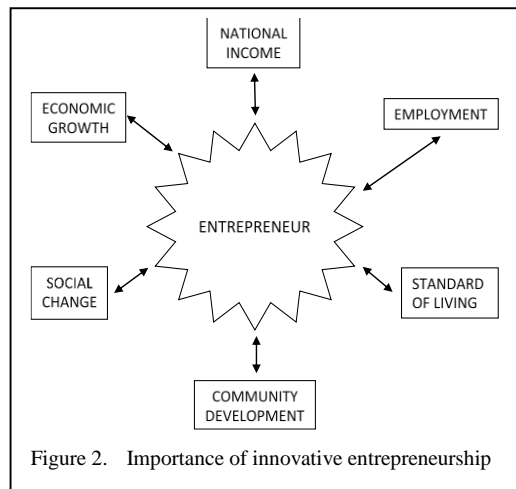
A. Role in Enhancing Economic Growth

Entrepreneurs create new products and services that have cascading effect which are demanded by related businesses to support new ventures and enhance economic growth.

B. Role in Promoting National Income

New products and services of entrepreneurs help in generating new wealth. Their products and services enable new markets to be developed and new wealth to be created.

C. Generation of New Employment

Entrepreneurs generate new employment for public. By employment, public get new source of income and this earning contributes to better national income in the form of higher tax revenues and higher government spending.

D. Role in Social Change

Entrepreneurs bring social change by removing depending on obsolete systems and technologies by offering new and unique goods and services. This improves quality of life, morale and greater economic freedom.

E. Role in Community Development

Entrepreneurs invest in community projects in order to assist local charities. This further enhances development beyond own ventures.

F. Improvement in Standard of Living

Entrepreneurs improve standard of living of public by bringing changes in products and services with innovation.

IV. REVIEW OF LITERATURE

Dr. J. Jayanthi (2019) studied entrepreneurship in India and its promotion under "START UP INDIA" scheme [2]. This study revealed that entrepreneurship is dominated by small enterprises. In case of entrepreneurship, India has 68th ranked out of 137 countries that describe "middle" performance.

Dr. Radhika Kapur (2018) studied the importance of entrepreneurship in India [3]. This study concluded that the economic development of every country depends upon entrepreneurial skills and competencies of persons. There is an urgency of various promotion schemes for promoting small and medium entrepreneurs in India.

IED (2020) studied the role of entrepreneurship in economic development. This study reported that experiencing growth can be enhanced by opening more entrepreneurial ventures [4]. Their role can be explained in areas of bringing wealth to local bodies, developing local businesses, exposing the local market to foreign opportunities.

A. Research Gap

There are few studies of empirical types in this area. Only few studies examine the impact of entrepreneurship on economic growth in India. The present study has tried to cover this gap by covering those variables which many studies have not covered in the past. The review of literature indicates that previous researchers conducted studies only on a few variables separately. This current study has covered some other additional important variables that were omitted by previous studies.

V. NEED OF THE STUDY

The impact of entrepreneurship on the economic growth in India is an empirical one. The findings of this study will be very beneficial to the entrepreneurs in examining the impact of economic growth in India. The scholars and researchers 'will be able to get up to date and relevant information on how the entrepreneurship impacted economic growth in India. Fellow researchers and entrepreneurs get proofs and knowledge on how the entrepreneurship impacted economic growth in India. Entrepreneurs will be able to make better financial decisions regarding various study variables in the study.

A. Rationale

Tremendous change in the financial environment after 1990 can be projected due to globalization and liberalization in India. It has given birth to various ideas in minds of people. Therefore in such a situation, they were aspired to start new businesses in which they can show their talents and expertise. Here entrepreneurship has taken birth whose impact on economic growth was necessary to study. This study made an effort to examine the impact of entrepreneurship on economic growth in India. This study brings out certain relationship and findings which can help the entrepreneurs to take better decisions in the coming future.

B. Objectives of the Study

The overall objective of the study is to establish the impact of entrepreneurship on the economic growth in India. The Specific objectives of the study are;

1) To examine the impact of entrepreneurship on employment in India.

2) To examine the impact of entrepreneurship on capital formation in India

3) To examine the impact of entrepreneurship on standard of living in India.

4) To examine the impact of entrepreneurship on per capita income in India.

5) To examine the impact of entrepreneurship on removing regional disparities in India.

6) To examine the impact of entrepreneurship on more innovations in India

C. Conceptual Framework

Economic growth by entrepreneurs is expected to influence employment, standard of living, capital formation, per capita income, removing regional disparities and more innovations Economic growth through entrepreneurs has been considered as the independent variable and employment, standard of living, per capita income, removing regional disparities and more innovations are taken as dependent variables

Figure 3. Conceptual framework
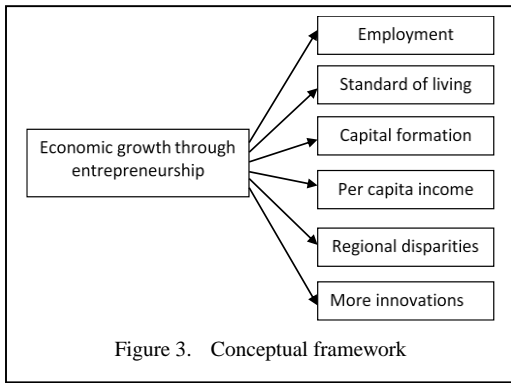
D. Hypotheses

By taking into consideration the upper states objectives, the following hypotheses have been formed to be tested:

H01: There is no significant impact of entrepreneurship on employment in India

H02: There is no impact of entrepreneurship on standard of living in India

H03: There is no impact of entrepreneurship on capital formation employment in India

H04: There is no impact of entrepreneurship on per capita income in India

H05: There is no impact of entrepreneurship on removing regional disparities in India

H04: There is no impact of entrepreneurship on more innovations in India

VI. RESEARCH DESIGN

A. Data Collection

The respondents of this study are entrepreneurs who are involved in various entrepreneurships. Conventionally this study was conducted to examine the impact of entrepreneurship on economic growth in India. That is why entrepreneurs are selected as respondents due to get better results.

B. Sample Size

Simple random sampling was utilized in order to collect data. One hundred five questionnaires were distributed among entrepreneurs. One hundred questionnaires were received and were finally utilized for data analysis.

C. Research Instrument

Data was gathered by questionnaire. These questionnaires include 25 questions relating to study variables. The respondents were asked to rate their responses on five point LIKERT Scale (Strongly Agree (2), Agree (1), Neutral (0), Disagree (-2), Strongly Disagree (-1).

VII. DATA ANALYSIS

Data was entered, edited and analyzed by using SPSS version 20. Microsoft excel was applied by using some techniques like Cronbach's alpha, Correlation and Regression.

A. Cronbach's Alpha

This study used Cronbach's alpha to check the internal reliability of the instrument. The value of Cronbach's alpha got 0.78 which was above standard value proposed by Nunnally (1978) of 0.744 [5].This reports that our instrument is reliable. Thus we can utilize various statistical tests and interpret results with full confidence.

B. Correlation Analysis

Pearson correlation was utilized in order to find the relationship between dependent variable and independent variables. From the table 7.2, it is depicted that all relationships were significant. The correlation value of employment, capital formation and removing regional disparities were 0.76, 7.2 and 0.77 respectively which show that these have large impact on economic growth. There is a strong relationship between economic growth and per capita income which is above 0.5. This indicates that per capita income has great impact on economic growth. The correlation value of standard of living and more innovation are 0.68 and 0.65 respectively. These show large impact on economic growth because of entrepreneurship.

TABLE I.   CORRELATION ANALYSIS

	Impact of entrepreneurship (dv)	Employment (iv)	Standard of living (iv)	Capital formation (iv)	Per capita income (iv)	Regional disparities (iv)	More innovation (iv)
Pearson correlate.	1	0.76	0.68	0.72	0.58	0.77	0.65
N (dv)	100	100	100	100	100	100	100

C. Regressiion Analysis

This table depicts model summary in which the value of *R* is 0.84 that shows strong relationship between dependent variable and independent variables. The value of adjusted R square is 0.705 that which shows that model is good fit. Thus our all alternatives hypotheses are accepted with significance value less than 0.05 which shows that all independent variables have great impact on dependent variable i.e. economic growth.

TABLE II. REGRESSIION ANALYSIS

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.84	0.705	0.672	0.343

a) Predictors : (Constants), employment, standard of living, capital formation, per capita income, more innovation

b) Dependent variable : Entrepreneurship

D. ANNOVA

This table depicts that F is significance because its value is 0.00 which is less than 0.005. This also indicates that all study independent variables do good job in explaining the dependent variable.

TABLE III. ANNOVA ANALYSIS

Model	Sum of square	DF	Mean square	F	Siq.
Regression	10.169	3	3.390	39.127	.00
Residual	8.316	96	0.087		
Total	18.485	99			

a) Predictors : (Constants), employment, standard of living, capital formation, per capita income, more innovation

b) Dependent variable : Entrepreneurship

VIII. DATA ANALYSIS

The findings of this study show that economic growth is strongly impacted by these factors like employment, standard of living, capital formation, per capita income, regional disparities and more innovations. It is also found that by using entrepreneurship economic growth can be increased in India.

This study advocates speedy encouragement to entrepreneurship in India. Different incentives and schemes must be started by government of India in order to encourage entrepreneurs In India.

This study on impact of entrepreneurship on economic growth in India covered only 100 entrepreneurs from Rup Nagar and Chandigarh only. In future further study can be conducted by covering other districts of Punjab.

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Crisis Communication and Risk Management

Ratomir Antonović[1], Milan Stanković[2]

[1,2]Faculty of Law, Security and Management "Constantine the Great" Nis, Nis, Serbia

[1]antonovicr@gmail.com, [2]glembay@yandex.com

Abstract—**The human mind, its design, the way in which it works, the way in which decisions are made and, ultimately, manipulations, is always a fascination for scientists and experts. Our decision-making is largely influenced by several factors at once, for example, desires, motives, emotional state at a given moment, the system of values that we have adopted, the way in which we look at our own ambitions and abilities, our assessment of the environment, etc. For the integration of emotions in the decision-making process, a part of the brain called Orbitofrontal Cortex (OFC) is in charge, and this paper deals with only some of the phenomena that can be triggered but also by models that run this whole new area of research called "predictive analytics".**

Keywords – predictive analytics, predictive model, decision making, Eliot CASE, COVID 19.

I. INTRODUCTION

The human mind, its design, the way it functions, the way it makes decisions and ultimately its manipulation, has always been a fascination for scientists and various experts. Our decision-making is usually influenced by several factors at once, e.g., our desires, motives, emotional state at a given moment, the value system we have adopted, the way we perceive our own ambitions and abilities, our assessment of environmental conditions, etc. And the question of whether to obey intuition or reason was also dealt with by Plato. He compared the functioning of the human mind to a carriage, to a two-wheeler. One horse represented the rational mind, the other the emotional, and the rider is the one who must constantly control them. After all these years, psychologists, philosophers, psychiatrists, neurologists, biologists and others, tried to penetrate the secrets of His Majesty. Of course, Plato's chariot driver depends on both horses, and horses depend on each other. And in that, perhaps, there is a charm, because what would happen if that connection was broken, such as in the 1984 Eliot case.

A part of the brain called the Orbitofrontal Cortex (OFC) is responsible for integrating emotions into the decision-making process. By impairing this part, people have intact cognitive abilities, but their ability to make everyday decisions is significantly reduced. So, Eliot, a happily married young man in his thirties, was an excellent student in college, then, a successful manager in a large corporation, a naturally gifted leader, and so on. Unfortunately, in the 35th year. he was diagnosed with a brain tumor. The operation was successful, but Eliot had bilateral OFC damage. Tests of his intelligence, memory, reading, writing, spatial-visual ability, facial recognition, showed that his performances range from average to superior. But making even the simplest decisions was very difficult for him. The decision to choose a restaurant for dinner would take hours. Shortly after the operation, he was fired, divorced, lost contact with family and friends, lost all his money, married a prostitute, and divorced after 6 months. Eliot was completely deprived of the emotional influences of the brain and his life turned from ideal to hell. Here is the paradox of OFC: how damage to this area leaves so many cognitive abilities intact, and destroys the ability to make decisions that guide us through life on a daily basis. And in the future, that enigma remains a task for experts. Our behavior, habits, attitudes and other data that we leave, someone carefully analyzes, constructs a picture of us and based on established patterns, predicts our next step, the next decision we will make.

Everything in the world is connected and if you are looking for connections, you will be able to predict. Wherever you have the opportunity to collect data, to learn from experience, you can predict. Predictive analytics is based on this principle: finding a template from "historical" data is the key to the future. Predictive analytics is used in marketing, medicine, telecommunications, sales, finance, politics, education, but also for any scams. Real-time monitoring lies between two extremes, learning from "historical" information and finding patterns with advanced predictive analytics. Real-time tracking detects events and event patterns as data flows through a transaction system, network, or telecommunications channel. The amount of data we leave on the internet has increased in proportion to the development of the internet and social networking. In addition to business motivation, the abundance of data is another key ingredient for the success of predictive analytics. The data goes through a modeling process and the model it predicts is ready for action. Many perceive the data as annoying piles of zeros and ones, but they are for high-tech miners, gold ore. So, to summarize the term predictive analytics: the terms are extracted from the data and used in the modeling process; combining someone's attitudes (behaviors) with some attributes (demographic) increases the accuracy of the created models.

Programming language R. Very simple, but has huge potential. A language that transcends the borders of all countries, the universal language of a large number of world companies. Some of the users are Google, Bank of America, Stanford University. In addition to being easy to use and flexible, it is also an open source project. The designers of this miracle are gentlemen professors of statistics from Auckland University, Ross Ihaka and Robert Gentleman. Another interesting tool used by predictive analytics is IBM's SPSS Modeler. The data he uses can be structured (age, gender, marital status, income ...) or unstructured (user notes, call center calls, content of posts on social networks, etc. From the huge amount of data, the given concepts are extracted. , are a very powerful weapon of companies in the fight for profit. Of course, the word profit is masked by caring about customers, their needs, their satisfaction, well-being, etc. Or e.g. Watson Explorer which provides the ability to answer in

real time how and why something happened using advanced cognitive neural network services, text and sentiment analysis. Such a tool is great in the context of Customer 360 views, because it interactively predicts which product the user will buy next.

II. INTERESTING EXAMPLES ARE THE BLACK SWAN PHENOMENON

An urban legend - men who buy diapers in supermarkets, buy beer, in fact, it is not. This is determined on the basis of credit card data that were used when shopping in supermarkets. Another example, based on an analysis of supermarket purchases and credit card payments, provided an answer to the question of how risky a person is in terms of repaying a loan installment. Some of the conclusions are:

- People who buy car oil from non-reputable manufacturers and at a lower price, compared to those who buy branded oil, more often fail to pay the loan installment.

- People who buy self-adhesive pillows as protection so that the chair does not scratch the floor, rarely fail to pay the installment.

Prediction is always better than guessing. And all actions stem from predictions about one person. And that is not the end of the game, because success is not only predicting someone's behavior in the future, but also influencing it. The man is surrounded by organizations that analyze him. Financial institutions advise on a daily basis where and how to invest money, companies offer a percentage of sales for certain services and products, insurance companies and health insurance are trying to identify possible diseases in a timely manner and offer adequate treatment and cure.

Amazon, for example, will send a pair of sneakers of a certain color and number to the nearest warehouse even before we confirm the order with the click of a mouse.

Powerful software and tireless prediction algorithms are no longer scenes of Spielberg's sci-fi film "Redundant Report" in which they are used to prevent crime. Police in Memphis, Los Angeles, Great Britain and Poland have a very serious approach to analyzes of this kind. The behavior of criminals can also be reduced to models. Mark Cleverley, an analyst at IBM, which works with police in London, Poland and

several US and Canadian cities, explained that it is possible to establish a model of behavior based on several factors such as weather, whether the day is when salaries are paid. .it does not mean that some crime will happen at a certain time and place, it cannot be predicted, but it can tell us, for example, that a wave of car theft is expected. That is how the police can react, because they are in the right place and at the right time. In Memphis, authorities claim that the crime rate has dropped by 30 percent since the police used the predictive analysis program designed by IBM. A program called CRUSH allows the police to identify individual dangerous areas in order to better deploy people in the field.

These, and similar examples, raise the following questions for controversy: To what extent does the use of predictive analysis please the privacy of citizens and their constitutionally guaranteed protection? And another question: Can we rely on observation-based learning or experience and the fragility of our knowledge, looking for a pattern and expecting the future to follow?

Although it is in the nature of people to attach importance to the experience of past events, looking for a pattern and expecting the future to follow it, human history is usually shaped by the strong influence of events for which history could not give us a guide. The author Nasim Nikolas Taleb, who started his career as a stockbroker, and encouraged by the acquired experience, opted for scientific work, is one of the most active financial mathematicians, researchers in the field of probability and chance, and whose scope of study includes the epistemology of chance. to answer the question of how to live in a world we do not understand enough. Taleb's concept of the Black Swan, an unpredictable event with great consequences, described in the book of the same name, is an original contribution to the theory of complex systems. Using the term Black Swan, he talks about phenomena that he considers to be completely unexpected, but which still bring tectonic changes on a global scale. The Black Swan is a reference to the famous philosophical thought experiment from the 17th century. Until then, no one in Europe had seen swans other than white, so the claim: "All swans are white" was often used as an example of undeniable truth. The chance of finding a black swan was considered to be zero, until it happened in 1697. in Australia. It was clear that based on previous experience, their alleged non-existence could not be proven. Similar predictions applied to the terrorist attacks of September 11, 2001 in America, to the famous Maginot Line, the supposedly insurmountable bulwark of French defense in World War II that German troops simply bypassed, to the expansion of the Internet, to the emergence of Google, to the collapse of world stock exchange in autumn 2008…

A small number of Black Swans explain almost everything in our world, from the rise of ideas and religions, the dynamics of historical events, to important events in our private lives. Their influence strengthened especially during the industrial revolution, when the world was becoming more complex. Transient trends, epidemics, fashion, ideas, new artistic directions and schools - all this follows the dynamics of the Black Swans. Precisely because of the combination of low predictability and huge influence, they represent a great puzzle. The central idea of Taleb's book is that we are blind to coincidence, especially to large deviations. It is easy to determine that life is the cumulative outcome of several significant earthquakes, if we only consider our own lives. Let's take into account the significant events, technological changes, and inventions that have occurred in our environment since we were born and compare it all to what was expected before they happened. How many were foreseen? Or say, choosing a profession, finding a partner, relocating, unexpected gains or losses. How often did these things go according to plan? Given the share of extraordinary events in historical dynamics, the inability to predict the extraordinary implies the inability to predict the course of history - Taleb concluded. But we still act as if we are able to predict everything and as if we are able to change the course of history. We are making multi-year projections of the social security deficit or oil prices, for example, and we are not aware that we cannot even claim what will happen next summer. We live in a world where there is more and more feedback. They cause events, which cause new events, thus triggering avalanches and unpredictable planetary outcomes. So, can we assess how dangerous a criminal is based on what he does during an "ordinary" day? Can we study health without knowing the deadly diseases and epidemics? Can we believe the methods of inference by means of a bell curve, and at the same time know that it neglects large deviations?

III. Privacy and Predictive Analytics

The time of global networks and information opens a strategic issue of security and privacy of a country and all its individuals. According to media reports, the American agency NSA (National Security Agency) currently monitors the largest part of telecommunication traffic and collects data that are stored in the world's largest data center, in the American state of Utah. Something similar is done by the French agency "French", "Onyx" from Switzerland, etc.

A huge amount of data from a politically "interesting" country, for example, is in-depth analyzed and a virtual scenario is projected, in order to play the appropriate moves of global planners and controllers of the cyber galaxy. By following the global network, videos, Facebook, Twitter, various reports, profiles of politicians are created, which should be paid attention to or influenced in order to satisfy certain strategic interests.

If such "powerful" people and states cannot defend and protect themselves, what should ordinary mortals expect? From domainers, trolls, bots, hackers, haters, spin doctors, to polished and reputable companies that subtly place ads, various unethical phenomena that lurk and follow every click, you need to save your life. Every click, every like represents information, which is stored in a hundred places at the same time. Recorded is a social network or site that we visited, but I also read through other companies that download data from those internet sites. World research shows that people perceive content on the Internet as free. Data show that only about 10 percent of people who use smartphones think they have bought the apps they use. In Serbia, that number would probably be 0.01 percent. So, we perceive this huge database of knowledge and information, which is searchable, classified and accessible - as completely free. This information has its value expressed in money. The more specific the data, the more it is worth. A thousand basic data - name, surname, address, etc., are worth, say, a few cents; that person's marital or health status will double the amount, which only grows further by crossing with different information about income, consumer habits, and so on. Sites like Amazon and Google make about a thousand dollars a second.

Thanks to technological development, society is on the threshold of another new paradigm - "internet of things", the networking of various devices that we use. New generations of pacemakers, refrigerators, traffic regulation systems, and even street garbage cans are being connected to the network. We absolutely do not have to pay for the online presence with money, we pay for it with personal data. There is no controversy, online privacy - an impossible mission.

IV. Crisis Management and Communication Problem

Crisis communication is defined as the perception of an unpredictable event that threatens to jeopardize the significant expectations that the company's stakeholders have and that can seriously affect the performance of the organization and create an undesirable outcome [1]. The communication process between sender and receiver in the rhetorical arena during crisis communication contains three elements, crisis communication, sender and receiver. The main sender is the company, ie its representatives. The crisis team defines those responsible for internal and external communication, as well as spokespersons with the authority to address the public.

The primary group that represents the recipient in the communication process are always the victims. In addition to the victims, there are four other types of public, ie stakeholders with whom a relationship is established through communication in a crisis: formative (enabling), functional, normative and diffuse public. The formative public provides authority and control over the resources that enable the organization to exist at all, and these are owners, shareholders, boards of directors, regulatory agencies, and the like [2]. Functional audiences provide the basic operational functioning of organizations and include employees, suppliers and customers. Normative publics are broader groups to which a company or employee belongs, and which have the power to represent their interests, for example trade unions, political groups and professional associations. Diffuse publics are the external public, the local community, the media, civil society organizations and citizens.

Crisis communication is a specific form of communication, and one of the typologies divides it into four main forms of communication among crisis participants: public relations, problem management, community relations, and media relations [3]. On the other hand, relations

with the media are more often conducted as one of the segments of public relations, both in terms of subject and formation, and therefore in the organizational sense within companies. Public relations that can be used in a crisis therefore includes, in addition to media relations, internal communication, social responsibility programs, and specific communication of leaders to the community. In this way, in this paper we will look at media relations, as part of a broader area of public relations.

V. COMMUNICATION PARAMETERS IN CRISIS PROCESSES

The interest of the media in the crisis appears very early and it is necessary to set a certain tone of the company's communication [2]. The tone should be in line with the crisis communication plan that the company already has. Organizations can choose one of two approaches in media relations. The first approach is assertive and proactive, which allows the organization to be the first to publish the news about the crisis, without waiting for someone to "report" it to the public and the media, nor to hide it and wait for it to go unnoticed. In that way, he has the opportunity to present his version, trying to tell the story precisely. The second approach is reactive and delays unavoidable events with the risk that the company version will be published incorrectly. Ignoring the situation only makes things worse. A proactive approach gives the company the opportunity to set the tone of communication that is in line with the situation, and which it has anticipated and occupied.

In the pre-crisis period, practice has shown that it is necessary to make preparations for a possible crisis. Companies should, in regular circumstances, outside the crisis, set their official communication policy and rules for working with the media. Such a plan is made as part of the management of the entire business process and stakeholders of the company, which lays the foundation for work even in crisis situations [4].

Preparation for the crisis includes conducting business risk analysis, anticipating crises in all segments, prioritizing crisis situations, anticipating the public at risk, formulating communication strategies and tactics, determining relevant communication channels to stakeholders, anticipating media interest, preparing a crisis management plan, defining procedures , appointing a team and training its members for adequate roles, appointing and training a spokesperson to present to the public

and prepare a communication center. The made plan should be practiced and tested through it, and as a consequence it should be updated and supplemented. Directors, managers and other members of the crisis team, and not just communication experts, should ideally be trained and trained to work with the media, which is especially true for crisis situations.

In larger organizations, communication professionals, along with the legal department and the operations sector, are given shared responsibility for crisis planning. It is their responsibility to create, maintain, manage and communicate a crisis management plan. This plan should include special media training for spokespersons during the crisis, as well as the establishment and maintenance of internal and external channels of communication and the development of contingent responses and messages for the presumed crisis scenario.

Crisis communication, by definition, takes place well before the crisis itself, and that is the period when the organization gets to know the work with the relevant media and has good relations. During the preparation period, it is necessary to get acquainted with the way each media works, as well as understanding how the organization is seen from the outside, what reputation and media image it already has, as well as planning to avoid the media chaos that most often occurs. The goal of crisis communication in the pre-crisis period is to build relationships of mutual trust with the media. Given that the power of the media is such that they can improve or worsen the company's image and affect business, the public relations department is expected to have adequate knowledge of the functioning of different types of media, work technology, genre they cover, reporting context, editorial preferences, overt and covert political or ownership interests. This means knowing how to prepare the content that the media expect, how to meet the deadlines, how to meet their requirements and attract their audience in a way that suits both the media and the company.

VI. CONCLUSION

The famous physicist Stephen Hawking warns about the level of development of machines and that in the near future we should not worry about who will control artificial intelligence, but whether control will be possible at all. Towards 2021, we will repeat the quotes of John Maynard Keynes, who back in 1919 (The

Economic Consequences of the Peace - London) simply emphasized as fate: "The power to adapt to the environment is a prominent feature of the human species. Very few of us are convinced of the extremely unusual, unstable, complex, unreliable and temporary nature of the economic system in which Western Europe has lived for the past half century. We hold that some of our strangest and most temporary recent benefits are natural, permanent, and reliable in the future, and we are forging our own plans accordingly."More than a legacy for the future.

The issue of crisis communication became especially relevant during the crisis, caused by the COVID 19 pandemic, which represents one of the greatest world threats since the Second World War. Communication between the subjects is of crucial importance, the exchange of information, data, as well as knowledge, have proven to be crucial. Also, basic issues, such as the exchange of data and information from a certain country, which has a prominent place and importance at the international level, are deeply analyzed and virtually projected into a possible scenario, in order to play adequate moves of global cyber galaxy planners and controllers. By following the global network, videos, reports from social networks, various reports, profiles of politicians are created, as well as other important personalities in the world of education, science, geopolitics, business who should be paid attention to or influenced in order to satisfy certain strategic interests.

In crisis situations, the crucial strategic interest is to maintain order and peace within the limits deemed necessary. Depending on the strength of the trigger of the crisis, the intensity of the actions of the competent subjects is determined, as well as the way of directing the communication itself, communication focuses, as well as determining the interest that is to be realized. At best, it is preventing the crisis from occurring at all, which is considered a top managerial success, and at worst, it is minimizing the potential consequences, while minimizing the damage.

In crisis situations caused by the COVID 19 pandemic, the interest of crisis communication is timely exchange of relevant information, regular informing of citizens on ways to prevent and combat pandemics, regular communication of knowledge about new knowledge about the virus and its characteristics, in order to prevent misinformation and inaccurate information. This way of communication prevents uncontrolled diffusion of the virus, its consequences, which have already inevitably occurred, are kept under control and within reasonable limits. The exchange of information must take place both nationally and internationally, as prevention and control systems against COVID 19 must be established at all levels, with a greater or lesser level of success.

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How Digital Data Are Used in the Domain of Health: A Short Review of Current Knowledge

Lana Tucaković[1], Nemanja Nikolić[2], Ljubiša Bojić[3]

[1,2,3]Digital Society Lab, Institute for Philosophy and Social Theory, University of Belgrade, Belgrade, Serbia

[1]lana.tucakovic@instifdt.bg.ac.rs, [2]nemanja.nikolic@instifdt.bg.ac.rs, [3]ljubisa.bojic@instifdt.bg.ac.rs

Abstract —**In the era of digitalization, digital data is available about every aspect of our daily lives, including our physical and mental health. Digital data has been applied in the domain of healthcare for the detection of an outbreak of infectious diseases, clinical decision support, personalized care, and genomics. This paper will serve as a review of the rapidly evolving field of digital health. More specifically, we will discuss (1) big data and physical health, (2) big data and mental health, (3) digital contact tracing during the COVID-19 pandemic, and finally, (4) ethical issues with using digital data for health-related purposes. With this review, we aim to stimulate a public debate on the appropriate usage of digital data in the health sector.**

Keywords - digital health, digital footprints, digital contact tracing, data privacy

I. Introduction

In the era of digitalization, digital data is available about every aspect of our daily lives, including our physical and mental health [1]. Digital data has been applied in the domain of healthcare for the detection of an outbreak of infectious diseases, clinical decision support, personalized care, and genomics (the study of all of a person's genes) [2]. One type of digital data which can be used in the domain of health are digital footprints. Digital footprints, alternatively called digital traces or digital records, are defined as data created by users which are left behind on digital platforms [3]. We can distinguish between two types of digital footprints – active and passive [4]. Active digital footprints refer to data which is intentionally shared by users, while passive digital footprints refer to data which is collected without user's consent [4]. Digital footprints can provide us with valuable insight into various individual psychological characteristics, behaviors, and preferences [3]. This type of personal data is stored in large databases, which can be collected by individuals themselves or collected by organizations interacting with individuals [1].

Digital footprints which can be useful in the health sector can be collected by various types of organizations such as retail chains, banks, insurance companies, and healthcare providers [1]. In other words, health can be revealed in behaviors outside the healthcare systems such as communications, locations, purchases, searches, etc. [5]. These activities are electronically recorded and they can be linked and analyzed [5]. Digital footprints can also be collected in the health sector by short-term and long-term tracking through digital health applications [3,6]. To give an example, when people wear devices that track physical states such as walking and running, they leave behind accelerometer data [7]. Research has also shown that digital footprint data can be utilized for predicting personality traits, which in turn can be utilized for creating custom-tailored public health messages [8]. The relevance of digital footprints in the health sector is even more increased in the presence of the COVID-19

pandemic. Countries such as the UK, China, Israel, Germany, South Korea, and Singapore developed digital contact tracing apps for COVID-19 in addition to manual contact tracing as a way of containing the pandemic [6,9]. This will be described in greater detail in a later section.

Current research is scarce regarding individuals' perception of the data which they generate online and how it can be related to health, their willingness to share the data for research purposes, and also their preferences regarding the way data is used [5]. This paper will serve as a review of this rapidly evolving field. In the course of the review, we will cover big data and physical health, big data and mental health, digital contact tracing during the COVID-19 pandemic, and ethical issues with using digital data for health-related purposes.

II. BIG DATA AND PHYSICAL HEALTH

It is thought that the collection of digital footprints and their analysis with modern analytical techniques could bring us into the age of new, more personalized, and timely health care providing [4]. Health-related data can be collected through smartphone sensors, smartwatch sensors, social media, ecological momentary assessment (EMA; i.e., prompt answers from users on smartphones to provide snapshots into their daily life), online search engine activity, etc. [10]. Recent research has shown that individuals are generally willing to share their data with health researchers and clinicians if it can help in gaining health-related insights [5].

It is important to note that the collected data is not necessarily related to a person which already has a disease [11]. The focus is put on data regarding lifestyle activities that are connected to health [11]. Some lifestyle indicators, which can be found on online platforms are sleep patterns, food intake, physical states (walking and running), social interactions, number of burned calories, heart rate, body mass index (BMI), status updates on social media, etc. [5,7,10,11]. Maintaining a healthy lifestyle is the best way to improve health and reduce the risk of premature death [1]. In that way, the burden on the health system is also decreased. It is expected that in the future, individuals will have a greater role in managing

their health if they have health-related data at their disposal [1].

Digital health data can also be used for active surveillance of diseases [6]. For example, patients with prostate cancer are offered active tracking of the disease, in order to have surgery and radiation therapy, when there are signs of disease progression [6]. The utilization of digital data can not only improve the health and wellbeing of individuals, but can also improve healthcare-related communication on social media [12]. This can potentially help in educating clinicians and patients about certain diseases [12]. Digital data is not solely used for the improvement of physical health, but also for the improvement of mental health. This will be described in more detail in the next section.

III. BIG DATA AND MENTAL HEALTH: DIGITAL PHENOTYPING

At the beginning and/or during the COVID-19 pandemic, most of us have experienced some sort of anxiety or know someone who has had similar experiences due to uncertainties brought by an unknown virus. The ongoing pandemic is leaving a significant mark on the mental health of citizens. The number of citizens with impaired mental health is expected to grow as a consequence of the aforementioned pandemic. That growth overcomes available capacities of mental health professionals which leads us to the question: can digital technologies in the broadest sense compensate for the lack of professionals in order to prevent and treat people with mental health difficulties [13].

Along with the implementation of digital technologies into different areas of medicine there is an emphasis on tracing mental health status of citizens as well. This brought a revolution in fields that deal with mental health, such as psychiatry and clinical psychology. The former director of the National (American) Mental Health Institute, Thomas Insel is one of the leading proponents of implementing digital technologies as clinical and research tools in the field of mental health. One of his main arguments is that smartphones could improve psychiatric assessments because smartphone apps could provide us with objective measures with respect to real-world functioning (ecological value) [14]. According to Insel's expectations, collecting passive data (i.e., digital

footprints) by using AI algorithms could compensate for the lack of objectiveness that is characteristic of self-report measures. Therefore, large amounts of data from different digital sources have the potential of improving psychiatric assessment, which consequently leads towards establishing more adequate treatment and a better prognosis of mental diseases.

This new approach characterized by collecting big data, which can be relevant in diagnostics (differential-diagnostic purposes), early detection of signals of mental disorder, identifying risk factors for the development of mental disorders, etc., is called digital phenotyping. Digital phenotyping is based on sensors that can provide data about motoric activity and location (Global Positioning System i.e. GPS, Bluetooth sensors), data related to the prosody of speech and sentiment, and human-computer interaction (HCI). HCI in this context refers mostly to how users of social media express certain signs of some mental disorders in the digital domain and how interactions on social media influence their mental status. For the purpose of detecting different emotional states which can be related to specific diagnostic categories (e.g., depression or mania) techniques such as natural language processing (NLP) can provide relevant insights by analyzing written communication on social media (e.g., user's posts on social media). NLP has proved its value as a tool in identifying users on social media who show signs of some mental disorder (e.g., PTSD, depression, bipolar disorder, and seasonal affective disorder) [15], schizophrenia [16], changes in mood and behavior characterized in postpartum depression [17], etc. In addition to NLP, models based on web scraping which harvest image or text data posted on social media might be very effective in identifying those who are at risk of depression or suicide [18].

Machine learning, a specific subset of AI, has found its place at the very core of digital phenotyping. Contrary to traditional statistical modeling that is mostly based on explanation, machine learning tends to facilitate prediction. Because of that, well-trained algorithms with high predictive value are of great relevance in detecting mental disorders at their earlier stages

as it is in the case of identifying people at risk of suicide [19,20].

For the sake of being concise, the purpose of this section is not to provide a detailed and extensive explanation of specific methods used in digital phenotyping in technical terms, just to emphasize the importance of an integrated approach that encompasses information technologies, mathematics, knowledge management on one side and clinical psychology and psychiatry on the other. In order to be more efficient in tackling mental diseases in the era in which we are intertwined with technology on so many levels, this step must be made. As mentioned in the beginning of this section, the COVID-19 pandemic is leaving a big impact on our daily lives, and in the next section, we will show how digital data is used for controlling the pandemic.

IV. DIGITAL CONTACT TRACING DURING THE COVID-19 PANDEMIC

Digital contact tracing applications are being used as one of the ways to battle the COVID-19 pandemic [6,21]. With the use of digital footprints, governments can identify potentially infected individuals, trace their contacts, and carry out social distancing measures [6]. More precisely, individuals are being tracked through the applications on their smartphones in a growing number of countries [21]. A more privacy-invading way of collecting data about individuals' activities that can lead to the spread of the virus is through the involuntary collection of security camera footage, financial transactions, and cell phone location data [22].

There are two strategies in collecting voluntary data through COVID-19 contact tracing applications [22]. Firstly, COVID-19 contact tracing applications can utilize Bluetooth technology to decipher the distance between smartphones and in doing so know the proximity of infected individuals to others [22]. Secondly, there are location-based approaches that use cell phone network data, GPS, Wi-Fi signals, and other types of smartphone sensors to determine the location of infected persons [22]. An alternative approach to using geolocation data is to ask the user through surveys, and of course traditional manual contact tracing [23]. Another alternative approach to digital contact tracing applications

is barcoding strategies, in which users can log their locations using Quick Response (QR) codes placed on public locations [22]. A related approach to barcoding strategies is Wi-Fi fingerprinting where a so-called "fingerprint" of a location is made using the received strength of the signal from each Wi-Fi network [22].

Current research suggests that digital contact tracing might be more effective than manual contact tracing in controlling the pandemic [9]. However, the use of digital contact tracing depends on the level of technological development of a certain country, and manual contact tracing is still more prevalent. It is expected that in the near future digital contact tracing will complement manual contact tracing [9]. One of the downsides of the usage of digital contact tracing is that its effectiveness depends on the level of public support and approval [9]. The most crucial downsides of the utilization of any technology that is based on digital footprints are the possibilities of data privacy breaches and unjustified mass surveillance of citizens [9]. This will be more broadly described in the next section.

V.   ETHICAL ISSUES WITH USING DIGITAL DATA FOR HEALTH-RELATED PURPOSES

In previous sections, we have listed numerous advantages of using digital data for health-related purposes. However, the way digital data is used can possibly invade individual privacy, in a manner that is unacceptable in free and democratic societies [21]. As the process of digitalization progresses, almost every aspect of our day-to-day lives will be trackable [1]. For instance, there are fears that digital COVID-19 contact tracing applications will pave the way for massive government surveillance beyond the management of the current COVID-19 pandemic [24]. Surveillance is not only unjust and can compromise basic civil rights, but can also lead to psychological consequences [6]. It leads to a sense of endangered autonomy [6]. In the case of COVID-19, individuals might avoid being tested in order to avoid being tracked [6].

In addition to that, applications that collect health-related data should be constructed in a way to prevent data breaches from third parties [9]. Hackers might try to obtain these sensitive data [9]. Companies that collect health data might also sell the data to third parties without the user's consent. A well-known case of privacy violations is the Facebook-Cambridge Analytica data scandal [5]. The firm Cambridge Analytica used data from more than 80 million Facebook users without their permission to create advertisements that aimed to influence the outcome of the 2016 U.S. presidential election [5]. These kinds of data breaches can create reluctance in individuals to share their information, and they could hesitate in downloading digital health applications [5]. Therefore, it is important to establish the best possible practices for ensuring data privacy in the domain of digital health, while still making it possible for the data to be shared for health-related purposes according to the preferences of all relevant digital health stakeholders [10]. For the establishment of best practices in the field of digital health, collaboration is needed between different scientific fields namely behavioral science, data science, computer science, and neuroscience together with the digital health industry and experts in public policy [10].

In the course of this paper, we have covered many ways that the digitalization of the health sector can transform our world for the better. However, this can only be done if the trust of patients/users is maintained in how their private data is handled with.

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Global Competence as a Path to a Knowledge Society

Aneta Bobenič Hintošová[1]

[1]University of Economics in Bratislava, Faculty of Business Economics in Košice, Košice, Slovakia

[1]aneta.bobenic.hintosova@euba.sk

Abstract— **Typical feature of the current world is interconnectedness and young people are expected to understand global issues and their influences in order to function effectively in today´s world. One of the few evidences on the level of global competence of the young population worldwide is the global competence framework introduced by the Organisation for Economic Co-operation and Development (OECD), the results of which are used in this paper as a basis for analysis. The aim of the paper is to provide a comprehensive comparison of the level of global competence between the Visegrad and Balkan countries, namely Albania, Croatia, Serbia and Slovakia, and place it in the broader context of other nationally oriented indicators. The comparison yielded quite surprising results especially in terms of the two instruments, namely questionnaire and cognitive test, used to assess global competence. Hence, the results of the global competence assessment need to be interpreted with caution and placed in a broader context.**

Keywords - global competence, assessment, questionnaire, cognitive test

I.   INTRODUCTION

Globalization affects all aspects of our lives, including business, finance, culture or the environment. Typical feature of the current world is interconnectedness and young people are expected to understand global issues and their influences in order to function effectively in today´s world. There are evident efforts to adequately prepare students to become global citizens especially within higher education institutions [1]. According to [2], nearly all existing studies have recognized global competence as one of the most important learning outcomes in higher education. This competence can at the same time contribute to the acquisition of global knowledge and creation of the knowledge society that was highlighted also by [3]. However, despite widespread urge in this context, there is relatively little evidence on the level of global competence of the young population and its progress. One of the significant attempts in this regard is the development and implementation of the global competence framework introduced by the OECD´s Program for International Student Assessment (PISA) in 2018 [4], which has already provoked extensive academic discussion (e.g. [5,6]).   There exist also some other approaches   for   assessment   of   global competence, e.g. Global Competence Aptitude Model [7] used in the study by [8] or approach developed by [2], but these are narrower in their scope or designed for specific situations or conditions.

Since   the   international   comprehensive assessment of global competences under PISA provides comparable indicators of students´ performance   in   various   dimensions,   this assessment serves as a basis for analysis within this paper. The aim of the paper is to provide a comprehensive comparison of the level of global competence between the Visegrad and Balkan countries and place it in the broader context of other nationally oriented indicators. From these groups of target countries only students from Albania,   Croatia,   Serbia   and   Slovakia participated on the both instruments designed for assessment of global competence, so only these countries were finally object of the analysis.

There are several existing definitions of the term "global competence" in the existing literature. From broader point of view [2] defines it as the ability of a person to transcend a discipline or domain and to understand cultural norms and global events correctly in order to interact, communicate and work effectively outside home environment. According to [9], global competence is defined as a set of developmental dimensions consisting of ability, knowledge and personality. Based on their study of employees´ dimensions and their development in connection with participation on the global leadership development program they concluded that the knowledge dimension is changeable; however, the personality characteristics remain unchanged. In this context, [10] subsequently defines global competence as a set of knowledge and skills that should help people understand the flat world in which they live, integrate across disciplinary domains to understand global issues and events, and create opportunities to address them.

Despite wide range of other definitions that share some similarities, there is still lack of consensus on what exactly forms the global competence framework. One of the existing more complex concepts is offered by PISA [4], which defines global competence as a multidimensional capacity to live in an interconnected and changing world that includes four dimensions, namely the ability to:

1) Examine issues of local, global and cultural significance – i.e. the ability to combine knowledge of the world with critical considerations whenever it is necessary to form one's own opinion on a global problem,

2) Understand and appreciate the perspectives and worldviews of others – i.e. the ability to consider global issues and perspectives and the behavior of other people from multiple perspectives,

3) Engage in open, appropriate and effective interactions across cultures – i.e. the ability to understand cultural norms, styles and the degree of formality of intercultural contexts and to adapt communication and overall behavior accordingly, and

4) Take action for collective well-being and sustainable development – i.e. the ability to create opportunities to take informed, reflective action focused e.g. on improvement of living conditions in own communities.

These four dimensions are further underpinned by four interrelated components, namely knowledge, skills, attitudes and values, as it is shown in the Fig. 1. Examining some global issue requires not only a good knowledge of the topic, but also the skill to transform awareness into deeper understanding, the ability to reflect it in attitudes built on multiple cultural perspective and the willingness to take action led by values like collective well-being and sustainability. Hence, global competence is not a specific skill, but rather a combination of knowledge, skills, attitudes and values that are successfully applied in personal, virtual or mediated encounters with people from other cultural backgrounds and their acquisition is a lifelong process. Effective education for living in an interconnected world can support students to activate their knowledge, skills, attitudes and values by sharing ideas on topics of global or local significance inside and outside the school, or by interacting with people from other cultures.

Fig. 1 shows the combination of four dimensions and their construction on specific knowledge, skills, attitudes and values, which together form the global competence framework.

Even though the global competence framework is not specifically focused on some recent global events, it covers many globally relevant topics such as: cultural diversity, gender equality, economic crises, environmental
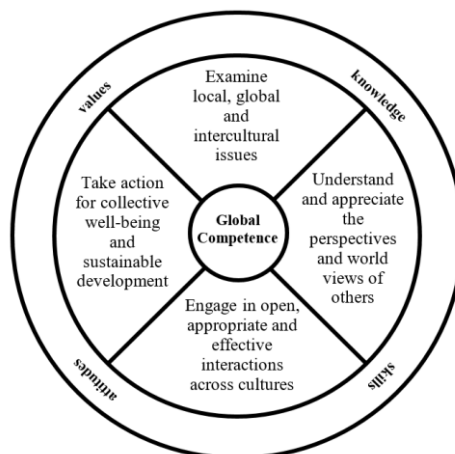
Figure 1. Global competence framework. Source: Adopted from [4].

sustainability, poverty, hunger and malnutrition, migration and so on.

III. METHODOLOGY

The aim of the present paper is to provide a comprehensive comparison of the level of global competence between the Visegrad and Balkan countries and place it in the broader context of other nationally oriented indicators. Due to the existence of an extensive survey completed in 2018 under the auspices of PISA, which assessed the level of global competence of 15-year-old students, the results of this survey [4] were used for comparison purposes within this paper. PISA has developed quality standards, procedures and verification mechanisms to ensure that national samples yield comparable results. Most samples were designed as two-stage stratified samples. Schools in which 15-year-old students can be enrolled were included in the first stage. At least 150 schools were selected in each country, although requirements for national analyzes often required a larger sample. The sampling of the students within selected schools was done in the second stage. Based on a prepared list of 15-year-old students, 42 students were then selected with equal probability, however their number could deviate from 42 but could not fall below 20.

The PISA assessment not only examines whether students can reproduce what they have learned at the end of compulsory education, but they also explore how well students can extrapolate from what they have learned and apply their knowledge in unfamiliar environments, both at school and beyond. Hence, the PISA global competence assessment is based on the use of the two following instruments:

1) A questionnaire consisting of a set of questions covering several items (statements) responses to which reflect self-reported information from students. There was also additional self-reported information from parents, teachers and school principals that is not object of the analysis within this paper. The questionnaire assessed students' attitudes, knowledge and skills covering all four dimensions of global competence. The responses to questionnaire items were based on a Likert-type scales and individual indexes related to particular questions and countries were further calculated. Positive values in the individual indexes indicate a higher level of global competence in the particular dimension

than the average student across OECD countries, while the negative values indicate the opposite. The OECD average corresponds to the arithmetic average of the results of the countries concerned.

2) A cognitive test that is focused on the cognitive aspects, including knowledge and cognitive skills required to solve problems related to global and intercultural issues covered by three dimensions of global competence. Students who passed the global competence test answered several test items that focused on understanding and appreciating various situations related to global competence dimensions. Answers to questions were scored as either full credit, partial credit or no credit. For the purpose of the analysis, partial credit was coded as no credit. The results presented reflect the average proportion of correct answers to all items tested within certain dimensions.

Fig. 2 shows the approach to assessing global competence through the questionnaire and cognitive test.

PISA in its publication [4] reported data from 66 countries and economies. Students in 27 countries and economies completed the global competence questionnaire and also passed the global competence test. Students in a further 39 countries and economies completed only the global competence questionnaire. Since the aim of the paper is to provide the most comprehensive comparison of global competence in the Visegrad and Balkan countries, the selection of particular countries that are object to further analysis is guided by their participation in both assessment instruments. Only Slovakia fulfills this criterion in the case of the Visegrad countries and
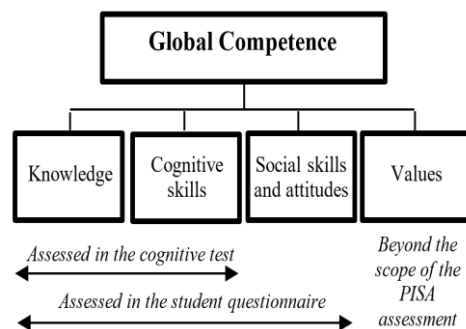
Figure 2. The approach to assess global competence. Source: Adopted from [4].

Albania, Croatia and Serbia in the case of the Balkan countries.

In order to evaluate the results of the assessment of global competences in a broader context and provide deeper descriptive analysis, additional information was used to compare the position of countries in related aspects. The data on the globalization index were taken from KOF Swiss Economic Institute [11], data on the environmental performance index were from Yale Center for Environmental Law & Policy [12] and values of GDP were taken from the World Bank database [13]. Further data on diversity of the particular countries were taken from World Population Review [14, 15].

IV. RESULTS AND DISCUSSION

First, the results of student questionnaire are reported and compared. The questionnaire covered all four dimensions of the global competence framework through following questions (Table I) for which mean indexes were counted subsequently.

TABLE I. QUESTIONS IN THE PARTICULAR DIMENSIONS

Dim.	Questions
1.	Awareness of global issues
	Self-efficacy regarding global issues
2.	Ability to understand the perspectives of others
	Interest in learning about other cultures
	Respect for people from other cultures
	Cognitive adaptability
	Attitudes towards immigrants
3.	Awareness of intercultural communication
4.	Agency regarding global issues

Source: Own processing based on data adopted from [4]

Based on the results of the questionnaire, global competence profile of students from each country, which are object of the interest in this paper are shown in the Fig. 3. The results for every question are reported separately, providing the values of the mean index. The OECD average with the value of zero is shown as well.

Awareness of global issues and students' self-efficacy regarding global issues fulfill the first dimension of the global competence framework, namely students' ability to examine issues of local, global and cultural significance. It consists in total of 13 questionnaire items. In terms of content, it covers students' ability to
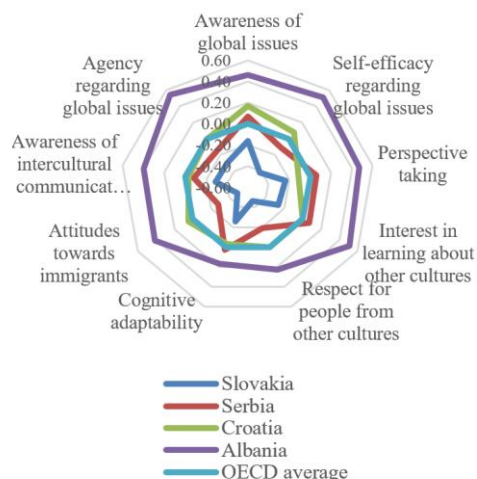
Figure 3. Comparison of global competence profiles based on the questionnaire. Source: Own processing based on values adopted from [4].

combine knowledge with critical understanding whenever they form opinions about topics related to environmental issues, global health, migration, international conflicts, poverty and hunger, as well as aspects of equality between men and women. In the case of both questions, Albania scored substantially higher than the OECD average, followed by Croatia reaching also slightly above average values of both indexes. Serbia scored positively in awareness of global issues but negatively in the field of self-efficacy. However, Slovakian students showed below average knowledge and understanding of global issues. Regarding the content of the particular items, students from Albania were most familiar with the topics connected with poverty and equality between men and women in different parts of the world. Similar is valid for Croatia and Serbia, however with slightly lower level of familiarity. On the other hand, Slovak students showed the greatest awareness of the migration issues, but this level is still lower than in the case of the other countries under comparison.

The second dimension of the global competence framework, namely ability to understand and appreciate the perspectives and worldviews of others, is covered by wider range of 5 questions, consisting in total of 24 questionnaire items. This dimension examines students' ability to adapt to new situations, their interest in learning about different cultures and their attitudes towards people from other cultures and towards immigrants. Individuals

who are scoring high in this dimension express their sensitivity towards cultural diversity and towards worldviews and values that are different from their own. Albania demonstrates the highest score in this dimension, from all investigated questions point of view. The extraordinary score reached this country in the question of understanding the perspective of others and learning about other cultures, which are the second highest scores among all investigated countries. In particular, students strongly expressed that they are trying to look at everybody's side of a disagreement before making a decision and showed strong will to learn how people live in different countries. On the other hand, Albanian students showed relatively lower score in cognitive adaptability, however it is still above the OECD average. Scores close to the OECD average in almost all questions reported Croatia. The relatively best results showed this country in attitudes towards immigrants. In particular, they strongly agree that immigrant children should have the same opportunities for education as the other children in the country. On the other hand, Croatia reported relatively low scoring in perspective taking. Serbian students show relatively high interest in learning about other cultures, especially in learning how people live in different countries. On the other hand, they showed a relatively low score in attitudes towards immigrants. Slovakia reports the lowest values of indexed in all questions that are below the OECD average in all cases. Extremely low values (the second lowest among all investigated countries) are found in students´ attitudes towards immigrants.

The third dimension of the global competence framework is covered by one question consisting of 7 items that are designed to evaluate the ability to engage in open, appropriate and effective communication across cultures. Similarly, as in the case of previous dimensions, awareness of intercultural communication is unequivocally the highest in Albania, which scored the highest also in absolute terms, i.e. among all investigated countries. An exceptionally high percentage of Albanian students said that they give concrete examples to explain ideas when talking to people with different native language. Croatian and Serbian students score slightly below the OECD average in terms of overall intercultural communication that is strengthened by careful listening to others while talking to people with

different language background. In the case of Slovakia, the score in intercultural awareness is significantly low, especially due to relatively low ability to explain things carefully when talking to people with different native language.

The fourth dimension of the global competence framework is expressed by the ability to take action for collective well-being and sustainable development and reflects practical nature of the acquired skills. As in the previous cases, the highest scores are found for Albania that reached priority also among all of the countries that were evaluated. This priority is based on the perception of importance of global environment as well as recognition of global citizenship. Croatia reported values equal to the OECD average, especially due to the recognition of global citizenship. Serbia scored slightly negatively and Slovakia significantly negatively in this dimension, since students there are skeptical about the ability to do something in regard with the problems of the world.

In order to gain more comprehensive view on the level of global competence in analyzed countries, the results of the cognitive test are further reported. The cognitive test assessed skills that are desirable and go beyond the scope of topics included in the questionnaire assessment such as ability to practically examine issues of global and local significance, development of critical thinking, ability to understand the perspectives of others and to evaluate actions as well as consequences. Hence, cognitive test covers following three of the four dimensions of global competence, namely:

1) Examining issues of local, global and cultural significance;

2) Understanding and appreciating the perspectives and worldviews of others;

4) Taking action for collective well-being and sustainable development.

The results of the cognitive test in the form of percentage of correct answers to all items tested in the three dimensions are shown in Fig. 4.

The results of the cognitive test show some differences in comparison to the results provided by the questionnaire. This is particularly significant in the case of Albanian students. Although self-reported information from students indicated a high level of their global
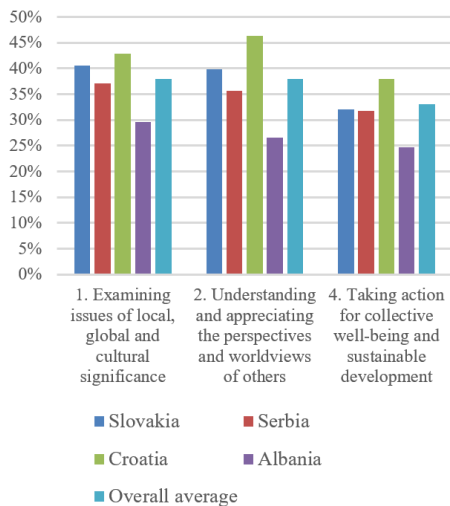
Figure 4.   Comparison of the cognitive test results.
Source: Own processing based on values adopted from [4].

competence, the correct answers to the cognitive test items showed a relatively low percentage, which did not exceed 30% in any of the dimensions. The best results of cognitive test were achieved by Croatian students in the case of all three dimensions, which are relatively higher than in the case of the questionnaire. Similar improvement is obvious also in the case of Slovakia, where students performed much better in test compared to the questionnaire. The most balanced results in terms of both instruments used to assess global competence were reached in Serbia.

These differences can be possibly explained by diverse sources that form knowledge, skills and attitudes of the students. On the one hand, significant role in this regard play formal education systems and their ability to equip students to live in an interconnected and diverse world and to benefit from it. On the other hand, students in their home country are differently exposed to global issues, cultural diversity or interethnic contacts, which in turn contribute to the formation of specific knowledge, skills and attitudes. To better illustrate this situation, the following Table II provide overview of some indicators that are in more or less extent connected with global affairs and can possibly have effect on the global competence of students. The latest available data are provided in the table. In the case of indexes, the higher values indicate higher performance (diversity)

and thus higher position in the particular ranking.

TABLE II.   OVERVIEW OF RELATED INDICATORS

Indicator	Albania	Croatia	Serbia	Slovakia
KOF Globalization Index	66.65	81.19	78.34	82.66
Environmental Performance Index	49	63.1	55.2	68.3
GDP per capita (current USD)	5,215	13,829	7,666	19,157
Linguistic Diversity Index	0.2086	0.2102	0.4573	0.2309
Racial Diversity Index	0.2204	0.369	0.5736	0.2539

Source: Own processing based on data from [11-15]

Based on the values of indicators it seems that students from countries that enjoy rather benefits of globalization, perform better in environmental aspects and have higher level of economic development are to less extent exposed to the global problems and thus are less familiar with these topics. This is particularly true for Slovakia and to some extent also for Croatia, which scored relatively low in students' questionnaire. The opposite seems to be true for Albania. Relatively higher level of linguistic and racial diversity in the case of Serbia compared to the other countries possibly contributed to the overall average position of Serbia in terms of global competence. These aspects, however, deserve further investigation within future research.

At the same time, the significant differences in the results shown by questionnaire and cognitive test arises doubts as to the extent to which the concept of assessment of global competence by PISA is adequate and selected dimensions are universal, rather than contextual features of competence. These aspects have already been highlighted in [16]. Hence, it should be agreed with [17] that caution is needed while interpreting the results of the PISA's assessment and identifying policies and practices related to the concept global competence.

V.   CONLUSION

The present paper provided comprehensive comparison of the level of global competence between the Visegrad and Balkan countries, namely Albania, Croatia, Serbia and Slovakia, on a basis of the PISA assessment of global

competence and placed it in the broader context of other nationally oriented indicators. The comparison yielded quite surprising results especially from the point of view of Slovakian and Albanian students. In terms of the two instruments used to assess global competence, namely the questionnaire and the cognitive test, both countries recorded essentially opposite results. These differences can be attributed to the distinct national contexts and educational systems in those countries as well as to the differences in construct of the instruments use to global competence assessment. In the case of Croatia and Serbia the differences between the results of the two instruments are not so significant and the overall level of the global competence of the students in these countries rotate around the OECD average, with slightly better results for Croatia. Hence, the results of global competence assessment provided by PISA can serve as an interesting cross-national and comparative data points. On the other hand, with regard to detected significant differences in the results of both assessment instruments, the results need to be interpreted with caution and placed in a broader context, as it was partially shown in this paper.

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Crowdsourcing and Organizational Effectiveness: Mediating Role of Organisational Capacity to Learn

Matea Zlatković Radaković[1], Biljana Bogićević Milikić[2] Ana Aleksić Mirić[3]

[1]Faculty of Economics, University of Banja Luka, Banja Luka, Bosnia and Herzegovina
[2][3]Faculty of Economics, University of Belgrade, Belgrade, Serbia

[1]matea.zlatkovic@ef.unibl.org, [2]biljana.bogicevic@ekof.bg.ac.rs,
[3]ana.aleksic@ekof.bg.ac.rs

Abstract—**Crowdsourcing practices represent one way of gathering intangible resources through easy access to human, network and social capital beyond organizational boundaries, enabling the creation of value and accumulation of new knowledge, skills, creative ideas and efficient solutions for various challenges companies face. Through crowdsourcing organizations, on one hand, make their structure, content and processes available to others, while getting access to the dispersed external knowledge, on the other.**
Objectives: The main objective of the present study is to investigate the significance of the influence of crowdsourcing on the organizational effectiveness constructs mediated by organizational learning.
Research Methodology: All data are collected via a well-structured survey questionnaire delivered to firms within different sectors by email or in person. At first, a pilot study was performed to obtain feedback on the quality of the questionnaire items although the measurement scales were adopted. With minor modifications, the general agreement was that the questionnaire was clear and easy to understand so there was no need for major adjustments before their administration. Latent constructs were measured with items used from existing measurement scales with established content and convergent validity. Measurement items of the constructs were measured on a seven-point Likert-type scale ranging from "7 =strongly agree" to "1=strongly disagree.
Tools of analysis: This study utilized Partial least squares structural equation modelling (PLS-SEM) is used to estimate the research model through the SmartPLS software package, version 3.3.3.

Findings & results: This study revealed that crowdsourcing has a positive and significant direct effect on most organizational effectiveness models. Crowdsourcing has a non-significant direct effect only on the internal process model

Keywords – crowdsourcing, organizational learning capability, organizational effectiveness

I. Introduction

The modern environment makes it very difficult for organizations to achieve desired goals by relying solely on their internal resources, knowledge, abilities and skills. To acquire promising solutions to their problems and innovate their knowledge stocks they must explore additional knowledge sources externally and search for ways to exploit collective external knowledge [1]. In this respect, crowdsourcing represents an accessible opportunity for organizations and has attracted increasing attention from academics and practitioners. Crowdsourcing practices represent one way of gathering intangible resources through easy access to human, network and social capital beyond organizational boundaries, enabling the creation of value and accumulation of new knowledge, skills, creative ideas and efficient solutions for various challenges companies face. Through crowdsourcing organizations, on one hand, make their structure, content and processes available to others, while getting access to the dispersed external knowledge, on the other. Many studies have suggested that crowdsourcing practices lead to the perception of the

organization as innovative and dynamic, which continuously seeks innovative and creative approaches to its business operations. Consequently, crowdsourcing practices may improve organizational results such as brand visibility, cost reduction, outputs' reliability, etc.

Organisational capacity to learn as one of the key organizational capabilities through which organizations can improve the process of knowledge creation and implementation can be seen as a complement to crowdsourcing improving innovativeness and competitiveness.

In this paper, we aim to address the relationship between crowdsourcing practices and organizational effectiveness by understanding the role of organizational capability to learn as the variable that mediates presupposed relations. The partial least squares structural equation modelling (PLS-SEM) is used with a sample of 221 organizations from various business sectors in the Republic of Srpska to assess measurement and structural model, to evaluate reliability and validity of measurement scales and to test hypotheses.

The paper is divided into six sections. Section 2 reviews the theoretical framework of the analysis and proposes the research hypotheses. The research methodology is set out in Section 3. The data analysis and results are presented in Section 4. Discussion of the research findings is presented in Section 5. Finally, in Section 6 we provide conclusions, discuss the implications of the research findings, present limitations of the study and highlight possible directions for future researchprovides authors with most of the formatting specifications needed for preparing electronic versions of their papers.

II. Literature Review and Research Hypothesis

A. Organizational Effectiveness

There is no generally accepted view on the conceptualization of organizational effectiveness [2]. In general, organizational effectiveness is a broad concept that implicitly takes into consideration a wide range of different variables and refers to the degree to which an organization realizes its goals [3]. The traditional effectiveness approach has put solely financial goals into the forefront, while later have recognized that goals can be defined based on different value dimensions, and consequently, different models of organizational effectiveness emerged.

B. Crowdsourcing

One of the first definitions of crowdsourcing that can be found in the literature describes it as a process of distributing problems and tasks that would be usually resolved and performed by employees to people beyond organizational boundaries through an open call focused on to the crowd of diverse external parties. Crowdsourcing appears in various types, such as crowd voting, ideas crowdsourcing, micro-tasking and solution crowdsourcing. From the point of resource-based view of the organization (and its upgrade the knowledge view) [4], crowdsourcing practices represent one way of gathering intangible resources providing easy access to external human, network and social capital beyond organizational boundaries, enabling the creation of value and accumulation of new knowledge skills, creative ideas and efficient problem solutions [5-7].

C. The Influence of Crowdsourcing on Organizational Effectiveness

Integration of crowdsourcing process into organizational structures and activities remain unclear due to rather scarce research studies. Recent studies revealed that the usage of crowdsourcing practices enhances information processing providing better organizational performance [8], benefits to the sales volumes [9] and boosts organizations ability to capture added value reflected in new investment fuds and future stock market performance [4,10,11].

According to above-mentioned, first hypothesis is formulated as follows:

Hypothesis 1: Crowdsourcing has positive effect on organizational effectiveness

D. The Influence of Organizational Learning on Organizational Effectiveness

Organizational learning is the development [12] and improvement in the knowledge base of the organization [13], an acquisition and the use of existing knowledge and/or the creation of new knowledge to improve economic performances [14] and the capacity of an organization to gain insight from its own experience or the experience of others and to modify the way it functions according to such an insight [15-17]. Several studies revealed that organizations following knowledge orientation gain better organizational results [18-20] that learning capabilities have a

positive influence on financial performance and organizational results [21] and organizational ability to seek, recognize and seize the business opportunities [22]. Organizational learning affects organizational performance by encouraging them to embrace new information flows and distinctive resources that enhance the organizational process and activities [17,23-25]. Recent studies revealed that organizations with highly developed adaptive capacity can absorb external information in their information bases and knowledge processes more easily and, consequently, enhance innovation abilities and organizational results such as brand visibility, cost reduction etc. [11,26].

Hypothesis 2: Organizational learning has a positive effect on organizational effectiveness.

E. Mediating Role of Organisational Learning Capability

Organisational learning is a complex construct often used as the dependent variable, independent variable, moderator or mediator in studies. Previous research findings indicate an important role of organizational learning capability in the relationship between organizational process capabilities and knowledge resources [27]. A positive relationship between organizational learning based on IT usage and crowdsourcing is indicated in some studies [28]. Some authors suggest that learning represents the core of crowdsourcing activities because of the expert participation in crowdsourcing activities [29]. There is a positive relationship between relationship capacity and organizational success in presence of mediator organizational learning [30]. Some authors revealed a significant mediation role of organizational learning in strengthening the link between organizational resilience and organizational success. Organizational performance can be indirectly affected by organizational learning. Also, some studies indicate the important role of organizational learning for business orientation-organizational performance linkage; social media platforms as sources of a creative approach to problem-solving suggest organizational technological adaptive capability that ensures better organizational performance [30,31].

Hypothesis 3: Organisational learning capability mediates the relationship between crowdsourcing and organisational effectiveness.

III. RESEARCH METHODOLOGY

This research aims to investigate the significance of the influence of crowdsourcing on the organizational effectiveness constructs mediated by organizational learning. To test the hypotheses, field research was conducted [32].

All data are collected via a well-structured survey questionnaire delivered to firms within different sectors by email or in person. At first, a pilot study was performed to obtain feedback on the quality of the questionnaire items although the measurement scales were adopted. With minor modifications, the general agreement was that the questionnaire was clear and easy to understand so there was no need for major adjustments before their administration. Latent constructs were measured with items used from existing measurement scales with established content and convergent validity. Measurement items of the constructs were measured on a seven-point Likert-type scale ranging from "7 = strongly agree" to "1 = strongly disagree".

A. Crowdsourcing

To measure latent construct crowdsourcing (CWS) measurement scale consisting of eight items developed by [11] was used. This scale is based on a broad conceptualisation of crowdsourcing activities, including any IT initiative related to accessing collective knowledge in virtual networks.

B. Organizational Learning

Organizational learning was assessed in two dimensions: commitment to learning (CL) (five items) and learning behaviour (LB) (three items). These measurement scales were adapted based on development scales tested by Baker and Sinkula (1999) and Edmondson (1999), respectively [33].

C. Organizational Effectiveness.

The competing value approach is used to conceptualize organizational effectiveness more broadly. Competing values instrument (CVI) is used to measure organizational effectiveness comprised from four distinct, but not mutual exclusive constructs called: model human relations (MHR), model internal process (MIP), model rational goal (MRG) and model open systems (MOS). This instrument consists of sixteen items.

Control variables such as age and industry are included in the structural model to avoid potentially misleading results due to endogeneity issues that may occur.

E. *Sample and Data Collection Procedures*

The questionnaire written in the native language was sent to randomly chosen five-hundred firms registered in the Business Register of Chamber of Commerce of the Republic of Srpska. Two hundred and twenty-one fulfilled and completely usable questionnaires were obtained from the survey and used for further data analysis. The survey response of two-hundred and twenty-one was considered to be good enough for the applied data analysis approach and it is considered to be suggestive and acceptable for exploratory research. The sample of the study consist of 81 product-oriented and 140 service-oriented firms. The majority of organizations are SMEs (89.14%) older than 15 years (63.35%).

According to the sample size rule of thumb, the number of observations should be 10 times more observations than arrows are pointing into construct in measurement and/or structural model [34]. In the proposed model the second condition has to be fulfilled to have a representative sample size. Latent constructs in the conceptual model are crowdsourcing, two dimensions of organizational learning (commitment to learning and learning behaviour) and four organizational effectiveness models (human relations model, internal process model, open systems model and rational goal model). The most complex partial regression in PLS path model has 3 predictors (3*10=30), so, in line with the above-mentioned condition, 30 observations represent an acceptable sample size that is several times smaller than the real sample size of 221 organizations selected.

IV. Data Analysis and Results

Using statistic power analysis performed in G*Power software version 3.1.9.2., using a maximum of 3 predictors of an endogenous construct in the proposed structural model the minimum sample size of 55 observations is determined to achieve 80% statistical power, with a probability error of 5%.

Partial least squares structural equation modelling (PLS-SEM) is used to estimate the research model through the SmartPLS software package, version 3.3.3. [35]. PLS-SEM is a two-stage technique that includes assesment of (reflective) measurement and structural model.

PLS-SEM model assessment and its predictive relevance. In the first stage of the PLS-SEM, indicators' reliability, constructs' internal consistency reliability, convergent validity and discriminant validity are determined. Second stage of PLS-SEM includes size and significance of PLS paths and model's predictive relevance assessment.

The values of R2 and intensity and significance of direct effects in the model are shown in Fig.1. Results indicate that all total effects of crowdsourcing on organizational effectiveness are significant: mutual presence of organizational capacity to learn constructs enhance above-mentioned relation.

Results of the assessment of the structural model using bootstrapping procedure and predictive accuracy are presented in Table I.

Mediation analysis. Total specific effects to indicate the role of each organizational learning construct more precisely as mediator in relationship between crowdsourcing and each organizational effectiveness model and VAF values are presented in Table II.
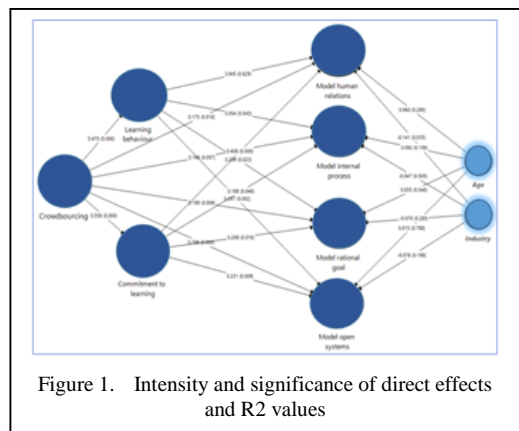
Figure 1. Intensity and significance of direct effects and R2 values

54

TABLE I. DIRECT AND TOTAL EFFECTS, BOOTSTRAPPING BCa CONFIDENCE INTERVALS AND MODEL'S PREDICTIVE ACCURACY

Panel c1: Direct and total effects and their significance at 5% level								
Path	Direct effects	p values	2.5% (LB)	97.5% (UP)	Total effects	p values	2.5% (LB)	97.5% (UP)
AGE -> MHR	0.060ns	0.290	-0.048	0.179	0.060 ns	0.290	-0.048	0.179
AGE -> MIP	0.092 ns	0.156	-0.037	0.213	0.092 ns	0.156	-0.037	0.213
AGE -> MOS	0.015 ns	0.788	-0.092	0.119	0.015 ns	0.788	-0.092	0.119
AGE -> MRG	0.035 ns	0.546	-0.077	0.150	0.035 ns	0.546	-0.077	0.150
CL -> MHR	0.408 **	0.000	0.224	0.571	0.408**	0.000	0.224	0.571
CL -> MIP	0.188 ns	0.048	-0.002	0.366	0.188 ns	0.048	-0.002	0.366
CL -> MOS	0.231**	0.009	0.051	0.396	0.231**	0.009	0.051	0.396
CL -> MRG	0.208**	0.016	0.029	0.365	0.208**	0.016	0.029	0.365
CWS -> CL	0.358**	0.000	0.234	0.465	0.358**	0.000	0.234	0.465
CWS -> LB	0.475**	0.000	0.356	0.564	0.475**	0.000	0.356	0.564
CWS -> MHR	0.175**	0.016	0.033	0.314	0.343**	0.000	0.211	0.456
CWS-> MIP	0.166 ns	0.057	-0.010	0.333	0.259**	0.001	0.096	0.392
CWS -> MOS	0.289**	0.000	0.161	0.405	0.489**	0.000	0.364	0.583
CWS -> MRG	0.190**	0.006	0.041	0.316	0.363**	0.000	0.232	0.468
IND -> MHR	-0.141 ns	0.035	-0.263	0.003	-0.141 ns	0.035	-0.263	0.003
IND-> MIP	-0.047 ns	0.505	-0.178	0.100	-0.047 ns	0.505	-0.178	0.100
IND -> MOS	-0.078 ns	0.198	-0.198	0.042	-0.078 ns	0.198	-0.198	0.042
IND -> MRG	-0.076 ns	0.285	-0.208	0.067	-0.076 ns	0.285	-0.208	0.067
LB -> MHR	0.045 ns	0.629	-0.142	0.222	0.044 ns	0.629	-0.142	0.222
LB -> MIP	0.054 ns	0.543	-0.127	0.225	0.057 ns	0.543	-0.127	0.225
LB -> MOS	0.247 **	0.002	0.084	0.397	0.248 **	0.002	0.084	0.397
LB -> MRG	0.209 **	0.023	0.021	0.381	0.207 **	0.023	0.021	0.381

Panel c2: Predictive relevance of the model						
Endogenous constructs						
	CL	LB	MHR	MIP	MOS	MRG
R2	0.128	0.226	0.259	0.109	0.372	0.233
R2 adjusted	0.125	0.222	0.242	0.088	0.358	0.215

Note: LB-lower bound; UB-upper bound; significance assessment of effects (p-values) is determined using the biased corrected and accelerated (BCa) (two-tailed) confidence intervals derived from the bootstrapping procedure with 5,000 samples, two-tailed test, no sign change, at 5% significance level; **$p<0.05$; ns – non significant

TABLE II. RESULTS OF MEDIATION EFFECTS OF ORGANIZATIONAL LEARNING CONSTRUCTS

Specific indirect effects	p value	Total Spec. effects	VAF	Mediation effect
CWS->CL->MHR	0.146**	0.321	0.455	Partial med.
CWS->LB-> MHR	0.021ns	0.196	0.107	No med.
CWS-> CL ->MIP	0.067ns	0.242	0.277	Partial med.
CWS -> LB -> MIP	0.025ns	0.191	0.131	No med.
CWS-> CL ->MOS	0.083**	0.372	0.223	Partial med.
CWS->LB ->MOS	0.118**	0.291	0.405	Partial med.
CWS-> CL ->MRG	0.074**	0.264	0.28	Partial med.
CWS-> LB ->MRG	0.099**	0.289	0.343	Partial med.

Results suggest that *c*ommitment to learning partially mediates the relationship between crowdsourcing and organizational effectiveness models while learning behaviour partially mediates the relationship between crowdsourcing and organizational effectiveness models with common dimension internal focus.

V. TESTING THE HYPOTHESIS AND DISCUSSION

According to the results of the structural model presented in Table 1, crowdsourcing has a positive and significant direct effect on most organizational effectiveness models. Crowdsourcing has a non-significant direct effect only on the internal process model. This result is supporting the expectations. The crowdsourcing process characterized by a system for sorting and filtering ideas obtained by IT platforms and an incentive system to develop the best ideas is not in line with the characteristics of the internal process model, such control and stability are. The essence of crowdsourcing is an informal way of gathering and exchanging ideas, knowledge, and wisdom regardless of hierarchy, established procedures and formal organizational structure. Thus, Hypothesis 1 is partially supported. The obtained results do align with the findings that the use of crowdsourcing can fill the gap between the knowledge available in organizations and the knowledge needed for solving organizational problems and generating unrealized solutions [36]. Crowdsourcing enables organizations to simultaneously adapt and create new services and solutions [11] and, among all, contribute to organizational growth and continuous acquisition of resources, as the main characteristics of the open systems model. Through IT platforms internal and external individuals are involved in problem-solving processes revealing their ideas and hidden knowledge that enhance collectivism and market dominance. IT platforms support organizational efficiency and managerial focus through the resolution of non-routine tasks and the solution to the problem.

Results indicated that there is a positive and significant relationship between "commitment to learning" as a part of organizational learning construct and the majority of organizational effectiveness models, except for the model of internal process. In the case of learning behaviour, there is a positive and significant effect of learning among organizational effectiveness models that share "external focus" as a dimension. Different aspects of organizational learning have different roles in enhancing certain organizational effectiveness domains. Thus, it can be concluded that Hypothesis 2 is partially supported. A high level

of organizational learning can be linked with a higher level of risk-taking, interaction with the external environment, open communications, and participative and flexible decision-making [31] which are characteristics of the majority of organizational effectiveness models. These results on the positive link between organizational learning and organizational performance are consistent with the findings of several authors [31,37].

This research conceptualizes organizational learning as a mediator (partial) between crowdsourcing and organizational effectiveness, which aligns with the earlier studies [30,38,39]. The results partially support Hypothesis 3, indicating that organizational learning mediates the relationship between crowdsourcing and organizational effectiveness.

VI. CONCLUSION

A. Contribution

This research provides a deeper insight into the crowdsourcing phenomenon by evaluating the relationship between crowdsourcing practices, organizational learning and organizational effectiveness, as well as by examining the mediating effects of the dimensions of organizational learning on the relationship between crowdsourcing and the different aspects of organizational effectiveness.

These results may be beneficial for both business academia and practice. Firstly, research findings contribute to the existing theories of organizational performance and overall organizational effectiveness by conceptualizing and providing evidence on simultaneous relationships between various aspects of crowdsourcing and organizational learning. Second, the research contributes to the existing literature in crowdsourcing practices and organizational effectiveness by providing new implications and insights into how a creative way of thinking and resolving problems can improve learning abilities and consequently enhance organizational effectiveness in different aspects. Empirical findings reveal that crowdsourcing can enhance organisational competitiveness and improve organizational effectiveness through organizational learning. This result is important as it offers empirical findings on how the link between crowdsourcing practices and organizational learning contributes to sharping the competitive edge.

Though research in crowdsourcing have gained popularity in recent years, to the best of our knowledge this is the first study addressing the issue in the Republic of Srpska, Bosnia and Herzegovina. Additionally, there is no empirical evidence on the importance of organizational learning as a mediator in the relationship between crowdsourcing practices and organizational effectiveness for examined research context. Therefore, obtained research findings try to fill the revealed research gap.

As far as a business practice is concerned, the research suggests that practitioners should pay attention to the sub-dimensions of all latent constructs in the proposed research model when considering the implementation of social platforms to improve overall organizational success. Furthermore, organizations aiming to enhance market position and competitiveness, effectiveness and efficiency through crowdsourcing practices should also improve their learning capacities. Organizational ability to learn has great importance in rising business success and achieving optimal organizational functioning. Our results suggest that crowdsourcing encourages creative thinking, organizational orientation towards learning, teamwork and the exchange of ideas.

B. Research Limitation

We find it important to address several relevant limitations of this study. Firstly, this empirical testing of the conceptual model is done solely within one economy - The Republic of Srpska. Cross-country empirical research would provide the basis for the generalization of the findings. Second, the sectoral structure of the selected sample together with a relatively small sample size does not representatively reflect the sector`s size in the studied population. Thus, hypothetical relationships have to be further analysed on a larger sample and in more contexts. Third, perceptual measures used in previous studies are validated in more developed countries. Likert's scales were used to measure all latent constructs including organizational effectiveness (performance). In future studies, objective indicators should also be included especially to measure organizational performance. Fourth, this research represents results at one point in time. Future studies should be longitudinal, to capture organizational development and the improvement of organizational effectiveness based on the

continuous usage of crowdsourcing practices and the growing learning capacity

C. Future Research

In addition to the examined role of organizational learning as a mediator, further analysis should examine the presence of other mediators of the crowdsourcing - organizational effectiveness relationship, such as intellectual capital or the environment. Other concepts of organizational learning that include different types of learning skills and processes of learning should be taken into considered and tested in proposed relationships between constructs of interest.

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Business Activities and Trade Law

Siniša Franjić[1]

[1]Independent Researcher, Osijek, Croatia

[1]sinisa.franjic@gmail.com

Abstract— **Trade law is a set of legal rules that regulate the subjects of trade law and the legal affairs of trade law. Trade law in the modern sense is a branch of law that refers to the rights and obligations arising from the delivery of goods and provision of services. Legal affairs of trade law are business activities that appear in their implementation. The legal framework relating to rights and obligations encompasses a number of elements, and this paper discusses some of them.**

Keywords - business, market, company, law

I.   INTRODUCTION

To a great extent, business activity across the world is carried on within a capitalist, market-based system [1]. With regard to such a system, law provides and maintains an essential framework within which such business activity can take place, and without which it could not operate. In maintaining this framework, law establishes the rules and procedures for what is to be considered legitimate business activity and, as a corollary, what is not legitimate. It is essential, therefore, for the businessperson to be aware of the nature of the legal framework within which they have to operate. Even if they employ legal experts to deal with their legal problems, they will still need to be sufficiently knowledgeable to be able to recognise when to refer matters to those experts. It is the intention of this textbook to provide business students with an understanding of the most important aspects of law as they impinge on various aspects of business activity.

One of the most obvious and most central characteristics of all societies is that they must possess some degree of order, in order to permit their members to interact over a sustained period of time. Different societies, however, have different forms of order. Some societies are highly regimented with strictly enforced social

rules, whereas others continue to function in what outsiders might consider a very unstructured manner, with apparently few strict rules being enforced.

Order is, therefore, necessary, but the form through which order is maintained is certainly not universal, as many anthropological studies have shown.

In our society, law plays an important part in the creation and maintenance of social order. We must be aware, however, that law, as we know it, is not the only means of creating order. Even in our society, order is not solely dependent on law, but also involves questions of a more general moral and political character.

II.   MARKET

Ours is a market system [1]. This means that economic activity takes place through the exchange of commodities. Individual possessors of commodities meet in the market place and freely enter into negotiations to determine the terms on which they are willing to exchange those commodities. Contract law may be seen as the mechanism for facilitating, regulating and enforcing such market activities.

It is usual for textbooks to cite how all our daily transactions, from buying a newspaper or riding on a bus to our employment, are all examples of contracts, but the point is nonetheless valid and well made. We are all players in the contract game, even if we do not realise it. In fact, we probably will not have any need to recognise that particular contractual version of reality until we enter into some transaction that goes wrong, or at least does not go as we hoped it would. Then, we seek to assert rights and to look for remedies against the person with whom we have come into dispute. It is at this time that the analytical framework of contract law principles comes to bear on the

situation, to determine what, if any, rights can be enforced and what, if any, remedies can be recovered. It is perhaps paradoxical that students of contract law have to approach their study of the subject from the opposite end from that at which the layperson begins. The layperson wants a remedy and focuses on that above all else; the student, or practitioner, realises that the availability of the remedy depends upon establishing contractual responsibility and, hence, their focus is on the establishment of the contractual relationship and the breach of that relationship, before any question of remedies can be considered. Such is the nature and relationship of law and ordinary, everyday reality.

Although people have always exchanged goods, market transactions only came to be the dominant form of economic activity during the 19th century, even in the UK. The general law of contract as it now operates is essentially the product of the common law and emerged in the course of the 19th century. It has been suggested that the general principles of contract law, or the 'classical model of contract', as they are known, are themselves based on an idealised model of how the market operates.

III. HUMAN RIGHTS

One of the highest priorities that businesses should set for themselves is respecting human rights, because their social license to operate depends on doing so [2]. In the due diligence process completed before financing a project, a development bank will always pay attention to human rights such as the prohibition of child labour, the elimination of discrimination, and the right of all workers to health, safety and security. Development banks apply the UN Guiding Principles on Business and Human Rights which distinguish the government's duty to protect the human rights of its citizens from the responsibility of businesses to respect human rights in all its activities and to aid victims of corporate abuse. Applying these principles is an essential step in making any project sustainable.

Given the huge number of infrastructure developments that are needed to reach the Global Goals, the support of local communities and their free, prior, and informed consent (FPIC) are crucial to their implementation. The transition to renewable energy also introduces an additional complexity. While in the past, most energy resources such as coal, oil, and gas were drawn from the earth's crust, today's renewable energy sources such as hydro, wind, and solar power rely on infrastructure that is above the ground. Communities are increasingly confronted with the question of whether they want to allow such projects in their vicinity.

This is not unique to developing economies. All over the world, protests are taking place against the visual pollution that wind, solar, and hydro energy projects cause. Governments should be playing an important role in balancing national and local interests in this issue. In democratic countries with sound legal systems, the possibility of arbitration and a reasonably fair process can be expected, but in countries that lack strong judicial institutions and legislation, it often becomes difficult for the local parties involved to solve these issues in a fair and peaceful way.

Like the WTO (World trade Organization), international human rights regimes have also been portrayed as threats to the legitimate regulatory power of States and the democratic choices of a State's population [3]. For example, there has been outrage in the UK regarding certain decisions of the European Court of Human Rights, which have found British counterterrorism measures (in the context of Northern Ireland) to breach international human rights standards. In Australia, the government has commonly impugned findings of violation against Australia by the HRC (Human Rights Committee) and other human rights bodies on the basis that those decisions lacked legitimacy and undermined policies and laws adopted via Australian democratic processes. Furthermore, the claims by certain States, such as China, Malaysia, and Singapore, that human rights are sovereign domestic matters, are well known and persistent, even if legally incorrect.

The purpose of international human rights law is in many ways counter-majoritarian. Though all people have human rights, they are probably most important for vulnerable minorities. In democracies, majorities are generally able to take care of themselves. Minorities, however, are in greater need of the support of international human rights regimes to guard against the arbitrary exercise of power by majorities. Majority rule per se is unlikely to cater for the human rights of unpopular minorities such as new refugee arrivals, suspected (and actual) criminals, or vulnerable minorities whose interests do not coincide with those of the majority or whose interests do not attract majority attention. The notion of

individual human rights would be considerably undermined if their extent was ultimately determined merely by the exercise of majority choices. Indeed, a key limit to the right of political participation is that majorities cannot compel government policies that breach other human rights. Therefore, there is significant justification for the removal of regulatory power from States under international human rights law (that is, its output) despite claims that such removal undermines majority rights.

In any case, the extent of the interference by international human rights law with State regulatory power is quite weak. The findings of the human rights bodies at the global level are not legally binding, though they have persuasive value. Numerous States have impugned the findings of these bodies on the basis of their non-legal status. Indeed, it is arguable that enforcement under the global human rights treaties has been delegated 'almost exclusively' to the municipal systems of States given the lack of strong international enforcement.

The negotiation of global human rights treaties is an open process, with significant NGO (non-governmental organizations) participation in bodies such as the Human Rights Council and its predecessor, the Commission on Human Rights. There is also ongoing civil society involvement in global human rights bodies. NGOs are permitted to participate in debates within the Human Rights Council. NGOs also commonly brief and submit information to the human rights treaty bodies.

IV. COMPANY

The objective of a good system of company law should be, first, to provide a framework within which entrepreneurs can be encouraged to take commercial risks and develop new businesses [4]. This will also provide passive investors with a mechanism by which they can invest capital in a business or industry, again, without the possibility that they will incur unlimited liability which may potentially bankrupt them. The justification for this must be that it will be for the good of the economy as a whole, even though there will be individuals who will lose out by dealing with such companies. Therefore, the second objective must be to provide sufficient controls on the persons forming and running companies, so that an outsider who deals with the company does not lose out unfairly as a result of fraud or sharp practice or abuse of the Companies Act.

Achieving the right balance between these opposing interests is not easy. Usually, the legislators of any system of company law adopt a mixture of measures which provide, on the one hand, ex ante protection, so that, for instance, minimum capitalisation requirements are laid down for the formation of a company and then strict rules are enacted for the maintenance of that capital to provide a sum for the satisfaction of creditors. Furthermore, there could, on its formation, be scrutiny by a central agency of the constitution and the proposed activities of the company and the reputation and character of the persons who will be running the company. And, on the other hand, there is ex post protection, whereby mechanisms are set in place, for example, to dislodge the security of various pre-liquidation transactions which are entered into in order to cheat bona fide creditors, or whereby procedures are established for fixing those who have been running companies fraudulently or recklessly with a liability to contribute to the company's debts. Further, steps can then be taken to disqualify these persons from running companies in the future

V. BITCOIN

The concept of bitcoin is rather simple to explain: During the financial crisis of 2008, people from all over the world felt its debilitating economic effects [5]. As the global financial system teetered on the brink of collapse, many central banks engaged in quantitative easing — or in simple terms, turned on the printing presses. Central banks flooded the markets with liquidity and slashed interest rates to near zero in order to prevent a repeat of the Great Depression of the 1930s. The effect of this was large‐scale fluctuations in fiat currencies and what has since been termed currency wars — a race to competitively devalue so that an economy can become more viable simply by its goods and services being cheaper than those of its neighbors and global competitors. The response of central banks around the world was the same as it always has been when these things happen: Governments had to bail out affected banks and they printed extra money, which further devalued the existing money supply.

In bailing out the banks, there was a net transfer of debt to the public purse, thus adding to future taxpayer liabilities. This created a sense of social injustice among some quarters. Aside from that, no one really knows what the long‐term effects of quantitative easing will be.

Perhaps inflation at some point in the future and a further devaluation of those fiat currencies who engaged in the schemes? What seemed clear is that central bankers, supposedly acting independent of governments, were taking many economies into the unknown and were prepared to devalue their fiat currencies at will just to keep the wheels turning. In doing so, they bailed out the very same institutions and bankers whose reckless behavior had brought about this crisis in the first place. The only other option would have been to let the whole system collapse and be purged, as for instance happened in Iceland. That country defaulted on its debt and endured great economic turmoil in the aftermath of that event.

VI. COMPETITION

Competition law generally contains three sets of prohibitions, concerning anticompetitive agreements, abusive practices by dominant firms and the ex-ante control of mergers [6]. It is quite striking how the substantive rules of competition law tend to converge on a global scale, notwithstanding the many differences that exist in terms of economic systems and legal and cultural backgrounds across countries. To be clear, the interpretation of these rules is largely influenced by local specificities, an aspect to which we return later. Yet, a less widespread consensus concerns the desirability of including merger control among the enforcement powers of the agency. Historically, even in the most advanced antitrust jurisdictions, a merger control regime was introduced only decades after the first enactment of the competition law. However, countries that have introduced competition law more recently have set up a merger control system from the very beginning, but even in these cases there is some room of manoeuvre as the scope of the merger regulation may be defined by adequately setting the thresholds that trigger the powers of the competition authority.

In many jurisdictions some economic activities are exempted from the applicability of competition law. The rationale for this exemption is that these activities pursue more general interests and require an organization that is not compatible with competition. Moreover, the state assigns to some bodies the objective of pursuing these general interests and does not want other institutions to interfere with the decisions they have to make, aimed at achieving the assigned objectives. This approach makes perfect sense. However, it can be easily distorted to protect vested interests (i.e. rents) in activities

that can be efficiently and effectively performed in competitive markets. Thus, the extent of these exclusions is an important policy choice that needs to be made based on careful assessment. Moreover, competition authorities might still act as advocates of the competition principles, even if the law prevents them from enforcing competition rules against the institutions entrusted with these general interest objectives. This is part of the more general advocacy powers that the authority typically can exert to induce lawmakers and policymakers to avoid unnecessary restrictions of competition.

While competition law and economic regulation are generally distinguishable by their modes of operation, their scopes of application overlap, meaning that some market problems can be addressed either through individual competition enforcement or through implementation of a systematic regulatory framework [7]. The issue of concurrency arises from this potential overlap: instead of choosing between competition law and regulation as mechanisms of market supervision, is it possible to apply both, simultaneously or consecutively, within the same market and even to address the same anticompetitive conduct? To a large extent there is asymmetry here, because the episodic and generally retrospective nature of antitrust intervention means that, typically, it does not cover the same ground as subsequently enacted, forward-facing sector regulation. Prior competition enforcement within a sector should not bar later regulation unless such activity indicates that competition law alone is adequate to ensure well-functioning markets. Essentially, the question to be considered is whether competition law is applicable ex post in markets subject to ex ante regulation, or, put differently, the extent to which sectorspecific regulation ousts antitrust jurisdiction to scrutinise the behavior of regulated firms or, more generally, economic activity in a sector.

VII. SUITABLE SPACE

Every business, whether small or large, must find suitable space for its activities [8]. For the sole proprietor, the studio may be in the home. For a larger enterprise, the studio or office is likely to be in an office building. While some businesses may own their offices, most will rent space from a landlord. The terms of the rental lease may benefit or harm the business. Large sums of money are likely to be paid not only for rent, but also for security, escalators, and other

charges. In addition, the tenant is likely to spend additional money to customize the space by building in offices, darkrooms, reception areas, and the like.

The old saw about real estate is, "Location, location, location." Location builds value, but the intended use of the rented premises must be legal if value is to accrue. For example, sole proprietors often work from home. In many places, zoning laws govern the uses that can be made of property. It may be that an office at home violates zoning restrictions against commercial activity. What is fine in one town— a studio in an extra room, for example—may violate the zoning in the next town. Before renting or buying a residential property with the intention of also doing business there, it's important to check with an attorney and find out whether the business activity will be legal.

In fact, it's a good idea to retain a knowledgeable real estate attorney to negotiate a lease, especially if the rent is substantial and the term is long. That attorney can also give advice as to questions of legality. For example, what if the premises are in a commercial zone, but the entrepreneur wants to live and work there? This can be illegal and raise the specter of eviction by either the landlord or the local authorities.

In addition, the lease contains what is called the "use" clause. This specifies the purpose for which the premises are being rented. Often the lease will state that the premises can be used for the specified purpose and no other use is permitted. This limitation has to be observed or the tenant will run the risk of losing the premises. The tenant therefore has to seek the widest possible scope of use, certainly a scope sufficient to permit all of the intended business activities.

VIII. CRIME

The intersection of criminal law and commercial activities is an area of growing importance in the governance of modern society [9]. While criminal law is not considered as a typical component of business law, the commission of crimes by persons, both natural and juridical, in the pursuit of commercial activities, requires examination in any contemporary exposition of the legal framework within which the business sector operates. It is hardly surprising that, in the business world, there are several activities that have attracted criminal sanction.

A crime is an act which the law, with appropriate penal sanctions, forbids. As prohibitions are not enacted in a vacuum, there is usually some evil or injurious or undesirable effect upon the public against which the law is directed. That effect may be in relation to social, economic or political interests where the legislature finds it necessary to suppress the evil or safeguard the interest threatened. A useful starting point is the definition of a crime but, in attempting a definition, what becomes apparent is the marked reticence by many writers to avoid such a task. One viewpoint is that the concept of what is a crime is better defined by examining the characteristics of a particular conduct rather than attempting a precise and all-embracing definition. It has been observed that criminal conduct generally contains elements of a public wrong and a moral wrong. With regard to a public wrong, crimes are generally considered to be 'acts which have a particular harmful effect on the public and do more than interfere merely with private rights'. The 'second characteristic of crimes which is usually emphasised is that they are acts which are morally wrong'.

The consequence of an act or omission that contains the characteristics of being a public wrong and a moral wrong is the commission of a criminal offence. 'A criminal offence is a legal wrong for which the offender is liable to be prosecuted by or in the name of the State, and if found guilty liable to be punished.' While breaches of contract or commission of torts may result in actions being taken by persons against the offending party, a criminal offence attracts the attention of the state which seeks to take action on behalf society in general.

IX. INTERNATIONAL LEGAL ENVIRONMENT

International business transactions are not unique to the modern world [10]. Indeed, commerce has always crossed national borders, as President Thomas Jefferson noted in the chapteropening quotation. What is new in our day is the dramatic growth in world trade and the emergence of a global business community. Because exchanges of goods, services, and ideas on a global level are now routine, students of business law and the legal environment should be familiar with the laws pertaining to international business transactions.

Laws affecting the international legal environment of business include both international law and national law. International law can be defined as a body of law—formed as

a result of international customs, treaties, and organizations—that governs relations among or between nations. International law may be public, creating standards for the nations themselves; or it may be private, establishing international standards for private transactions that cross national borders. National law is the law of a particular nation, such as Brazil, Germany, Japan, or the United States.

The major difference between international law and national law is that government authorities can enforce national law. What government, however, can enforce international law? By definition, a nation is a sovereign entity—meaning that there is no higher authority to which that nation must submit. If a nation violates an international law and persuasive tactics fail, other countries or international organizations have no recourse except to take coercive actions—from severance of diplomatic relations and boycotts to, as a last resort, war— against the violating nation.

In essence, international law attempts to reconcile the need of each country to be the final authority over its own affairs with the desire of nations to benefit economically from trade and harmonious relations with one another. Sovereign nations can, and do, voluntarily agree to be governed in certain respects by international law for the purpose of facilitating international trade and commerce, as well as civilized discourse. As a result, a body of international law has evolved.

X. CONCLUSION

Trade law is one of the most dynamic branches of law. The accelerated development of knowledge and the appearance of modern information technology in economic activities leads to the emergence of new relationships in the economy. It should certainly be emphasized that most of the legal rules that were valid before the appearance of modern information technology are still valid, but they must be adapted to modern trends. Trade law is a peculiar regulator of these relations and is therefore subject to very frequent changes.

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Codification of Knowledge as a Determinant of Job Satisfaction

Mihailo Ćurčić[1], Ivica Matejić[2]

[1]Univeristy of Defense, Belgrade, Serbia
[2]University of Kragujevac, Kragujevac, Serbia

[1]curcicmihailo@gmail.com, [2]ivica_matejic@yahoo.com

Abstract—**The subject of research are the elements that make up the process of knowledge management and the impact of these factors on employee satisfaction. The aim of the research is to identify the interdependence between knowledge codification, knowledge sharing and job satisfaction. The empirical research was conducted in 2021 in the organizational units of the Ministry of Defense of the Republic of Serbia on a sample of 58 respondents, using the survey method. The results of the research show that there is interdependence between the elements of knowledge management and job satisfaction. The motivation for the realization of research on this topic stems from the fact that there is not a large number of researches that put knowledge management and job satisfaction in a relationship.**

Keywords - knowledge management, knowledge sharing and job satisfaction

I. INTRODUCTION

Globalization, understood as a process of denationalization of markets and organizational structures, has given a significant impetus to the development of knowledge management [1]. Knowledge management places emphasis on identifying, sharing, creating, and storing knowledge in search of organizational learning [2]. It is a process that begins with the acquisition or creation of knowledge, continues with the use of knowledge to improve the business of the organization and ends with the retention and improvement of acquired knowledge [3,4].

Knowledge can be divided into explicit (documented, codified) and implicit (subjective) knowledge [5]. Implicit knowledge exists within the individual, is acquired through experience, and is manifested through the daily performance of activities in which the skill is demonstrated [6]. It is uncodified knowledge that is acquired through the informal application of learned procedures and behaviors [7]. Unlike implicit, explicit knowledge is expressed in a formal form and is characterized by a high level of systematicity [6]. It is publicly available, formalized, documented, clear and concise [8].

For the purposes of this research, knowledge management is viewed through four elements: knowledge acquisition, knowledge sharing, knowledge codification, and knowledge retention [9].

The subject of the research are the elements that make up the process of knowledge management, specifically the codification of knowledge and knowledge sharing, and their impact on employee satisfaction. The aim of the research is to identify the interdependence of knowledge codification, knowledge sharing and job satisfaction [9,10].

II. LITERATURE PREVIEW

A. Konwledge Management

Knowledge-based organization management emphasizes human capital - the skills, knowledge, competencies, attitudes, and motivation of people who work for the organization and the way they use these skills for the benefit of the organization [11]. If we base knowledge solely on human capital, we come to the problem that most of that knowledge is implicit, and it is very difficult to manage such knowledge. Gathering and codifying implicit knowledge is the basis for implementing knowledge management in an organization [12]. Knowledge management is a continuous process

consisting of a large number of activities [6]. Reference [13] divide knowledge management into four elements: knowledge acquisition, knowledge creation, knowledge storage, and knowledge sharing. Reference [14] divide the process of knowledge management into: knowledge creation, knowledge application and knowledge dissemination. Reference [15] view knowledge management through: knowledge absorption, knowledge use, and knowledge production. For the purposes of this research, knowledge management is viewed through four elements: knowledge acquisition, knowledge sharing, knowledge codification, and knowledge retention [9].

Knowledge acquisition is a process aimed at gathering information from external sources [16, 17]. Acquired knowledge will have no purpose if it is not shared among employees in the organization [18]. Explicit knowledge is very easy to share because it is codified, formalized and available to everyone in the organization. The challenge in sharing knowledge arises with implicit knowledge. The most common way of sharing implicit knowledge is "face to face" [14], i.e. direct contact of employees. The success of knowledge sharing depends on the organization's willingness to develop a knowledge sharing culture [14,19]. The organization must motivate employees to share knowledge through informal communication, brainstorming, mentoring, and training [20]. The success of knowledge sharing depends on the degree of motivation and status of employees who possess the necessary knowledge. Employees who are motivated both financially and non-financially, and confident in their position in the organization will share knowledge with others without fear that any of the employees may take their place.

Codification of knowledge is the most reliable way of storing and sharing knowledge in an organization. It involves formalizing the acquired knowledge through procedures, rules and instructions that are easily accessible to all and that cover all work processes in the organization. When codifying knowledge, the fear arises in the fact that codified knowledge can be very easily transferred to competitors. An error in the codification of knowledge occurs if we do not check and harmonize the codified knowledge with new practices and newly acquired knowledge. Knowledge management is a continuous process, and once acquired knowledge must be continuously revised and improved.

B. Job Satisfaction

Job satisfaction can simply be described by the degree to which employees like or dislike their job [21] and is related to employee motivation and enthusiasm they have for their work [22]. It is manifested through the feelings that employees have about the work they do [23; 24]. Job satisfaction starts from the needs and expectations of employees and the subjective experience of fulfilling those needs and expectations [25]. Job satisfaction is often equated with the well-being of employees at work [26]. Welfare can be divided into psychological, psychological, and social well-being [26]. Impaired welfare of employees results in frequent absences from work due to illness, inefficiency in performing tasks, lack of interest in work and general dissatisfaction [27].

Job satisfaction has been linked through research to a variety of organizational and individual characteristics, such as organizational commitment [28], performance, organizational culture [29], age and gender, employee structure. Although job satisfaction has been researched by many researchers, a new approach to this phenomenon is to examine the interdependence between knowledge management and job satisfaction [6,9,10,30,31,32].

III. CONCEPTUAL RESEARCH FRAMEWORK

Through job satisfaction research [28,29], a scientific "gap" is evident in the research of the interdependence of knowledge management elements and job satisfaction. Reference [30] investigated the interrelationship of these factors in a company engaged in the production of cables and electrical installations in Taiwan, while authors [33] conducted research in an Indian telecommunications company. The results of this research show the existence of a connection between the elements of knowledge management and job satisfaction. Unlike previous research [31] who conducted research on Turkish luxury hotels, did not establish an interdependence between knowledge management and job satisfaction.

No research was found by both domestic and foreign researchers on the interdependence of knowledge management and job satisfaction, which was conducted in institutions similar to the Ministry of Defense. This research is a step forward in relation to the already existing

research on this topic, i.e. the previous research results were checked in a very specific organization such as the Ministry of Defense of the Republic of Serbia.

Based on the conclusions from the above research and analysis of the elements of the knowledge management process, the research idea in this paper refers to determining the interdependence of knowledge codification, knowledge sharing and job satisfaction. In accordance with the stated research idea, research hypotheses are defined as follows:

H1 – *There is a statistically significant interdependence of knowledge sharing and job satisfaction and*

H2 – *There is a statistically significant interdependence of codification of knowledge and job satisfaction.*

IV. RESEARCH METHODOLOGY

The empirical research was conducted in 2021 in the organizational units of the Ministry of Defense of the Republic of Serbia and the Serbian Army on a sample of 58 respondents, using the survey method. A questionnaire containing 18 statements [9] was used to collect research data, which are evaluated on the Likert scale with values from 1 to 5 and represent elements of knowledge management (knowledge acquisition, knowledge sharing, knowledge codification and knowledge retention), and job satisfaction. The structure of the respondents is shown in Table I.

The findings from the survey were grouped into variables (elements of the knowledge management process), and after that, in the SPSS program, an analysis of the interdependence of variables was performed by correlation analysis and linear regression.

V. RESULTS AND DISCUSSION

At the very beginning of the data analysis, an analysis of the reliability of the data obtained by the questionnaire was performed, and Chronbach's Alpha value of 0.771 was obtained. For each factor, these values are higher than the threshold of 0.7, which indicates their reliability, ie the internal consistency of the statements through which these factors are measured.

In order to examine the interdependence of knowledge codification, knowledge sharing and job satisfaction, a correlation analysis was performed, which was observed on the basis of

the obtained value of the Pearson coefficient. The results are shown in Table II.

As can be seen from Table 2, the value of the Pearson coefficient varies from statistically significant at the level of 0.01 ($p < 0.01$). Regression analysis examined the impact of codification of knowledge on job satisfaction. The results of the regression analysis are shown in Table III.

TABLE I. RESPONDENTS STRUCTURE.

Gender	
female	30
male	28
Age	
25 – 34	15
35 – 44	23
45 – 54	14
55 – 65	6
Years of Service	
< 5	3
5 – 9	13
10 – 14	12
15 – 20	9
> 20	21
Education	
Middle	13
College	5
University	40
Job Position	
Manager	20
Referent	38

TABLE II. PEARSON'S CORRELATION.

Variables		Knowledge Sharing	Knowledge Codification	Job Satisfaction
Knowledge Sharing	Correlation	1		
	Sig.			
	N	58		
Knowledge Codification	Correlation	.397**	1	
	Sig.	.002		
	N	58	58	
Job Satisfaction	Correlation	.607**	.577**	1
	Sig.	.000	.000	
	N	58	58	58

TABLE III.   REGRESSION ANALYSIS RESULTS.

Factor	Knowledge Codification	Knowledge Sharing
β	.577	.607
t	5.290	5.719
R^2	.333	.369
adj. R^2	.321	.357
std. err.	.71822	.69883
sig.	.000	.000

The coefficient of determination obtained by multiple regression is $R^2 = 0.333$, which shows that 33.3% of the variability of the dependent variable is described by the regression model of variability, i.e. it is influenced by the codification of knowledge. The analysis shows that the codification of knowledge has a statistically significant impact on job satisfaction ($\beta = 0.577, p = 0.000$). This result confirms the hypothesis H1.

The coefficient of determination obtained by multiple regression is $R^2 = 0.369$, which shows that 36.9% of the variability of the dependent variable is described by the regression model of variability, i.e. it is influenced by knowledge sharing. The analysis shows that the codification of knowledge has a statistically significant impact on job satisfaction ($\beta = 0.607, p = 0.000$). This result confirms the hypothesis H2.

The conducted research concluded that there is a significant interdependence of knowledge codification, knowledge sharing and job satisfaction. The presented results of the conducted research confirmed the results of previous research on the existence of interdependence of knowledge management elements and job satisfaction [9,10,30,33].

The codification of knowledge in the Ministry of Defense is done through the adoption of rules, procedures and instructions that regulate in more detail the business activities it performs. Written procedures make it easier for new employees to acquire the knowledge needed to complete tasks. Analyzing the level of development of knowledge management in organizations in the Republic of Serbia, and especially in organizations belonging to the public sector, such as the Ministry of Defense,

raises the question of the orientation of these organizations to knowledge sharing. Knowledge sharing depends precisely on the organization's willingness to motivate employees with "critical knowledge" to share that knowledge [14,19]. The process of knowledge sharing in the Ministry of Defense and the Serbian Army is reflected in various types of training and development, where professional members of the Ministry of Defense of the Republic of Serbia who have "critical knowledge" in the field to which the training relates are appointed as lecturers. The Ministry of Defense, as part of the public sector of the Republic of Serbia, has rigid regulations on the realization of salaries and allowances. Salaries and allowances are earned according to the rank and position of the employee, and there is no "space" for identifying employees with "critical knowledge", and thus the financial motivation of these employees to codify or share the acquired implicit knowledge. It is in the above that a potential space for improving the knowledge management process has been identified.

VI.   CONCLUSION

Research linking knowledge management and job satisfaction has raised questions about the interdependence of these two processes. In knowledge management-oriented organizations, this interdependence would be greater than the interdependence established by this research. Given that job satisfaction was more difficult to see in terms of meeting the needs of employees [34], we can conclude that the need for respect is gaining in importance among employees. The knowledge of employees is coupled with respect, and by expanding existing knowledge, the need for respect in the organization is met.

The scientific contribution of this research can be viewed from two aspects. The first aspect is the confirmation of the results of previous research which show that there is an interdependence of the elements of knowledge management and job satisfaction. Another aspect is the lack of a large number of papers on knowledge management in organizations similar to the Ministry of Defense, and there is some scientific "gap" research on this topic.

The Ministry of Defense of the Republic of Serbia are evolving under the pressure of a dynamic environment, thus shifting the boundaries of openness of this social system to new research topics. Knowledge management should certainly be one of the topics of future research. By identifying employees with "critical

knowledge" and finding ways to encourage those employees to codify and share that knowledge, it can improve employee satisfaction with a job at the Ministry of Defense.

The limitation of this research is reflected in the small number of respondents in relation to the number of persons employed in the Ministry of Defense of the Republic of Serbia. It is necessary to increase the sample of respondents in future research in order to evaluate the results of this research. Another limitation is the fact that the examination was conducted only in the Ministry of Defense of the Republic of Serbia, and due to the specifics of this organization, the results of the research cannot be generalized. The only limitation is the use of the survey as a method of data collection. In the use of the survey, the problem of potentially giving "socially desirable answers" by the respondents was identified. The survey is based on the subjective perception of the respondents, which reduces the objectivity of the obtained data.

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The Effective Path of Urban Knowledge Management in China from the World Perspective

Wang Hongyue[1], Inna I. Koblianska[2]

[1]Economics and Management Department, Sumy National Agrarian University, Sumy, Ukraine; Henan Institute of Science and Technology, Xinxiang, China
[2]Associate Professor of Economics and Entrepreneurship Chair, Sumy National Agrarian University, Sumy, Ukraine

[1]why2060191@163.com, [2]koblianska@protonmail.com

Abstract—**With the continuous advancement of information technology revolution and the development of knowledge economy, the traditional urban development model is facing severe challenges in the context of globalization. In the 1980s and 1990s, under the impetus of knowledge management movement, western scholars examined the practical problems in urban development from a new perspective, studied the knowledge-based development in cities from the perspective of knowledge and sustainable development, and put forward the concept of "knowledge city" [1]. Driven by the new economy and knowledge economy, the concept of knowledge city has been widely valued since its birth. Many countries have successfully transformed some original industrial cities into knowledge cities through the "renaissance city" plan [3]. The success of knowledge city depends on the management of knowledge [4]. The article summarizes the world experience in this field and explores the practical steps to be applied to build "knowledge cities" in Chinese context. It is concluded that Chinese city managers should attach great importance to knowledge management networking and teambuilding, promote knowledge innovation and culture, develop and cultivate knowledge industry clusters, establish appropriate monitoring systems to trace the knowledge management success and its results for transformation and upgrading of Chinese cities in a sustainable manner.**

Keywords – knowledge, knowledge city, knowledge management

I. Introduction

With the continuous advancement of information technology revolution and the development of knowledge economy, the traditional urban development model is facing severe challenges in the context of globalization. Ways to realize the transformation and upgrading of urban economy and ensure the sustainable development of the city have become the primary issue facing the current urban development. In the 1980s and 1990s, under the impetus of knowledge management movement, western scholars examined the practical problems in urban development from a new perspective, studied the knowledge-based development in cities from the perspective of knowledge and sustainable development, and put forward the concept of "knowledge city" [1].

II. The "Knowledge city" Concept

"Knowledge city" is formed in the process of urban transformation and Renaissance in western developed countries. It is a city that strategically carries out a purposeful mission to encourage knowledge cultivation, technological innovation, scientific research and enhance creativity in the process of knowledge economy and social development [2]. It aims to make full use of and tap the existing economic, social and cultural resources of the city, through the urban development strategy that encourages knowledge cultivation, technological innovation, scientific research and creativity, put

"knowledge" at the core of urban planning and economic development, combine knowledge management with intellectual capital planning, promote knowledge dissemination and innovation, so as to enhance the creativity of cities and win a favorable position in the future international competition. Driven by the new economy and knowledge economy, the concept of knowledge city has been widely valued since its birth. Many countries have successfully transformed some original industrial cities into knowledge cities through the "renaissance city" plan, and a number of recognized "knowledge city" models have been born in the world [3].

The development experience of global successful "knowledge city" shows that knowledge has become the core force of urban development, and whether knowledge can be fully and effectively managed will be the key to determine whether the city can be transformed into a "knowledge city" [4]. The success of knowledge city depends on the management of knowledge. In the era of rapid development of knowledge economy, the relationship between knowledge and urban development is becoming more and more close. The effective management of urban knowledge resources will effectively promote the optimization and upgrading of industrial structure and enhance the sustainable development ability of the city [5].

III. DEVELOPING KNOWLEDGE CITIES INN CHINA

Learning from the development experience of global successful "knowledge cities", Chinese city managers should attach great importance to knowledge management, promote knowledge innovation, cultivation and utilization, which has a positive role in promoting the sustainable development of Chinese cities and the transformation and upgrading of cities.

Attach great importance to the significance of knowledge management to urban development. Ideas determine action, and only correct ideas can produce correct actions and strategies. First, the urban management level should have a correct understanding of knowledge management in concept, and fundamentally realize the great significance of "urban knowledge management" to urban development. Only when the whole city, especially the knowledge managers, have the corresponding concept of knowledge management and attach importance to

knowledge management, can they effectively carry out knowledge management.

Constructing a perfect urban knowledge management network system with the help of modern information technology. Knowledge management is the product of the era of knowledge economy, which determines that knowledge management is built on the basis of modern advanced information technology. Therefore, it is urgent for the city authorities to build a perfect "urban knowledge management network system" under the guidance of the system thought through modern information technology. According to the principle and process of knowledge management, knowledge management is essentially required city managers around the various sources of knowledge content, knowledge assets such as knowledge resources, the use of advanced information technology, through to the existing knowledge innovation, as well as the city of external knowledge acquisition and form a new knowledge constantly, and make the necessary knowledge sharing platform and channel, Knowledge resources can be rapidly transformed into knowledge achievements and knowledge wealth, so that the city can embark on the development based on knowledge in this way, and continuously add new power to enhance the core competitiveness of the city.

Building a good knowledge management and knowledge innovation team in cities. Knowledge management in cities, in the final analysis, is about the management of people and the management of knowledge workers with knowledge. Therefore, the implementation of urban knowledge management strategy, it is necessary to cultivate a high-quality urban knowledge management team, as well as knowledge innovation team. At present, many large organizations in the world generally have knowledge management departments and chief executive officers (CEO) to strengthen knowledge management and operation of knowledge capital and give full play to the advantages of knowledge [6]. This is because the advantage of knowledge is the key to solve the growing complexity in this era, and it is the concrete embodiment of effective management of urban knowledge capital.

Tamping the platform of urban knowledge innovation and unblocking the channels of knowledge sharing. The goal of urban knowledge management is to realize the

innovation and sharing of knowledge, and the sharing characteristics of knowledge also show that knowledge can only create value and extend value in communication and dissemination. Therefore, in order to implement the strategy of knowledge management in cities, it is necessary to consolidate the platform of knowledge innovation and smooth the channels of knowledge sharing. For example, on the basis of improving the information and knowledge infrastructure, it is necessary to build a reasonable public platform for knowledge and information exchange, and encourage the development of newspapers, magazines, networks, television and other media for citizens to share knowledge.

Creating a knowledge-oriented and sharing-oriented ecological environment of urban innovation culture. To carry out knowledge management and rebuild urban culture, it is necessary to create a cultural atmosphere of daring innovation, respecting innovation and encouraging innovation in the whole society, and form a knowledge-oriented ecological environment. Highly respect for knowledge, fully respect knowledge workers, respect all innovative wishes and ideas conducive to urban development and social progress, encourage and encourage all kinds of innovative activities. In addition, knowledge sharing between knowledge workers and knowledge organizations within and outside the city should be encouraged to promote the dissemination and exchange of knowledge and establish a long-term incentive and reward mechanism.

Unblocking the transformation channel of knowledge achievements and accelerating the cultivation of knowledge industry clusters. Knowledge management is a management process of knowledge value, and one of the ultimate goals of urban knowledge management is to speed up the transformation of knowledge assets into productive forces. Therefore, it is necessary for urban knowledge management departments to smooth the channels of knowledge transformation and accelerate the cultivation of knowledge industry clusters. World-renowned knowledge cities such as Boston in the United States and Delft in the Netherlands have good experience in transforming knowledge achievements, especially in giving full play to the role of universities and science and technology parks [7]. In these knowledge cities, universities and science and technology parks are often closely

linked with the development of the city. While universities export talents and technology, the city authorities also encourage urban high-tech enterprises to strengthen cooperation with universities, truly forming a virtuous circle chain of production, teaching and research.

Establishing a knowledge management evaluation and monitoring system with chinese urban characteristics. So far, the practice of urban knowledge management in China is only in its infancy, and there is no systematic achievement on how to evaluate and monitor knowledge management in cities at home and abroad. For example, "the Roadmap of Knowledge Management Results: Staged Implementation Method" developed by the Productivity and Quality Center of the United States evaluates the value of knowledge from five stages: start, develop strategy, design and implement the first step of knowledge management, expand and support, and institutionalize knowledge management, but it is still difficult to really apply it to China [8].

IV. CONCLUSION

In the current era of knowledge economy, China has entered the fast lane of urbanization, in order to effectively introduce knowledge management, it is necessary to establish a set of knowledge management evaluation and monitoring system in line with its own urban characteristics.

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Some Economic Aspects of Waste Derived Fuels

Bratimir Nešić[1], Jelena Malenović Nikolić[2], Ljubiša Stajić[4]

[1]Academy of Technical and Vocational Studies Niš, Serbia
[2]Faculty of Occupational Safety, Niš, Serbia
[3]Research and Development Centre "ALFATEC", Niš, Serbia

[1]bratimir@gmail.com, [2]jelena.malenovic@znrfak.ni.ac.rs, [3]ljubisa.stajic@alfatec.rs

Abstract - **Fuel derived from municipal solid waste (MSW) is defined in different ways. The components with high thermal power separated from MSW or industrial waste are most often called: fuel obtained from waste or RDF (Refuse Derived Fuel) and solid renewable fuel, i.e. SRF (Solid Recovered Fuel). These are quality energy sources for: city heating plants, thermal power plants and industrial plants. The fuel obtained from the waste is used for energy production and meets the quality criteria prescribed by the standards. Thus, 1 ton of fuel from waste energetically replaces about 0,7 tons of coal. The paper discusses the economic aspects of the use fuel derived from waste (RDF / SRF).**

Keywords – economy, fuel, waste, environment.

I. Introduction

Although the priority activities in the waste management hierarchy are known, above all, recycling, as an option there is also a process of converting waste into energy. Only waste of high thermal power can be used for such purposes and as a problem there is a direct opposition to recycling, which is interested in the same type of waste (plastic, rubber, paper, etc.). Therefore, only waste that does not meet the recycling criteria can be used for energy recovery, primarily due to its contamination.

Fuels obtained from MSW contain fractions of high thermal power, separated from different types of waste, primarily commercial, municipal and industrial, and the most common are: paper and cardboard, rubber, textiles and plastics. These fuels belong to the group of renewable fuels and are most often referred to as RDF fuel (Refuse Derived Fuel) and if it meets the set quality requirements, it becomes SRF fuel (Solid Recovered Fuel) which is of better quality because it is obtained from smaller waste particles and meets certain conditions about content of unwanted substances. The fuel obtained from waste is similar in its chemical properties to fossil fuels, such as coal, and by comparing these two types of fuel, it is surprising that 1 ton of fuel from waste can energetically replace about 0,7 tons of coal. The economic benefits will be analysed according to the possible savings in the used fossil fuels and their replacement with fuels from MSW.

II. Material and Method

Fuel from waste is most often obtained from non-hazardous waste, so the input raw material can be: municipal, commercial, industrial and construction waste, and less often dried sludge from wastewater treatment plants is used. These are combustible fractions, of high thermal power, which are found in waste, which is sorted at the source and cannot be recycled, most often due to contamination. These are most often: paper and cardboard, plastic, rubber, wood and textiles, but

TABLE I.   Typical composition of waste derived fuels [1].

RDF/SRF COMPOSITION	MASS SHARE (%)
Paper and cardboard	56,00
Plastics (soft)	17,50
Plastics (hard)	7,50
Textile	7,80
Rubber	3,10
Wood	5,50

also other high-energy waste (e.g. oil filters, spent solvents, waste oils, refinery waste, agricultural waste, etc.).

Table I shows a typical composition of fuel obtained from waste [1].

Fig. 1 shows the separated fractions from municipal solid waste that can be used as fuel [1]. Although these percentages by weight vary from country to country, paper and board are mainly the main fractions of fuel, while the share of waste tires (tires) and waste biomass is relatively small. Waste plastics make up about a quarter of the composition of this fuel.

The most important parameters that define the quality of fuel from waste and affect the market price are: thermal power, chemical and physical composition and the share of chlorine and heavy metals. These parameters vary depending on the source of generation (households, companies, industry, etc.), the method of waste collection (mixed waste or primary selection system) and the type of production technology.

SRF thermal power is about 16,5 MJ /kg. Relatively high value comes from the presence of: plastic, paper and cardboard. The advantages of SRF are also: lower moisture and ash content. The main problem is the chlorine content, which negatively affects the properties of the fuel. According to EN 15357:2011 [2], SRF (Solid Recovery Fuel) is a solid fuel obtained from non-hazardous waste. SRF is a subtype of RDF which means a fuel that complies with the requirements of the standards of the technical committee EN 15415:2012 [3]. It can be said that SRF is a heterogeneous group of fuels because it can be a product originating from MSW, industrial and commercial waste. The SRF classification is based on the limit values of three important fuel characteristics [4]:

1) Thermal power - Market value indicator and the most important property because it
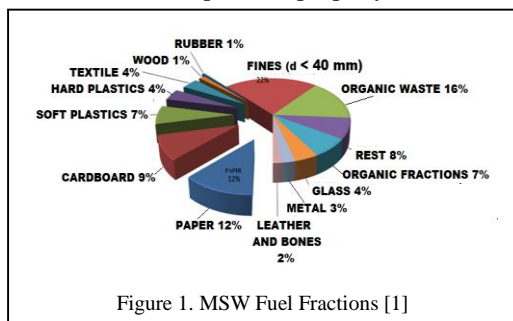
Figure 1. MSW Fuel Fractions [1]

provides information on the value of SRF as a fuel.

2) Chlorine content - Chlorine is not desirable because it causes corrosion. The high share of chlorine will reduce the market value of SRF.

3) Mercury content - Mercury has been singled out as an indicator of the quality of the environment because, due to its high volatility, as a heavy metal, it will most likely be emitted.

These three classification properties give an immediate and reliable impression of the overall quality of the SRF but do not provide the complete information that must be provided for the specification form. For the mentioned properties, 5 classes of SRF were established, shown in Table II, and the mean value was taken as a statistical measure [1,5].

TABLE II.   CLASSIFICATION OF SRF PROPERTIES [1].

Classes	Thermal power (MJ/kg)	Chlorine content (%)	Mercury content (mg/MJ)
1	≥ 25	$\leq 0,2$	$\leq 0,02$
2	≥ 20	$\leq 0,6$	$\leq 0,03$
3	≥ 15	≤ 1	$\leq 0,08$
4	≥ 10	$\leq 1,5$	$\leq 0,15$
5	≥ 3	≤ 3	$\leq 0,5$

The characteristics that define the quality of RDF are: thermal power and contents of moisture, chlorine, sulphur and ash.

Thermal power is the amount of heat released in the combustion process per unit mass of fuel, under standard conditions. There is lower and upper thermal power. Upper thermal power is the amount of heat released by the complete combustion of a unit of mass of fuel where the water from the combustion products is converted into a liquid state. Lower thermal power is the amount of heat released per unit mass of fuel where the water in the combustion products remains in the vapour state. The lower thermal power of the same fuel is less than the upper for the heat of condensation of water vapour [6].

The value of thermal power is determined by measurement using a calorimetric bomb or calorimeter or, if the fuel composition is known, using known equations [7]. The lower thermal power of RDF for MSW sorted at the source, is usually from 20 to 23 MJ/kg, for mixed MSW is

13 MJ/kg and for untreated MSW the value is even lower and is from 8 to 11 MJ/kg [4,5].

Moisture as another important characteristic of RDF also affects thermal power. The moisture content, in optimal conditions, should be between 15 and 25%. However, in developing countries, there is a large number of fractions with high moisture content in MSW, so it is to be expected that RDF obtained from such MSW will be of lower quality [5].

The chlorine content is one of the limiting factors in placing RDF on the market. MSW contains a large number of chlorine-containing fractions, which can create technical problems during combustion. Plastic and packaging waste are the main source of chlorine in MSW. Plastic products, footwear, composite materials, electronic waste, rubber and leather have a total chlorine content, much higher than 2%.

The main reason is the presence of PVC in the composition of MSW fractions. It is estimated that about 70% of the chlorine in MSW originates from plastics, mostly PVC. The production of chlorine-containing plastics has declined in recent years, but as most PVC-containing products have a shelf life of 5 to 30 years a chlorine reduction in MSW is not expected in the next few decades. The following contribute to the increase of the chlorine content in the waste: sodium chloride, i.e. table salt and potassium chloride, which are contained in food residues.

During combustion, all chlorine-containing materials behave in a similar way. As the temperature rises, the organic components begin to decompose, releasing chlorine and at higher temperatures the chloride salts begin to evaporate. During the combustion process, chlorine-containing gases are formed, responsible for the material corrosion. In order to prevent the production of these toxic and corrosive substances, chlorine from flue gases must be removed through control processes in the waste to energy recovery plants [5].

More than 90% of sulphur (S) from fuel is emitted in the form of sulphur-dioxide (SO_2) flue gas. Part of the sulphur dioxide is transformed into sulphates (SO_4) in the atmosphere, under the influence of various chemical and photochemical reactions. The remaining sulphur is emitted in the form of sulphur-trioxide (SO_3), which is transformed into sulphates in contact with water (H_2O). The sulphur content in RDF is

approximately the same for all types of waste (0,1 – 0,2%), with slightly higher values in RDF from MSW [4,5].

Ash is an inorganic and non-combustible mineral part of RDF that is formed after the combustion process. The ash content in RDF, from commercial and industrial waste ranges from 7 to 10%, which is lower than other types of waste (10 to 16%). Ash mainly consists of complex compounds such as: SiO_2, Al_2O_3, CaO, MgO, K_2O, NaO, FeO, Fe_2O_3, etc. The concentration of individual ingredients in the ash depends on the composition of the fuel. The ash content is an important characteristic of RDF because [5]:

- RDF with a high ash content requires efficient removal equipment to reduce particulate matter (PM) emissions;

- Higher ash content - lower thermal power of RDF;

- Characteristic ash temperatures are essential in determining the combustion temperature to avoid ash handling problems.

The physical characteristics of RDF are characterized by: particle size in the range of 10 to 300 mm and particle density, which is ideal in the range of 120 to 300 kg/m^3. RDF appears on the market in various forms as: rough or fine in the form of briquettes, pellets or as a powder.

Compared to the size of coal particles, RDF particles are several times larger, which results in different combustion behaviour. Characteristics such as: thermal power and particle size have a great influence on the field of application in industrial processes and processes of conversion into electric and thermal energy. Studies have shown that, for example, RDF with a diameter of d50 (6,8 mm) can be directly co-incinerated in thermal power plants that use coal (fine powder) [5].

Chemical composition of RDF, i.e. elementary analysis of contents [5] includes: carbon (C), hydrogen (H), oxygen (O), nitrogen (N), sulphur (S), chlorine (Cl), water (H_2O) and ash but it depends on the fractions in the RDF as shown in Table III.

Table IV, shows the characteristics of RDF depending on the source. The analysis of the data shows that commercial waste is the most interesting in terms of RDF because it has the

highest thermal power and the lowest content of negative elements.

TABLE III. CHEMICAL COMPOSITION (ELEMENTARY ANALYSIS) OF RDF FRACTIONS [5].

RDF FRACTIONS	PAPER	PLASTICS	WOOD	TEXTILE	LEATHER, RUBBER
C (%)	34,4	56,4	41,2	37,2	43,1
H (%)	4,72	7,79	5,03	5,02	5,37
O (%)	32,4	8,05	34,5	27,1	11,6
N (%)	0,16	0,85	0,02	3,1	1,34
S (%)	0,21	0,29	0,07	0,28	1,17
Cl (%)	0,24	3	0,09	0,27	4,97
H_2O (%)	21	15	16	25	19
Ash (%)	4,62	8,59	2,82	1,98	22,5

TABLE IV. RDF CHARACTERISTICS DEPENDING ON THE SOURCE [8].

RDF SOURCE	THERMAL POWER (MJ/kg)	ASH CONTENT (%)	CHLORINE CONTENT (%)	SULPHUR CONTENT (%)	MOISTURE CONTENT (%)
Household waste	12-16	15-20	0,5-1	0,1-0,2	10-35
Commercial waste	16-20	5-7	<0,1-0,2	<0,1	10-20
Industrial waste	18-21	10-15	0,2-1	-	3-10
Construction waste	14-15	1-5	<0,1	<0,1	15-20

Household waste is of the lowest quality due to its higher moisture content. The significance of the well-conducted MSW primary and secondary selection process is shown by the thermal power of RDF from this type of waste (12 - 16 MJ/kg) in relation to the thermal power of unclassified MSW, which in our conditions is about 6 MJ/kg [8].

Six groups of parameters have been identified to define the characteristics of waste derived fuel [8]:
1) Thermal power and characteristics of the combustion process;
2) Method of dosing into the firebox and storage conditions;
3) Causing corrosion;
4) Waste pproperties that affect the financial incentive for use;
5) Waste pproperties that affect the environment during use;
6) Waste pproperties that lead to the creation of by-products in the process.

The first economic condition for the production of fuel from waste is that waste disposal to landfill is charged. If the municipality deposits its waste in unregulated landfills and does not pay for waste disposal, then there is no economic incentive for the municipality to reduce the amount of waste that is deposited because the disposal is free. On the other hand, municipalities that dispose of their waste at regional sanitary landfills pay landfill and transportation costs. The second economic condition for the production of waste fuels is the assumption that there is a potential buyer in the domestic or foreign market, which refers to both traders and plants that use waste fuels. The third economic condition implies that the price of domestic fuel from waste is competitive in relation to imported fuel. The current purchase price for RDF is from 20 to 40 EUR/t depending on the quality. At the same time, operating costs of production must be less than operating costs of disposal in order for RDF production to be considered as an option [9].

These assumptions will contribute to the economic justification of the separation and classification of certain waste fractions in order to produce RDF. In the next phase, it is necessary to analyse in detail the capital and operating costs of managing the RDF production plant, including the costs of separation and sorting and pre-treatment. A rough assessment can conclude that there is economic justification, which needs to be confirmed by a detailed analysis.

The economic parameters of RDF/SRF use are influenced by: fuel quality, current market situation (alternative fuel exchange, i.e. supply

and demand of RDF/SRF) and length of transport to end users. SRF is more desirable compared to RDF due to: higher thermal power per ton and better quality. If the RDF is of poor quality, it often cannot be sold, but RDF producers are charged an incineration fee (20 - 30 EUR/t for RDF with poor characteristics), while SRF is mostly traded as a high-value energy source [9].

Of the good economic aspects, the replacement of expensive and non-renewable fuels is the first to be imposed. Thermal waste treatment plants receive a subsidy for combustion, which in Europe averages 90 euros per tonne. It is the largest in Germany, where it amounts to 100 to 350 euros per ton. The disadvantage for greater investment in the conversion of waste into energy is the price of waste disposal, which is 30 euros per ton, while the price of thermal treatment is 120 euros per ton, so it is clear that most municipalities are committed to landfilling. The quality of waste and fuel from waste largely depends on the quality of primary and secondary selection of waste fractions, which further increases the cost of the waste management process. On the other hand, the biggest problem is the large costs affected: land lease costs, projected capacity, current regulations regarding permitted emissions, method of ash disposal from the plant, type of energy obtained, possibility of using metals from the process, fees and subsidies for thermal treatment, construction costs, insurance costs and labour costs [9].

Costs are divided into: capital (CAPEX) and operating (OPEX). Both are affected by: location, size of the facility, capacity, and type of applied technology, energy efficiency and type of energy obtained at the output. Capital and operating costs are the two main components that determine the development of energy sources that use waste as fuel.

Capital costs refer to costs associated with project planning and development, including: location, feasibility studies, licensing, consulting, design, land, equipment, and construction. Although these costs can only be roughly estimated because they differ even for plants of similar size, it can be said that they range from 900 to 1200 dollars per ton of installed capacity.

Operating costs include: labor, fuel, energy, maintenance and repair costs, emission control and monitoring, revenue collection, public communications, management and

TABLE V. ESTIMATED COST FOR DIFFERENT WASTE MANAGEMENT METHODS AND TECHNOLOGIES [10].

WORLD BANK DATA	COUNTRIES WITH:			
	LOW INCOME	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME
Income (USD) (GDP/per capita/2006)	<876	876-3465	3466-10725	>10725
Waste Generation (kg/per capita/year)	220	290	420	780
Households Billing Coverage (%)	43%	68%	85%	98%
WASTE MANAGEMENT COSTS (USD/t)				
Collection	20-50	30-75	40-90	85-250
Sanitary Landfills	10-30	15-40	25-65	40-100
Open Dumps	2-8	3-10	-	-
Composting	5-30	10-40	20-75	35-90
RDF/SRF Incineration	-	40-100	60-150	70-200
Anaerobic Digestion	-	20-80	50-100	65-150

administration, safe disposal of residues, disaster response and downtime. These costs range from $ 65 to $ 95 per ton of installed capacity [9].

Table V, gives the estimated costs for different waste management methods. It is noticed that the incineration process in plants is by far the most expensive type of waste management [10].

Although the cost of equipment for these plants is approximately the same in the world, the

TABLE VI. ESTIMATED COSTS OF PLANTS THAT USE WASTE AS FUEL IN DEVELOPED AND DEVELOPING COUNTRIES [10].

COSTS	DEVELOPED COUNTRIES	DEVELOPING COUNTRIES
Initial Investment (Million €)	135–185	30-75
Capital Costs (€/t)	80–115	22-55
Labour and Management Costs (€/t)	180	20-35
Total Costs (€/t)	260–295	42-90
Energy Sales Revenues (€/t)	60 (Heat and Electricity) 27 (Electricity)	2-10 (Electricity)
Costs to be Covered (€/t)	200-235	40-80

costs of engineering, construction, land and labour vary widely in countries with different income levels.

Therefore, it is difficult to compare plant costs in different countries due to cost variations based on different local conditions. Table VI, shows the estimated costs of plants that use waste as fuel in developed and developing countries [10].

The capital cost of plants in developed countries is higher due to higher labor costs and stricter architectural and emission standards. Other major costs in developed countries that contribute to higher capital costs include land acquisition and construction [10].

Long-term funding sources must be provided for the sustainable operation and maintenance of the plant. Sources may include: direct revenues, including exit fees, direct citizen fees, and energy sales revenue. In addition, indirect revenues from regulating open waste disposal and increasing landfill fees are also possible financial sources.

Other opportunities for external financing include: government subsidies, international funds and private sector investment. Municipalities may consider regional-based projects rather than city-level projects to obtain government funding at the regional or national level. Public-private partnerships can help municipalities raise private capital from investors. Public-private partnerships have different frameworks and the private sector is often involved in the plant construction, design and operation during the contract period [11].

Due to the poor reputation of incineration, it is often required that plants that use waste fuels to be plants with an attractive design. Although this often results in additional costs, it can increase local acceptance. Examples are the plants: Spittelau (Vienna, Austria), Copen Hill (Copenhagen, Denmark) and Maishima (Osaka, Japan) (Fig. 2, 3 and 4) [12].

Vienna's Spittelau waste incinerator confirms that such plants do not necessarily have to be ugly complexes, on the outskirts of the city. Spittelau has become another Viennese attraction, whose striking façade was designed by the famous artist Friedensreich Hundertwasser, an environmental activist. The Spittelau incinerator was built between 1969 and 1971, and in 1987 the main parts of the plant were destroyed in a fire. Instead of demolition, the incinerator was renovated in the same place

because all the infrastructure was already present, and it is a great advantage that the waste was incinerated where it was created - in the centre of the city. Helmut Zilk, the then mayor of
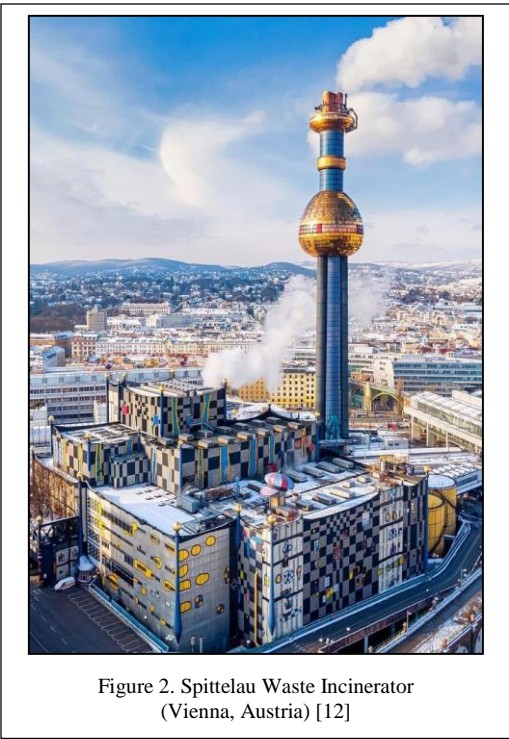
Figure 2. Spittelau Waste Incinerator
(Vienna, Austria) [12]

Figure 3. CopenHill Waste Incinerator
(Copenhagen, Denmark) [12]

Figure 4. Maishima Incinerator
(Osaka, Japan) [12]

Vienna, wanted new standards in environmental protection to be set in Spittelau. The new incinerator plant was completed in 1992 [12].

Perhaps even more interesting is the story related to the CopenHill incinerator in Copenhagen, in raising public awareness about waste incinerators. CopenHill, also known as Amager Bakke, is an incinerator for waste energy located not far from the centre of Copenhagen, which converts 440,000 tons of waste into clean energy annually.

The incinerator treats waste that is produced by about 600,000 inhabitants and 50,000 business entities, so it is partly recycled and partly incinerated, which produces electricity and heat.

The incinerator was designed by the architectural firm Bjarke Ingels Group and on the roof it designed: hiking trails, trees and a ski resort together with the highest artificial rock for climbing in the world.

This is probably the cleanest incinerator in the world and is expected to help the city of Copenhagen achieve the ambitious goal of making the capital of Denmark the first city in the world that does not produce carbon dioxide by 2025.

In terms of design, the incinerator in Osaka is also interesting. At first glance, it is visually almost the same as Spittelau in Vienna. The reason for this is the same author of both incinerators, so in 2001 a partnership was concluded between Spittelau incinerators and Maishima Osaka Plant.

III. CONCLUSION

Municipal solid waste (MSW) generation and consumption of energy is continuously increasing due to rapidly growing populations and increasing public living standards. The implementation of sustainable MSW management is the biggest issue around the world for the conservation of environment and human health.

Nearly 8 million tons of waste are generated in Serbia annually, of which about 2,7 million are municipal waste. This is an extremely large potential of raw materials, which mainly end up in landfills. Recycling in Serbia is still at a low level because a small part of waste fractions (less than 10%) enters the recycling process, while the conversion of waste into energy is at an even lower level, and in terms of the amount of waste treated in this way, at the level of statistical error. Given the increasing amount of waste that is generated and the stricter laws related to environmental protection, it is completely clear that our country will have to find a way to use the generated waste very quickly. When we talk about converting waste into energy, as an option in waste management, it is clear that currently there is no possibility to build an incinerator in our country, both because of the high cost of such plants and because of public opinion regarding possible pollution from waste incineration, harmless as well as dangerous. Due to high investment costs, plants that use waste as an energy source are built in developing countries, but only in accordance with basic technical standards. These low-cost plants may omit technical backup systems such as: pumps, pipelines, electronic control systems, other furnaces and appropriate flue gas filters, or use lower quality steel for high-voltage furnace components. Whether these low-budget power plants can meet appropriate technical and emission standards in the long run remains unknown. The risks of failure associated with these low-budget plants are higher due to the lack

of backup systems. Consequently, operating costs may increase and plant life may be shortened. This could lead to greater negative impacts on human health and to irreversible environmental pollution.

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Decision-making in Management During the COVID-19 Pandemic in Central Europe

Lenka Veselovská[1], Lucia Hudáková[2]

[1,2]Institute of Managerial Systems in Poprad, Faculty of Economics, Matej Bel University, Francisciho 910/8, 05801 Poprad

[1]lenka.veselovska@umb.sk, [2]lucia.hudakova@umb.sk

Abstract–**The whole world is facing an unprecedented crisis due to COVID-19 pandemic. This situation created new challenges for managers in a form of disruptions. This paper provides a brief assessment of the COVID-19 pandemic effects on decision-making of managers. The main goal of this research was to evaluate the changes in attitudes of managers towards making decisions in various companies located in Central Europe during the COVID-19 pandemic. A survey was realized to explore the opinions of managers and their experiences. It was discovered that the majority of managers did not make any significant changes in their decision-making processes and they still favored the same decision-making methods they had been familiar with before the pandemic. However, many managers decided to implement new measures to mitigate the fluctuations in revenues of their companies. Even though managers in 2020 have been making decisions using the same methods, they reached new and innovative conclusions.**

Keywords – management, decision-making, COVID-19, revenues, disruptions

I.   INTRODUCTION

The whole world is facing an unprecedented crisis due to COVID-19 pandemic. This situation highlighted the vulnerabilities of companies and continues to do so even now. Some company managements were shocked by the scale of disruptions they had to face since many were not prepared to flexibly handle such disruptions. Even now after almost two years of living and operating in the world with the COVID pandemic, it is still nearly impossible to correctly predict the evolvement of market situation and processes in business environment even so far as few weeks ahead.

Most of the central European countries were at first not significantly impacted neither by the pandemic nor by the consequent economic crisis. Many managers therefore believed that it was simply the task to endure this for a few short weeks. That was the spring 2020. And they seemed to had been correct in their assumption. The summer months in these countries were quite normal in terms of business environment. However, the situation soon started to change drastically, especially in October 2020. That was the breaking point. It is possible to believe that was about the time when business owners and managers realized that this crisis is not just going to solve itself any time soon. The good news was that they were no longer just forced to implement some minor changes to survive, but finally became motivated to do so to evolve and to innovate. This paper strives to provide an overview of how managers reacted during the early stages of COVID-19 pandemic in 2020 and how this crisis impacted and changes their decision-making practices in management.

II.   LITERATURE REVIEW

This global pandemic the world is facing nowadays brought on an economic crisis as well. In Central Europe, two of its main business industries are car production and tourism. The later has been struggling significantly since international travel has been considerably reduced and even domestic tourism was sometimes virtually nonexistent due to

lockdown. It could be observed that many even well established travel agencies went bankrupt despite of receiving financial aid from government. Hotels and other accommodation providers have also been struggling since they had to be completely closed during long periods of time. The winter season which is the main source of income for them and other related businesses was virtually lost in 2020. As a result, their suppliers have also been struggling to stay afloat [1].

So far, the car production has managed to successfully deal with any major disruptions that this crisis created. No significant delays were observed. However, a new problem seems to be arising as of the beginning of year 2021. It seems that this problem originates on the demand side of supply chains, with customers who can be labeled the final consumers. The car sales seem to be drastically decreasing. The COVID-19 crisis is just one of the main reasons for this. Many experts believe that it was to be expected since this decrease is a natural part of economic cycle and this crisis just accelerated it. However, another reason could also be found in the lack of economic funds people allocate for buying cars since other expenses take priority. Consumers are also more cautious nowadays and prefer to increase their savings thinking about the potential risk of unemployment. Since this seems to be not just the case of central European consumers, but a worldwide trend, as a result, car production enterprises will most likely soon adjust their production volumes. This will definitely impact also their suppliers. It will be interesting to observe what decisions will managers of these companies take as this situation evolves [2-4].

It is impossible to examine the impacts of COVID crisis on businesses without taking under consideration the response of governments. The governments of central European countries have played a key role in decision-making processes. The main issue that had the potential to cause significant disruptions has been the threat of partial or total closing of borders. In 20 or so years the citizen of central Europe all got used to the borders being nothing more than road signs. At first this issue was handled correctly from the business point of view and no considerable delays in procurement processes had been noticed by businesses in examined countries. However, that has changed when Germany implemented rigorous controls on their border with Czech Republic which is the

main corridor from and to Slovakia. It was reported that delays due to controls and excessive handling have been up to 12 hours. Some Slovak transport companies even decided to change their routes to avoid Germany completely [5-7].

Originally, as a preventive measure many central European businesses especially production enterprises decided to briefly increase their stocks of materials or pooling of reserves which also requires addition transport capacities and in many cases also reengineering of their procurement processes that used to operate on the just-in-time principles. During that time period it was also possible to observe an increased in use of external logistics providers since managers of many companies has started to favor outsourcing more [8]. This decision is not unexpected since in time of uncertainty managers often choose to transfer the risk or at least diversify. Predictions are highly unreliable as the market situation changes drastically and therefore, managers cannot rely on quantitative decision-making tools as much as they used to.

The managerial practice has already provided other measures that managers decided to successfully use during the pandemic. One highly innovative way of dealing with the forced loss of customers that some service companies such as hotels and restaurants implemented was this new form of "lending of employees". Waiters, cooks, housekeepers and so on were sent to work in production plants. These unconventional partnerships have become beneficial to all. Hotels and restaurants had the resources to stay afloat and cover their costs. Production enterprises did not have to stall their production processes due to lack of healthy employees and even employees themselves were satisfied to be paid their wages in full instead of staying at home with reduced wages.

Various other examples of implementing new decision-making approaches and methods during the times of crisis can be found in research studies of various authors [9-17]. Furthermore, decision-making is a management function that involves all basic management functions. Making decision during the planning stages of processes is especially hindered by the uncertainty during any crisis. Vulnerability factors need to be considered such as underlying causes, dynamic pressures, unsafe conditions. Each of these factors includes also the combination of vulnerability and hazard in

the case of a crisis such as virus outbreak. These factors present a starting point for the constructed plans and correct decisions [18]. According to [19] similar to other public leaders around the world, managers need to make tough decisions under pressure, as they lead through unprecedented times. Leadership must take such decisions that maintain employee motivation even during the crisis [20]. [21] discovered that by changing the decisions and approach during the time of crisis, managers would more significantly influence employees' motivation. [22] even stated that in a world turned upside down, when many conventions are disposed of, it is clear that things will not return to the status quo ante any time soon, if ever. [23] emphasizes the role of delegations of non-strategic decision-making. His research proved that company´s profit is lower if managers do not delegate minor decisions and are therefore making all the decisions themselves. [20] discovered that calculated and rapid decision-making can be achieved by utilization of knowledge management. Other authors also favor the unity of knowledge management and decision-making during the COVID-19 pandemic [24].

II. METHODOLOGY

This paper provides a brief assessment of the COVID-19 pandemic effects on decision-making in pandemic. The main goal of this investigation was to evaluate the changes in attitudes of managers towards making decisions in various companies located in Central Europe during the COVID-19 pandemic. A survey was realized to explore the opinions of managers and their experiences in practice concerning the changes in decision-making due to either the COVID-19 pandemic itself or measures implemented by governments as a respond to the threat. An electronic questionnaire was used to collect primary data in 2020. Consequently, the research sample file of 211 managers from diverse companies was created. Detailed data on the structure of sample file is provided in Table I. The sample file which consists of managers of companies in central Europe through its size and diversity offers an appealing foundation on researched topic which is vital for creating an image of current business reality and drawing recommendations to mitigate the crises.

In order to further evaluate the data and discover possible correlations relationships between analyzed factors Spearman's Rank Correlation was calculated according to formula 1 [25], where the value n is the number of customers and d represents the difference in the ranks:

$$R_s = 1 - \left(\frac{6 \times \sum d^2}{n^3 - n} \right). \tag{1}$$

TABLE I. STRUCTURE OF SAMPLE FILE.

Country of origin	Slovak Republic	Czech Republic	Poland	Hungary		
No. of companies	61	54	47	49		
Percentage (in %)	28.91	25.59	22.27	23.22		
Business sector	Groceries	Services	Industrial production	Agriculture	Construction	Transport of material
No. of companies	14	51	79	6	27	34
Percentage (in %)	6.64	24.17	37.44	2.84	12.80	16.11
Company size	micro and small	medium	large			
No. of companies	116	31	64			
Percentage (in %)	54.98	14.69	30.33			

III. RESULTS AND DISCUSSION

Even though this research focuses mainly on decision-making in management, it is essential to consider the context in which the managers make those decisions since it highly influences this process. Table II provides the data on how managers experienced the effects of pandemic crisis in terms of observation of disruptions in their internal or external environment.

TABLE II. SIGNIFICANT PROCESS DISRUPTIONS AS NOTICED BY MANAGERS IN 2020.

Country of origin	Disruptions observed	Disruptions not observed
Slovak republic	60,66%	39,34%
Czech republic	61,11%	38,89%
Poland	74,47%	25,53%
Hungary	95,92%	4,08%

The data indicate that Hungarian companies were the most affected from the central European countries in 2020 since less than 5% of Hungarian companies did not observe any negative changes in form of disruptions.

Table III shows how the companies experienced changes in their revenues during the pandemic in 2020. Spearman's R_S was used to evaluate the possible dependency between changes in revenues and experienced disruption. The calculated value was at level –0.46. This result of negative correlation indicates that when company experienced disruptions and managed to overcome them, its revenues were more likely to increase. This finding is highly positive in terms of future of these companies if the pandemic continues or even during their post-pandemic development. However, what is not present in this research are the corresponding costs related to mitigating these disruptions.

More than two hundred managers from various companies experienced the pandemic differently which affected their attitude towards decision-making in management. In 2020 only approximately a third of managers believed that the COVID-19 pandemic and the resulting crisis would create serious problems for their company (31.75% of managers in sample file). Up to 35.54% of managers stated that even though the pandemic would create some problems for their company, they would not be of serious nature. And 32.7% of managers

TABLE III. SIGNIFICANT PROCESS DISRUPTIONS AS NOTICED BY MANAGERS IN 2020 STRUCTURED ACCORDING TO COMPANY'S REVENUES CHANGES.

Changes in revenues:	Disruptions observed	Disruptions not observed
No change	56.14%	43.86%
less than 25 % decrease	83.53%	16.47%
26 % - 50 % decrease	22.22%	77.78%
51 % - 75 % decrease	33.33%	66.67%
over 75 % decrease	100.00%	0.00%
less than 25 % increase	80.00%	20.00%
26 % - 50 % increase	85.71%	14.29%
51 % - 75 % increase	87.50%	12.50%
over 75 % increase	100.00%	0.00%

believed that their company would not be significantly affected by the crisis. Interestingly, the majority of managers that did not consider the pandemic impacts serious were from Industrial production enterprises and companies producing and/or selling food products. On the other hand, the majority of managers from transportation companies and companies providing services had considered the pandemic impacts significant. Furthermore, this research also includes the managers' opinion on duration of pandemic and resulting disruptions as considered in 2020. The opinions were nearly evenly distributed between managers who believed that this crisis should be considered as a long-term problem (52.61%) and managers who consider the COVID-19 pandemic as a short-term problem (47.39%). On the other hand, all surveyed managers reported that their time dedicated to decision-making increased significantly since the outbreak of the COVID-19 pandemic and the resulting economic crisis.

Moreover, the research results indicate that managers mostly favored the same decision-making methods during this crisis that they had used before. The majority of them chose the methods they are familiar with (89.1%). Only 10.9% of mangers stated that they used new methods to make decisions after the COVID-19 outbreak. In 2020 up to 78.67% of managers used empirical-intuitive methods such as method of analogy, method of kinematic inversion, method of aggregation and disaggregation and so on.
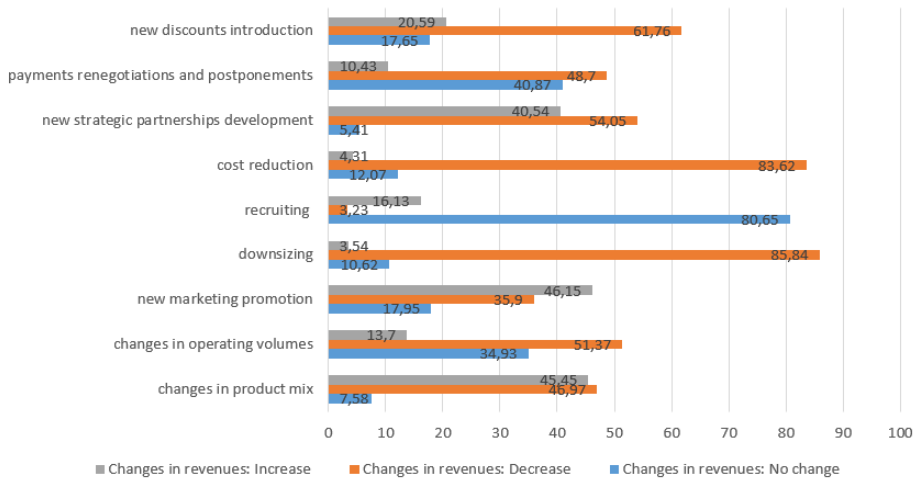
Figure 1.   Changes in revenues according to new implemented
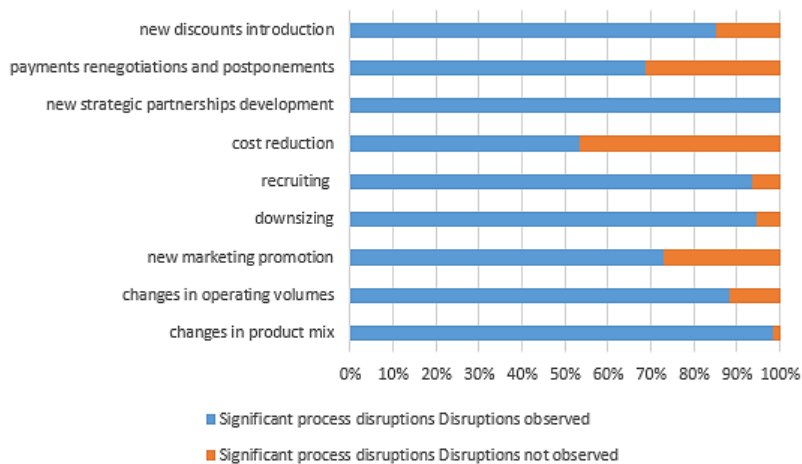
Figure 2.   Significant process disruptions according to new

Slightly fewer managers used empirical-analytical methods such as significance tree, morphological analysis, pair-wise comparison method, best value method, weight distribution method and so on (62.56%). Only 25.12% of managers used expert decision-making methods such as Delphi method, devil's lawyer method brainstorming, brainwriting, scenario method and so on.

Some managers even decided to implement new methods and tools (67.3%). These measures focused on mitigating disruptions. According to the data nearly half of the companies that experienced an increase in revenues (46.15%) applied new marketing promotion. Also many managers decided to create new products or discontinue existing products.

IV.   CONCLUSION

These research results prove that the COVID-19 crisis affects all businesses and their management has to make correct decisions to mitigate the negative influences or to take advantage if possible. It would be impossible not to be affected since the global world is interconnected and this crisis is worldwide. Managers have only just begun discovering how much.

The research findings create an early image of how managers made their decisions during the early stages of the COVID-19 crisis. This image is not as negative as would have been expected which indicates the resilience of managers and their ability to learn from this

crisis. Some decisions can already be seen as key components of making successful changes during this crisis:

- to constantly monitor changes in markets

- the use of intermediaries to find suitable new partners

- to make rapid changes in product mix

- to avoid cost reduction through downsizing

- the use innovative marketing promotion techniques.

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Ethical Dimension of Science and Technological Development

Dejan Dašić[1]

[1]Faculty of Finance, Banking and Auditing, Alfa BK University, Belgrade, Serbia

[1]drddasic@gmail.com

Abstract—**The paper discusses the consequences of two interrelated processes: the strong development of science and technology and the ethical dimension of that development, i.e., the global threat to human life on Earth, as a consequence of that development. The author analyses the essence and consequences of these processes and points to the need for a qualitative change in attitudes towards nature and society as a whole, all in order to solve environmental problems and eliminate the dangers of the global environmental crisis**.

Keywords - Science, technological development, ethics, sustainable development

I. Introduction

There are numerous answers and definitions to the question of what science is. Depending on the understanding, different authors give different definitions. What we can say with certainty is that today science is an important factor in the survival and progress of human society. This is confirmed by the research of the marketing company "Edelman" conducted in March 2020 in the USA, Italy, Great Britain, Germany, France, Brazil, Canada, Japan, South Korea and South Africa, on the question "Who do you trust the most" when it comes to information about the Covid 19 pandemic (10.000 respondents), the vast majority of respondents, as many as 83 percent, answered that it is the scientists. In the second place, 82 percent are chosen doctors, and in the third place, with 72 percent, the World Health Organization [1].

However, huge economic development and population growth result in continuous environmental degradation. Intensification of agriculture, industrialization and increasing use of energy are the most difficult drivers of environmental health problems. Improving the technical and technological basis of human labour, in addition to the positive consequences, included a certain risk of endangering and violating the integrity of man in the work environment and disturbing the ecological balance in the natural environment - the biological framework of his life. Industrial risk is a companion of industrial civilization, so that civilization is also referred to as the civilization of risks. High-tech industries, such as computers and electronics (whose development has made globalization possible) initially enjoyed a reputation as a relatively clean industry, with safer working conditions for employees and no harmful environmental consequences. Today, however, the perception of the consequences of these technologies is pessimistic. In these industries, too, work is not safe, from the point of view of protecting the integrity of employees and preserving the ecological balance in the environment [2].

Some authors state, it would be tempting to open the discussion of the ethical problems facing science and technology by focusing separately, on the one hand, on issues concerning the generation of scientific knowledge and, on the other, on problems of its application and their consequences. However, although this distinction is useful for some analytical purposes, it is biased and misleading, insofar as actual scientific and technological practices involve both the generation and application of knowledge [3]. The rapid developments in science and technology raise many ethical questions and regulatory challenges. To address these, we need to understand the impacts of such developments and how society should develop frameworks

and institutions to address them continually. Mainstreaming ethics in science and technology policy-making is a major challenge that needs to be addressed flexibly. Given the diverse contexts, and the influence of various discourses in policy-making and the normative values embedded in them, it is not possible to suggest a one-size-fits-all approach or solutions based on that [4].

II. SCIENCE IN THE FUNCTION OF SOCIETY DEVELOPMENT

Science and art - intelligent creation, have existed since the existence of man, says academician Miloje Sarić, and the first systematized knowledge appeared in Greece in the period around 600 BC. At the beginning of the 10th century, translation of texts appeared, which was of great importance for the progress of science. The stacking technique of printing began to spread in Europe only in the 16th century, the 17th century included the appearance of the first scientific journals, the 18th century, the appearance of the first reference journals and the 19th century, the formation of a centre for international scientific documentation [5]. The periods from discovery to their application are getting shorter. Thus, from the moment of the discovery of photography to its industrial realization, it took 112 years, for steam engines 85, telephones 56, radios 35, radars 15, televisions 14, atomic energy 6, and for transistors and lasers that period is reduced to 5 years [6]. The news of the unilateral declaration of independence of the British colonies in the New World in 1776 (USA), arrived in Europe only after a month. The biggest and most important news in the 19th century, the assassination of the President of the United States, Abraham Lincoln, in April 1865, "travelled" to Europe for 12 days. "In November 1963, the president of the United States was assassinated in Dallas, Texas. He died at 1 p.m. 68% of Americans learned about the news at the same time, 92% at 2 pm, and 98.8% at 6 pm. Thus, very quickly, the whole country knew [7].

The progress of science is noticeable in all parts of the world. Owing to the progress of society, science, living standards, etc., there is more university population in the world today than ever before. New knowledge is increasingly gained through organized research, and less and less through spontaneous and accidental discoveries. The innovative and entrepreneurial spirit of Thomas Alva Edison still lives at in the

main research laboratory in Schenectady, New York. The lab, known as the "Magic House", was responsible for a number of innovations, including an X-ray tube and a high-frequency alternator that enabled radio and television broadcasts. It is also very important to emphasize the importance of multinational corporations in the creation and diffusion of scientific and technological knowledge. These corporations concentrate significant financial and material resources, and based on the large volume of turnover, they can invest huge financial resources for research and development. They employ large research teams, which in such corporations as IBM, include thousands of researchers.

Encouraging innovation is of great importance and developing awareness of the importance of innovation for the overall progress of the economy and society as a whole. Silicon Valley achieved success only thanks to the fact that it united three markets: the market of ideas, the market of capital and the market of talents. A large number of creative and enterprising people merged into the Valley and brought in new ideas. The new Russian innovation centre "Skolkovo" is the result of the joint work of the state, business and science, a counterpart to Silicon Valley conceived as a centre of international scientific thought. A city has been created in the suburbs of Moscow, a city of innovations in which five high-tech directions are being developed in the field of energy, information technologies, telecommunications, biomedical and nuclear technologies. In Serbia as well, the construction of the most modern science and technology park at the University of Novi Sad has been completed with over 4.000 engineers, mostly in the IT profession, and in Kragujevac) [8].

Science and technology have been and remain the backbone of the development of civilization and its achievements. Man has developed his abilities and improved his power, material and spiritual wealth thanks to discoveries and technologies that he has applied through the centuries. Thus, science and technology directly influenced the development of the human community, the improvement of living standards and quality of life. In the future, it is the dominant dimension of development that should provide the highest standards of living and ensure the lasting progress of human civilization, but also enable the development of human settlements outside the home planet.

These facts give for the right that science and technology are an unavoidable dimension of quality of life [9].

Science, technique and technology have opened the way for more intensive exploitation of natural resources. Special measures against environmental degradation have been taken only in the last thirty years. Technological innovations allow newspapers to be made much cheaper using recycled material, and glass factories can use almost 90% of recycled material. Toyota and Honda use 85% of recycled material in making parts for the cars they produce. For these companies, waste is no longer waste but an industrial resource and a driver of innovation. Science and scientific knowledge are also very important in solving this problem. Hard drives that were produced a decade ago consumed 10 times more energy than those that are produced now. Only with the introduction of an innovation that automatically shuts down the computer when not in use, about 70% of the energy it consumes has been saved (cooling fans have become redundant), and the service life has been significantly extended [10].

However, the ethical dimension must be taken into account until knowledge is reached that will lead to a higher quality and better life on earth. Dr Franz Heimlich was a very important researcher at the Hudson Institute of Science and Technology. He worked for years anonymously, trying to study the secrets of the brain that would eventually lead to a cure for a whole range of neurological diseases and disorders. His results in the field of genetics brought him the greatest scientific recognition - the Nobel Prize, and the Hudson Institute, a private college in the state of New York, gained a great reputation. After the increased presence of his character in public, it was learned that he was in fact Hans Stein, who worked during the Holocaust as an associate of Dr Josef Mengele, who was, according to many, responsible for 400.000 of Jewish victims. Stein helped Mengele, also known as the "Angel of Death" or "Butcher", in medical experiments on thousands of Jews, who remained permanently disabled after those experiments. Thus, his medical discoveries were possible thanks to data obtained from inhumane experiments on Holocaust victims [11].

Nevertheless, in addition to the extremely positive effects of science and technology on the human community and its quality of life, the application of technological solutions (rapid development of industry, energy, transport, urbanization, military technologies) has extremely negative effects on the environment and a sharp increase in risk to human community. The negative effects of science and technology are multiple and with different forms of action on the environment and human life. These are: pollution of the atmosphere with greenhouse gases (the effect of global warming and climate change on the planet), acid rain, radioactive fallout (nuclear tests), depletion of non-renewable natural resources (energy, ores, etc.), endangering renewable natural resources (water, food, forests, etc.), sudden pollution of soil, surface and groundwater, destruction of large numbers of ecosystems, sudden increase in poverty and malnutrition (economic and social sciences), negative impact of pollution and lifestyle on human health, alienation and social exclusion, endangering the survival of the human species due to the cumulative effect of the negative effects of science and technology [12].

Recently, interdisciplinarity and multidisciplinarity are increasingly used in scientific research as special forms of scientific research. [13] As a result, there are modern, extremely dangerous means of warfare; constant exploitation of natural resources and pollution of nature in all parts of the world; technicalized, inhumane behaviour; genetic changes for which it is not known where they lead; and many other problematic things. "Unfortunately, the best example of the above is the production of a nuclear bomb, in the production of which numerous scientists, physicists, mechanical engineers, managers, etc. participated [14].

III. ETHICAL ASPECTS OF SCIENCE AND TECHNOLOGICAL DEVELOPMENT

In the spectrum of social values, ethical values occupy an important place among researchers, emphasizing moral responsibility for their own actions and the actions of other actors in the research process. Although unethical behaviour is not characteristic of scientists (or at least it should not be) and a large number of researchers respect basic ethical standards in science, there are individuals who are prone to manipulation. Therefore, science is also prone to mistakes, ethical and moral issues.

Today's achievements of the overall social development in the world, and especially of the

most economically developed countries, have been achieved primarily under the influence of scientific and technological progress. However, in addition to the positive effects of technology on development in all areas of social life, there have been degrading effects, especially on the environment. In order to achieve higher productivity and increase the volume of production, man developed scientific technology without expecting its application to have devastating consequences not only on the resources used but also on the natural environment and its ecological systems [15].

In the modern age scientists and technology developers or users have generally had little interest in either ethics or policy implications beyond professional standards of duty and veracity as well as scientific standards of procedure and objectivity. This is especially so for those who have exclusively subscribed to a positivist model of retrospective explanation, a pragmatic model of progress for its own sake, or a commercial model with a profit rationale as an end in itself [16]. Today, information technologies are a generator of social development of unimagined possibilities, but at the same time they are a phenomenon with the potential of unimagined dangers. Their appearance, dynamic development, but also the possible negative consequences of that development, are most closely connected with the civilizational openness of communities and individuals, to whom these new media enable independent and interactive communication. The global internet and other new media, in such circumstances, also bring new ethical challenges. The fact is that technological breakthroughs are also introducing new approaches to unethical behavior and that one of the biggest concerns at that level is the ease with which personal information can be collected and shared over the Internet [17].

Military technologies have a very big negative impact on the quality of life. These are mainly weapons of mass destruction of people and material goods. Biological weapons have been developed on the basis of microorganisms that cause serious diseases, such as anthrax, smallpox and biotoxins. In addition, completely new biological weapons are being developed, based primarily on the latest knowledge in the field of genetics and genetic engineering. The invention of the atomic bomb had a strong effect on the conscience of many scientists, because its use at the end of the Second World War led to

the suffering of a huge number of people. After that, numerous ideas about the peaceful use of atomic energy emerged, which brought prosperity to millions of people, and that then alleviated the feeling of guilt. This practice does not stop, so today the exploration of space, except for the purposes of better and faster world communication, is carried out in parallel for military purposes, by setting up powerful military satellites which in most cases serve for war destruction and murder.

The relationship between man and nature, i.e., their life interconnectedness and conditioning are a permanent companion of the history of mankind, because human life is part of the natural chain of life, and production is the process of taking and processing matter from nature in accordance with human needs. However, in the period of pre-industrial society, which is dominated by agriculture, livestock and crafts, man's influence on nature has a different character. Man influences nature and changes it with his production and other activities. But these changes are limited to the local environment, exclusively to those places where man builds his habitats or takes matter directly from nature for his own needs. The natural balance is not questioned by this relationship between man and his environment [18].

In the modern conditions of our economic and social development, the protection of the environment and its further improvement represent a very important issue in which our entire society is permanently interested. The technological process accompanied by the development and increase of the economic potential of the country, as well as the development of social relations, enable wider changes in terms of material position and way of life. However, that development has at the same time created some problems, certain dangers and risks, a higher degree of human endangerment in the work and living environment. The damage done to the local environment today, tomorrow is a problem on a global scale. People are increasingly aware of toxic waste, pollution, mountains of garbage that fill hollow landfills in the ground, deforestation and the like. The gradual destruction of forests, the uncontrolled discharge of various faeces and toxins into rivers and nature, the constant catastrophes at sea and the discharge of oil from tankers are just some of the threats to humanity. Although gradually, over time, the consequences are felt on a global level (the planet is getting warmer, the glaciers

are melting), mostly everything starts from the local community. With the development of modern chemistry and increasing industrialization, a very large number of possibilities have been opened and realized, but without adequate care for their harmful effects. Science, technique and technology have opened the way for more intensive exploitation of natural resources. Special measures against environmental degradation have only been taken in the last thirty years. For example, pesticides and herbicides are a boon for farmers, increasing yields and releasing plants from diseases that have plagued farmers for centuries. But pesticides and herbicides can also have harmful effects. They can drip into the soil and pollute groundwater and springs. They can find their way to streams and rivers, killing fish or poisoning them. Eventually, through the food chain, they find their way to people, causing cancer, immersed deformities and other evils.

Scientists very often encounter problems caused by certain centres of power, influential individuals, politicians, powerful social institutions and the like. As an example, we can cite the powerful world pharmaceutical industry, which invests a lot in science, research and development of new drugs, but at the same time is accompanied by a large number of rumours about unethical behaviour and immoral actions. Investment analysts predict that the American biotechnology company Moderna and the German Biontech, with their partner, the American giant Pfizer, will most likely earn billions of dollars next year. It is believed that "American taxpayers paid for 100% of the development of the Moderna vaccine, for which it is said that a total of about $ 2.5 billion is invested in. The help is also reflected in support from Emory University, Vanderbilt University Medical Center, Dolly Parton Research Fund and other organizations in the development of the Moderna vaccine, for which studies show that it is 94.5% effective. The prices of all deals with vaccines are shrouded in secrecy, and companies and public institutions are defending their right to confidentiality. Although billions of dollars of public money have been invested in the development of vaccines, drug manufacturers have been reluctant to talk about how much a single dose will cost. It has been said that it was the result of many factors, including efficiency, test results, development and production costs, competition, demand, and whether the customers were private groups -

such as insurers - or government agencies. The urgency and spread of the pandemic added layers of intricacy [19].

In the field of scientific research, both innovation and accurate reporting of information are critical to society, and society implicitly trusts scientists and researchers to be ethical and honest in their work. The need for data reliability has become even more profound as technology advances at an ever increasing rate. Indeed, the tools of "big data," with its advances in statistical applications, have made it easier than ever to detect unethical behavior. Once an individual is associated with such behavior - once the implicit trust in their scientific integrity is broken - it becomes almost impossible to recover that reputation [20].

Finally, numerous researchers and innovators have changed the world, but not their lives. Thomas Young refuted Newton's theory of light, but his discovery met with very strong resistance, due to Newton's great authority at the time. He was ridiculed, the printers did not want to print his works and he was forced to leave physics altogether. It took a lot of time and experiments by other scientists to prove that his theory of light was correct. Certainly, our Nikola Tesla has a significant place in this, who would surely have become the richest man and, probably, the first billionaire man in history, if he had not broken his contract with George Westinghouse, who guaranteed him royalties for patents' rights.

IV. CONCLUSION

Over the centuries, science has had a great influence on the development of civilization, constantly increasing its material and spiritual capacities. This influenced and led to the development of today's civilization and the conditions for a safe and comfortable life. Science and technology are still the dominant force in the development of every country on our planet. However, the changes are so fast and radical that it is difficult to follow them, and even more difficult to see the consequences of their development that we all notice and feel. What is even more problematic, many scientific achievements and technologies are a top secret, in order to ensure economic and military superiority. All reports and scientific achievements are largely censored, so there is no complete public insight into scientific and technological development. Lately, the results of science have been modern, extremely

dangerous means of war; constant exploitation of natural resources and pollution of Nature in all parts of the world; technicalized, inhumane behaviour; genetic changes for which it is not known where they lead; and many other problematic issues. Numerous clumsy social explanations also contribute to the negative evaluation of science, which - insisting on their (alleged) scientificity - in various stages and occasions of the modern age led to the degradation of humanity and the affirmation of violent methods, unnecessary absolutization of revolutionarism and encouragement of segregationist ideas.

Science indeed opens up new avenues and provides impulses and means for construction and human progress - but it also threatens life and the world. Science reveals the bad face when its knowledge causes suffering to people and leads to the injury of Nature. However, this is not directly a moral work of scientific thought and action, or very rarely their direct consequence, but results from human careless use of scientific discoveries. Ethical conduct of research is critical not just for scientific professionals and the scientific enterprise. Society at large depends on innovation in many disciplines to address emerging health, environmental, and technological challenges, and therefore to improve quality of life. So, as a member of this profession, be original, be virtuous, and do good. In the past two centuries, owing to the accelerated progress of science, the progress of medicine, a more comfortable life, economic prosperity, that is, the increase in the quality of life of people as a whole, the length of human life has also increased. Regardless of the undeniable significance and meaning of this change and which probably sounds contradictory, it has, however, led to a multiple increase in population on the planet, and a sharp increase in population has led to numerous direct and indirect changes on the planet and the ecosystem, which are harmful to humans.

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Regression Modelling as a Basis of Clinical Decision Support

Jan Kalina

The Czech Academy of Sciences, Institute of Computer Science, Pod Vodárenskou věží 2, 182 07 Prague 8, Czech Republic

kalina@cs.cas.cz

Abstract—**Clinical decision support systems have established their place as assistive tools helpful in particular decision making tasks related to medical care. This paper is focused on regression modelling applicable to solving clinical decision making tasks. A general overview and selected particular examples of regression applications are presented. The role of medical informatics in the recent combat against the COVID-19 pandemic is discussed as well. The authors also characterize future trends of machine learning tools within clinical decision support systems.**

Keywords - clinical decision making, machine learning, data mining, nonlinear regression, Big Data analytics, predictive analytics, healthcare, medical informatics, COVID-19 pandemic

I. Introduction

Clinical decision making can be characterized as a complex interdisciplinary task requiring a physician to consider several possible alternatives and to select a particular action, which seems optimal based on various (and possibly contradictory) criteria [1]. Human decision making under uncertainty is well known to be far from being reliable [2] and software tools may nowadays outperform the ability of a less experienced physician to find the appropriate diagnosis. Indeed, software tools themselves (possibly guided by medical informatics experts) can nowadays greatly assist physicians in their decision making tasks [3]. Such experience is supported by numerous available clinical decision support systems (DSS), which are able to support clinical decision making by giving recommendations related to determining the diagnosis, therapy, and prognosis for individual patients [4].

This paper starts by recalling principles of clinical decision support systems in Section 2. Regression methodology with a focus on methods with a potential to find successful applications in clinical tasks is discussed in Section 3. The role of medical informatics in the recent combat against the COVID-19 pandemic is discussed in Section 4. Section 5 characterizes future trends of machine learning tools within clinical decision support systems.

II. Clinical Decision Support Systems

This section recalls decision support systems as important tools of artificial intelligence with a potential to contribute to reshaping medical care. Naturally, decision support is an important task of computerized knowledge management in healthcare. We can characterize clinical decision support systems as software systems with a complicated architecture, offering assistance with clinical decision making processes [5]. Using (possibly big) data as the main input, they are capable to analyze diverse information components, to obtain knowledge from different types of information, and to deduce conclusions relevant for the original clinical task [3].

The construction (implementation) of clinical decision support system is known to represent an extremely demanding task [6]. Based on practical experience, it can be recommended to start the implementation with a pilot version, which can reveal some weaknesses of the first plan [7]. An effective configurability of the system requires sufficient time available for tuning all its parameters. In a validation mode, the system should be repeatedly exposed to the cycle containing all these steps: formulating the requirements, proposing the design (or

modifications of the last version), implementing relevant modifications, multi-level testing under artificial conditions, and finally testing in real situations. After that phase, a decision support system should be evaluated under diverse conditions in different hospitals or at different physicians taking into account also the safety of patients and the seriousness of wrong decisions. As decision support systems may exploit knowledge from different medical fields, they have the potential to contribute to a holistic understanding of medical care.

From the application point of view, clinical decision support systems have established their place in certain disciplines, where they assist in determining the diagnosis, recommending a suitable therapy, and predicting the most likely prognosis, i.e. in the important elements of the complex decision making performed by a physician within the care for an individual patient [8]. Clinical decision support systems may be alsy successfully exploited within distant medical care (telecare).

Keeping in mind the application point of view, clinical decision support systems should not be perceived by the users as disturbing. It is not only a question of a fast internet connection, but also other technical issues may much reduce (or increase) the stress of the physicians. Particularly, we recommend to connect a decision support system directly with the medical information system (MIS) used by the physician or hospital, so that the decision support may be exploited immediately during an examination of a particular patient. Also, the output of DSS should be automatically stored to electronic health record (EHR) used at the point of care. In addition, it is beneficial to connect the systems also with particular systems for prescriptions or for reporting the clinical performance to health insurance companies.

If appropriately interconnected, clinical decision support systems may also be deployed for organizing and checking the information flow within a hospital or for solving complex organization tasks. Further, the systems may be used to evaluate the quality of life of individual patients, to control expenses of the proposed medical care, and to inspect if a given top limit of the total expenditures has been reached (which is meaningful only within the economic healthcare systems in some countries). Such issues are highly sensitive from an ethical perspective. Nevertheless, we are critical to any

attempts for completely automated decision making in medical care. Even if a clinical decision support system is exploited, the physician remains to carry the legal responsibility (liability) for the decision making.

III. REGRESSION METHODOLOGY

Regression modelling (regression analysis) has the aim to study (explain, compare, or interpret) the statistical relationship of a single continuous response by means of one or several (continuous or categorical) explaining variables (regressors). Thus, regression models are very useful within the classification rules of clinical decision support systems [9] and may be successfully considered during the training phase of the decision support systems.

Classification analysis, i.e. the methodology methods for assigning an observation to one of given groups, can be interpreted as a special case of regression analysis [10]. For example, logistic regression is often used to construct classification rules to two groups based on the knowledge of given regressors (i.e. conditioning on the regressors). Thus, regression methods may be exploited for extracting biomedical knowledge from training data used within decision support systems. Because regression methods allow to model (and predict) the response variable for an individual patient, they may at the same time contribute to transforms of medical care and to the development of targeted decision making.

A. Overview of Regression Methods

Let us now consider the total number n of observations (measurements). We have values of a continuous response $Y_1, \ldots, Y_n$ for each of the observations and the task is to explain this by means of p-dimensional regresors. The vector of values of the regressors for the i-th observation will be denoted as $X_i = (X_{i1}, \ldots, X_{ip})^T$. The usual (nonlinear) regression model (cf. [11]) has the form:

$$Y_i = f(X_i) + e_i, \qquad (1)$$

for $i=1,\ldots,n$, where $e_1, \ldots, e_n$ are random regression errors and the task is to estimate the unknown nonlinear function f.

Various methods for estimating f have been proposed in both statistics and machine learning. These can be characterized as linear or nonlinear. If no assumptions on the nonlinear trend are

specified, the methods are denoted as nonparametric. Statisticians and computer scientists have retained their traditional ways of thinking, their own notation, and their own techniques developed in their own (rather inaccessible) environment [12]. Although comparisons of the performance of linear and nonlinear tools are still quite rare, it is useful to overview advantages of linear regression. It is namely a descriptive tool accompanied by a variety of confirmatory (and/or diagnostic) tools.

The properties of linear regression (compared to nonparametric methods) include:

- No tendency to overfitting,

- Comprehensibility,

- Diagnostic tools and remedies,

- Efficient computation,

- Modifications for a high dimension such as availability of lasso-type versions of methods, corresponding to Bayesian way of thinking,

- Modifications robust to outliers,

- Available hypothesis tests,

- Confidence interval for parameter estimates,

- Confidence band (region) for the whole regression curve (or line).

B. Nonlinear Regression

Nonparametric regression (regression curve estimation, function approximation) methods include:

- Regression trees (or their ensembles),

- Multilayer perceptrons,

- Support vector regression,

- Kernel-based methods (kernel estimation of regression curve, or shortly kernel estimation),

- Regularization networks,

- Many other methods including very recent ones.

When assuming normal distribution (or any other given probability distribution) of random errors in the regression model is not suitable, the user may choose one of many methods for nonparametric regression modeling. From the practical point of view, it remains to be an open problem how to select the most suitable method for a given biomedical dataset depending on its characteristics. This task may be solved by means of metalearning (automatic method selection).

As a promising tool, let us now discuss the SVR (support vector regression) method proposed in [13] as a regression analogy of the SVM (support vector machine) classifiers. In spite of good experience with the performance of SVR, it still remains to be much less popular compared to its classification counterpart so far. Both the SVR and SVM methods have been rigorously investigated within the context of machine learning theory. This represents a significant advantage compared to neural networks, which are often criticized for weak theoretical foundations; the networks remain suboptimal if the networks are accompanied by sophisticated heuristics. The SVR method can be said to explicitly formalize the concept of statistical learning, which is solved by neural networks only implicitly. Other nonparametric regression methods were overviewed in [14].

C. Multilayer Perceptrons

In the task of nonparametric regression, multilayer feedforward perceptrons represent the most commonly used form of neural networks [15].

Most commonly, multilayer perceptrons exploit the back-propagation algorithm minimizing the total error computed across all data values of the training data set. The back-propagation algorithm for performing the regression modelling is based on the least squares method, which is optimal (only) for normally distributed random errors in the data. After an initiation of the values of the parameters, the forward propagation is a procedure for computing weights for the neurons sequentially in particular hidden layers. This leads to computing the value of the output and consequently the sum of squared residuals computed for the whole training data set. To reduce the sum of squared residuals, the network is sequentially analyzed from the output back to the input. Particular weights for individual neurons are transformed using the optimization method of the steepest gradient.

There are no diagnostic tools available for neural networks, allowing to detect substantial information in the residuals, such as their

dependence, heteroscedasticity, or systematic trend. There are also only a few theoretically proven optimality results for neural networks. As an important example, let us mention an asymptotic estimate of their approximation error investigated in [16]; this result brings arguments in favor of using multilayer perceptrons for high-dimensional data. Still, such theoretical considerations are very distant from the original biological motivation for artificial neural networks.

The output of neural networks usually represents a disorganized black box [17], i.e. it is typically impossible to explain why the algorithm yields particular results, although comprehensibility would be very desirable in a variety of fields in which they have been successfully applied. The impossibility of a clear interpretation is an attribute of deep multilayer perceptrons (deep networks, convolutional neural networks), which have recently become popular. Nevertheless, there seem no theoretical results related to methodological issues regarding their training.

D. Extraction of Rules from Neural Networks

Neural networks represent a popular class of methods for solving (not only) the task of nonlinear regression. Let us now describe a method allowing to improve the interpretation of estimates (i.e. estimated trend) obtained by a neural network.

Particularly, we now describe a suitable approach to extracting rules from multilayer perceptrons, which represent the most commonly used type of artificial neural networks in practical applications. We remark that (logical) rules are the basis of a number of other machine learning tools, including regression trees. In fact, the most common way of constructing trees, known as CART (Classification and Regression Trees), is based on building a regression tree from individual logical rules.

Practitioners may realize a recent tendency to use neural networks with a larger number of hidden layers. Still, even the shallow networks do not allow for a simple interpretation of the results. For deep networks [8], it is basically infeasible to express the estimated nonlinear regression function by means of an explicit formula. Practical tasks of estimating the regression curve, particularly in clinical decision support, however often require not only to perform the estimation task as such, but also

require to understand why is the resulting estimated trend exactly of the given form.

A possible method for extracting rules from a trained neural network will be now described. If the described approach is performed correctly, it may represent a unique effective tool for obtaining some comprehensible interpretation of a given neural network. The whole approach is motivated by the book [18], which is in our opinion one of the most comprehensible books on Big Data analytics.

A simplified example described here is devoted to our past cooperation with a university hospital devoted to finding the cause of autoimmune thyroiditis. This autoimmune disease is still waiting for identifying its (presumably multiple) causes and is currently diagnosed mainly at random. The association of the disease with the gene HLA-DR5 has been discussed. Let us assume that various data in the form of continuous and/or categorical variables are available for each of the patients in the study. The concentration of the thyrotropic hormone, which stimulates the activity of the thyroid, plays the role of the response here, while age, sex, or gene expression of HLA-DR5 are used as regressors.

To explain (predict) this response variable, a neural network with a single hidden layer will be used with three neurons (units). The prediction of the response is thus based on three neurons of the hidden layer. The whole procedure will be formally described to be performed in five steps of Algorithm 1:

1. Construct and train a neural network for estimating the regression curve based on given training data.
2. Categorize the outputs of the hidden layers of the neural network.
3. Extract rule, which connect the obtained outputs of the neural network with categorized outputs of the hidden layers.
4. Extract rules, which connect categorized outputs of the hidden layers with the original inputs.
5. Connect both types of rules.

The given data of the study over the autoimmune thyroiditis patients are shown in Table 1. The weights corresponding to the neurons of the hidden layer, i.e. values obtained in the first step of Algorithm 1, will be now denoted as $h_1, h_2,$ and h_3. These are shown in Table 2 together with their categorized

TABLE I.   DATA OF THE THYROIDITIS STUDY OF SECTION 2.D.

Patient	Age	Expression of HLA-DR5 gene	Sex	...	Real response	Predicted response
A	28	15.0	F	...	1500	1650
B	44	22.9	M	...	3000	3250
C	30	18.1	M	...	2000	1970
D	58	36.3	M	...	3500	3250
...	...	...	...	...	...	...

counterparts denoted as h_1^*, h_2^*, and h_3^*. These quantities correspond to values h_1, h_2, and h_3 divided to 3 categories. Interpretation of the 3 categories (i.e. logical rules based on categorized values of the 3 weights) is then much more accessible compared to interpreting the continuous weights within the multilayer perceptron.

Let us remark that the process of extracting rules have found simple rules constructed directly based on values h_1, h_2, and h_3. On the other hand, the neural network as such typically constructs the outputs based on linear combinations of h_1, h_2, and h_3, or possibly on some nonlinear transform applied to such linear combinations. Thus, the approach of this section is much simpler compared to the complex model provided by the multilayer perceptron.

E. Principles of Robust Regression Models

The least squares estimator in both linear and nonlinear regression is very sensitive (vulnerable) with respect to the presence of outlying values (outliers) in the data. Therefore, various robust (resistant) estimators have been proposed since 1960s as alternative techniques for estimating parameters in regression models contaminated by outliers.

Robust estimators have been studied especially in the linear regression, because it represents the simplest regression model. Gradually, robust regresssion estimators have become self-standing (not only diagnostic) tools

TABLE II.   ANALYSIS OF THE THYROIDITIS STUDY OF SECTION 2.D.

Patient	h_1	h_2	h_3	h_1^*	h_2^*	h_3^*
A	-1.20	2.34	0.66	1	3	2
B	0.78	1.22	0.82	2	3	2
C	2.12	-0.18	0.16	3	1	2
D	-0.13	0.83	-2.34	1	2	1
...	...	...	...	...	...	...

tailor-made for a reliable analysis of data also under the presence of a larger percentage of severely outlying values [19] corresponding to different types of contamination. However, robust regression has started to penetrate to applications only quite recently.

Some of the robust methods perform an unambigous decision which of the observations are outliers and which are not. Then, outliers are discarded from the considered dataset completely. This may however lead to an inappropriate loss of information, especially in clinical applications, where acquiring each measurement requires complex or financially demanding processes. Other robust methods do not aim at making an exact decision about discarding individual observations from the dataset, but rather strive for reducing their influence on the estimates of the regression parameters [20].

We may distinguish between two types of outlying values in regression tasks. The first type includes observations, which are outlying because of a large regression error in the model (but not outlying in any of the regressors). The second type contains leverage points, which are outlying in on or several regressors. Some robust methods for estimating the parameters are robust with respect to outliers of the first type, but they may be actually very vulnerable with respect to the leverage points. This can be said in general e.g. about M-estimators, which happen to be the most commonly used robust estimators. However, from the practical point of view, we may recommend to use regression methods robust against both types of outliers [21].

The breakdown point can be characterized as one of the fundamental measures allowing to quantify statistical robustness. The breakdown point, which thus allows to compare different robust methods, is formally defined as the least

possible contamination of a dataset with n independent measurements, which may cause a given estimator to acquire an infinitely large value. Highly robust methods are then defined as those with a sufficiently large value of the breakdown point. Such highly robust estimators are resistant against both types of outliers as described in the previous paragraph. This is not the case of M-estimators, which do not attain a high breakdown point in the linear regression model.

The least weighted squares (LWS) estimator [22] is an example of a robust regression method with a high breakdown point, which works reliably also for biomedical data. So far, robust regression methods are usually not mentioned in surveys on methods for analyzing biomedical data [23]. Therefore, let us mention a recent example of robust regression modelling in fetology, i.e. the field related to diagnosis and care of fetal (prenatal) patients before birth. An advanced regression method for assessment fetal size (and thus of gestational age) by means of linear models tailor-made for data, which are clustered (in different groups) and longitudinal (i.e. observed sequentially from the same probands over time), was developed in [24]. Such analysis considers a linear mixed effect regression (LMER) model of the mean of the response, conditioning on the regressors. In order to obtain a robust version, also modelling of the variability of the response is performed.

IV. MEDICAL INFORMATICS AS A STRATEGY IN COMBATING THE COVID-19 PANDEMIC

The aim of this section is to discuss the importance of medical informatics tools for the recent combat against the COVID-19 pandemic. The Czech Academy of Sciences has been intensively involved in proposing and validating epidemiological models of the nation-wide level. An interesting realistic model on the level of a given municipality was proposed and investigated in [25], who used agents to simulate the behavior of individuals and their social contacts. The study also included modelling of the effect of state interventions against the pandemic. The whole study thus illustrates that epidemiological models and predictions primarily require to have experience in statistics and informatics and to deploy suitable artificial intelligence machinery.

The currently insufficient support for medical informatics is one of reasons of failures of the Czech Republic in its fight against the pandemic

in 2021, although the origins of medical informatics were successful as appraised in [26]. To recall the history of the Czech school of medical informatics, prof. Jana Zvárová built an interdisciplinary team able to obtain international projects, to promote health literacy, to perform education for medical faculties, or to offer partnership cooperation to university hospitals already in 1990s. In the Department of Medical Informatics at the Institute of Computer Science of the Czech Academy of Sciences founded by her, the first author served as the head from 2013 to 2017. When the director decided to dissolve the department from July 1, 2017, prof. Zvárová passed away only 4 days later. Still, some results in the field of medical informatics continue to be influenced by prof. Zvárová, which is true e.g. for algorithms for analyzing gene expression measurements acquired by innovative microarrays [27].

Also clinical decision support systems have been found helpful during the COVID-19 pandemic [28]. They were successfully applied for prioritization of patients, planning of vaccination, or preparing for a worsening of the epidemiological situation during the COVID-19 pandemic [1]. Further, they allowed to use the latest available knowledge about newly emerging mutations of coronavirus or for the diagnosis of the multisystem inflammatory syndrome, which may appear in patients as a consequence of COVID-19; this is difficult to be diagnosed especially if the patient is not even aware of having become infected with COVID-19. On the other hand, we are not aware of applications of decision support systems to epidemiological and political decision making reflecting troublesome conditions during the pandemic. Such decision making is very complex and we are skeptical about the possibility of their full automation by means of artificial intelligence.

V. FUTURE TRENDS

Finally, let us briefly discuss some emerging future trends related to applications of regression modelling applicable to clinical decision support. Decision support systems in the (near) future will be able to make use of the internet of things (IoT), i.e. of available inter-connections of devices [29]. The increasing availability of connections among medical devices gradually converges to the phenomenon described as the internet of everything (IoE). Clinical decision support systems will be able to compute more

demanding techniques including robust statistical methods. On the other hand, focus will be paid on applying regression methods with low computational or energetic demands. These methods will have to be well interpretable (explainable). The availability of individualized information will allow to target the medical care, transforming the basic paradigm of the current care towards the principles of the information-based medicine [7]. Other specific aspects required from data mining tools are the ability to handle missing values and to perform dimensionality reduction [30]; the latter, which is especially useful for molecular genetic data [31], can be solved e.g. by clustering the available variables.

As a particular future plan, we intend to propose and implement an innovative clinical decision support system allowing to predict the diagnosis of schizophrenia in patients, whose disease is only at the initial stage of its development. This expected joint work with the National Institute of Mental Health (Klecany, Czech Republic) should analyze functional magnetic resonance (fMRI) images by means of nonlinear regression models. The images should be combined with other data of various forms (including fMRI images and gene expression measurements); such complex combination of data of various sources can be expected to bring unique knowledge related to genetic predispositions for schizophrenia.

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Black-box Modeling the Spread of Covid-19 in Serbia

Jasmina Lozanović Šajić[1,2], Maja Đurović-Petrović[1]

[1]Innovation Center of the Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia
[2]Institute of Health Care Engineering with European Testing Center of Medical Devices, Graz University of Technology, Graz, Austria

[1]jlozanovic@mas.bg.ac.rs, majadjurovic18@gmail.com; [2]j.lozanovicsajic@tugraz.at

Abstract—**This paper represents the appliance of control system theory and system identification to develop a mathematical model of the spread of the novel coronavirus. A model is considered as a black-box model with assumed input and output. A black-box model describes the dynamic behavior of the pandemic in Serbia based on data provided by the Ministry of Health of the Republic of Serbia and the Institute of Public Health of Serbia "Dr Milan Jovanović Batut". The Black-box model under consideration provides a more detailed explanation of the dynamic behavior of virus spread.**

Keywords - covid-19, spread, black-box model, system identification

I. INTRODUCTION

Covid-19 is an illness caused by the novel coronavirus, called SARS-CoV2. The first reported case was registered in China, 30 December 2019 [1]. Despite numerous restrictions, the spread of the virus was inevitable. In almost all countries in 2020, the novel coronavirus was registered. The World Health Organization (WHO) characterized COVID-19 as a pandemic in March 2020 [2].

Data for all countries were collected in a country database and also globally. Most visited websites for data tracking are World-o-meter-coronavirus [3], WHO [2], Covid-19 Data Science [4], Our world in data [5], European Union Open Data Portal (EUODP) [6], European Centre for Disease Prevention and Control (ECDC) [7], Coronavirus Serbia [8].

Available datasets have enabled data analysis and the development of different types of mathematical models. Unfortunately, some data sets are archived, and data are not consistent in some observed periods.

Initially, data were recorded daily, and then in the period from December 2020 to March 2021, data are available weekly in the countries of the European Union and other countries for which data are available on the EUODP.

ECDC [7] provides different datasets, data on Covid-19 vaccination in the EU/EEA, data on the daily number of new reported COVID-19 cases and deaths by EU/EEA country, data on SARS-CoV-2 variants in the EU/EEA, data on 14-day notification rate of new COVID-19 cases and deaths, data on the daily subnational 14-day notification rate of new COVID-19 cases, data on hospital and ICU admission rates and current occupancy for COVID-19, data on testing for COVID-19 by week and country, data on country response measures to COVID-19, data on the 14-day age-specific notification rate of new COVID-19 cases, data for the maps in support of the Council Recommendation on a coordinated approach to the restriction of free movement in response to the COVID-19 pandemic in the EU/EEA, and historical data (to 14 December 2020) on the daily number of new reported COVID-19 cases and deaths worldwide earlier available on EUODP [6].

In Serbia, the Office for IT and eGovernment opened the data to the public on COVID-19 statistics [9]. Input data are taken from [8], and the source is the Institute of Public Health of
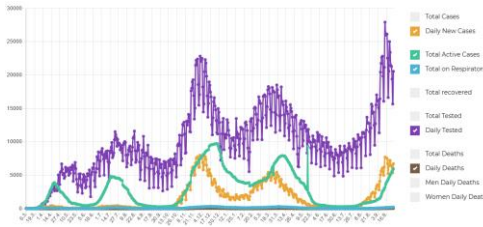
Figure 1.   Covid-19 in Serbia [9].

Serbia, "Dr Milan Jovanovic Batut". On the Covid-19 statics in Serbia [9] (Fig. 1), it is possible to track different datasets, total cases, daily new cases, total active cases, total on respirators, total recovered, total tested, daily tested, total deaths, daily deaths, men daily deaths, women daily deaths, daily percent infected/tested, total percent infected/tested, percent active cases/infected, total percent recovered/infected, and total percent on respirators/hospitalized.

II.   DATA-BASED MODELS

All recorded datasets are helpful for the development of different mathematical models and the prediction of the pandemic. Existing epidemiological models are based on SIR (Susceptible-Infective-Recovered) model and its variations, e.g., SEIR (Susceptible-Exposed-Infective-Recovered) model. Mentioned models are deterministic, based on three differential equations of the first order.

The SIR model is described with (1), [10]:

$$s(t) + I(t) + R(t) = N \ . \qquad (1)$$

The classical SIR model is shown in Fig. 2 and detailed described with (2), [11]:

Figure 2.   Classical SIR model

$$\frac{dS}{dt} = -\frac{\beta IS}{N}$$
$$\frac{dI}{dt} = \frac{\beta IS}{N} - \delta I \ . \qquad (2)$$
$$\frac{dR}{dt} = \delta I$$

The spread is described with three first-order differential equations. However, if we analyze the dynamics of the spread behavior, we can conclude that a better description of the spread can be obtained with a higher-order differential equation.

In this research, we tried to use big data analysis, data science, and control system theory to determine a mathematical model of the spread of the novel coronavirus. We used the dataset available at [5] and particular data to develop a mathematical model. The dataset contains data for the continent, country, date, total cases, new cases, new cases smoothed, total deaths, new deaths, total cases per million, new cases per million, reproduction rate, intensive care unit patients, new tests, total tests, total test per thousand, etc.

Let us suppose that the spread novel coronavirus model can be considered as a system with appropriate input and output. The spread of the coronavirus is a dynamic system.

System identification uses methods to build mathematical models of dynamical systems [12]. Therefore, when it is not possible to develop a mathematical model based on physical equations, we can use a system identification methodology to develop a system model.

Since we do not know what a mathematical model describes a spread's dynamic behavior, we can consider it a black-box model. The black-box is defined in [13].

Black-box models are related functions between system inputs and system outputs [14] (Fig. 3). Therefore, black-box models can be classified as linear or nonlinear systems.

Moreover, a model must be determined from observed data [15]. In this analysis, we assumed the input and output function of the black-box spread model.

III.   SYSTEM IDENTIFICATION AND RESULTS

The focus of interest for black-box models is on their input and output characteristics [15]. This paper considers the dataset on Our World in

Figure 3.   Illustrated black-box block diagram.

Data [5] due to data comparison. The dataset contains data for new cases, new deaths, total cases, total tests, new tests, new cases per million, reproduction rate, new tests, positive rate, tests per case, median age, aged 65 older, diabetes prevalence, female and male smokers, hospital beds per thousand, life expectancy and much more. Data are under open source license, and data are in accordance with the data collected for our country Serbia by the Institute for Public Health [8,9].

In this research, we only use data of interest to obtain a mathematical model. Let us assume that a mathematical model of the spread coronavirus can be determined by observing new cases, new deaths, new tests, total cases, total deaths, total tests. Data are collected and updated daily worldwide. In this paper, we consider data for Serbia from the first registered case 6/3/2020 to 27/09/2021 until the day of preparation for this paper.

Now, we can define the input vector in MATLAB according to the number of new tests and output vectors according to the number of new cases and new deaths. First, input and output vectors are defined in Workspace in MATLAB, after which System Identification Toolbox can be used. The system identification toolbox creates linear and nonlinear dynamic system models from observed or measured input and output [16].

Input/output data are shown in Fig. 4, where assumed input represents new tests daily, and assumed output represents new cases daily, sample time is one day.

System identification toolbox allows to import data as time-domain data, frequency domain data, and data object. Operations under imported
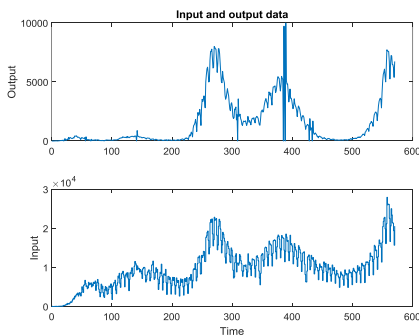
Figure 4. Time plot input/output data in regards to new tests and new cases daily.
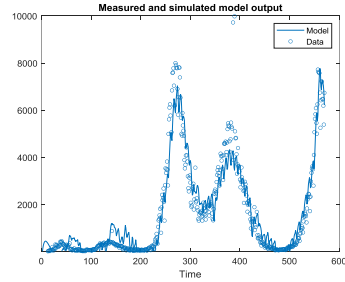
Figure 5. Estimated model based on input/output data in regards to new tests and new cases daily.

data are possible, e.g., data can be filtered, removed means, and selected range. Finally, a model can be estimated as a transfer function, state-space, process, polynomial, nonlinear, spectral, correlation, or refine an existing model after preprocessing data.

By analyzing numerous estimated models, we adopted the model shown in Fig. 5. The model is linear and estimated as a third-order transfer function model with three poles and two zeros.

The third-order model in the Laplace domain given by the transfer function corresponds to the third-order differential equation in the time domain. The system's transfer function, denoted as G(s), is the ratio of the Laplace transformed output to the Laplace transformed input when all initial conditions are zero [18]. The developed transfer function of the spread model is obtained in MATLAB and given by (3),

$$G(s) = \frac{0.108s^2 + 0.0007356s + 1.099 \cdot 10^{-5}}{s^3 + 0.2564s^2 + 0.002127s + 5.743 \cdot 10^{-5}} \quad (3)$$

In the time domain transfer function given in (3) represents behavioral differential equation, (4):

$$\dddot{c}(t) + 0.2564\ddot{c}(t) + 0.002127\dot{c}(t) +$$

$$+5.743 \cdot 10^{-5} c(t) = \quad (4)$$

$$= 0.108\ddot{\tau}(t) + 0.0007356\dot{\tau}(t) + 1.099 \cdot 10^{-5}$$

where $\tau(t)$ is the input, and $c(t)$ is the output of the black-box model.

As we previously mentioned, continuous-time functions were identified, parametrization was done for three poles and two zeros, the number of free coefficients is six, and the stability is enforced. Therefore, the stability of
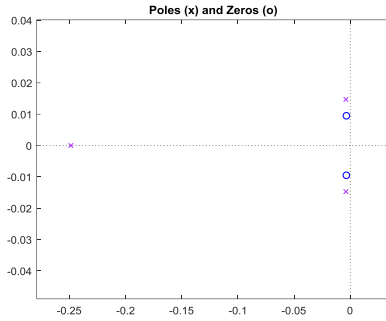
Figure 6. Pole-zero map of the system, in regards to new tests and new cases daily.
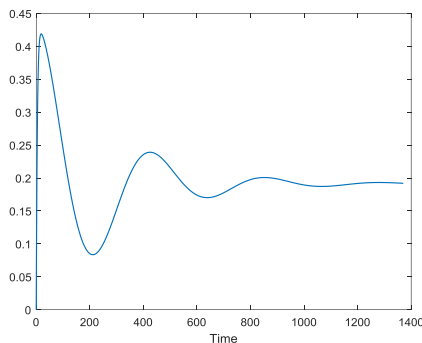
Figure 7. Transient response of the system in regards to new tests and new cases daily.

the black-box model can also be analyzed from the pole-zero map and a system's transient response, Figs. 6 and 7, respectively.

The conclusion about stability is crucial because only if the system is stable can we consider the observability and controllability of the system.

Similarly, we can consider a black-box model regarding the number of new cases and the number of deaths. In this research, in order to establish a link with other epidemiological models, we consider the number of newly infected individuals in relation to the number of deceased individuals.

The model regarding new cases and new deaths daily was estimated similarly as the model regarding new tests and new cases. Interestingly, the disturbance reappears, which can be attributed to the database [5]. That is, an error occurred while entering some data from official provided data.

The peaks in Fig. 8 appear in the same places. Thus, the error in the database can be attributed to the human factor, and the data can be filtered.
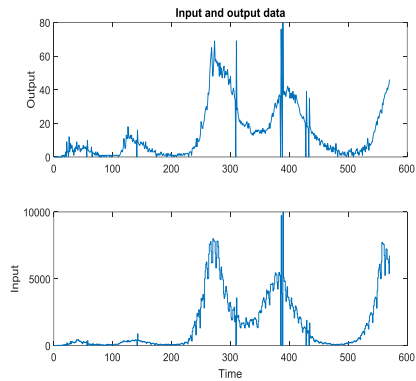
Figure 8. Time plot input/output data in regards to new cases and new deaths daily.
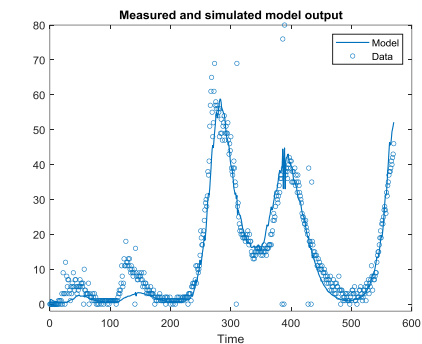
Figure 9. Estimated model based on input/output data in regards to new cases and new deaths daily.
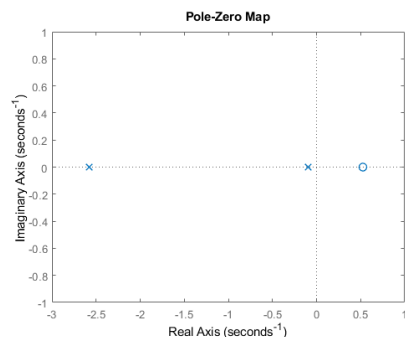
Figure 10. Pole-zero map of the system in regards to new cases and new deaths daily.

After analyzing the model regarding new cases and new deaths, the transient response, and

the position of poles, we can conclude that the developed model is stable Figs. 9 and 10. The same methodology was used, but the identified model is a second-order model. That means the model regarding new cases and new deaths daily is represented by the second-order transfer function and second-order differential equation, (5) and (6), respectively:

$$G(s) = \frac{-0.003985s + 0.002095}{s^2 + 2.673s + 0.2353} \quad , \quad (5)$$

$$\ddot{d}(t) + 2.673\dot{d}(t) + 0.2353d(t) =$$
$$= 0.00\dot{c}(t) + 0.002095c(t) \quad . \quad (6)$$

where $\partial(t)$ is output and $c(t)$ is input, correspondingly to the number of new deaths and the number of new cases daily, respectively.

We analyzed both models and transformed models into the state-space representation. Into state space, we determine the controllability matrix and observability matrix. The ranks of the matrices correspond to the order of the system, so it can be concluded that both model gains are controllable and observable.

If we compare the equations of the classical epidemiological model with the equations obtained by applying the theory of system identification, it is important to note that first-order differential equations do not give the models presented in this paper. Higher-order differential equations better describe the dynamic behavior of virus spread.

IV. CONCLUSIONS

This paper shows that it is possible to implement control system theory and system identification methodology to determine a mathematical model of the spread of the novel coronavirus.

System identification as a methodology can be applied if we assume the input and output of the black-box model. However, our black-box model is data-driven, and it is not possible for all countries to apply this methodology. For example, some countries started with massive testing, and it is no longer possible to determine the model, according to the officially available data.

The model of the spread of the novel coronavirus was determined as a black-box model. The major disadvantage of the black-box model is that the parameters of these functions do not have any physical significance in terms of equivalence to process parameters [14].

The black-box model is determined and described with a third and second-order differential equation compared to classical epidemiological models, where are implemented first-order differential equation. Based on the above, the advantage of the black-box model is a better description of the spread of the virus SARS-CoV-2.

The black-box model does not include vaccination data, but in future research, according to available data, these types of data also can e implement into a black-box model. A model can be determined regarding the total numbers in the database.

The black-box model determined in this paper may be used for prediction or development control strategies of the pandemic.

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Does IT Revolution Force States to Erase Fundamental Principles of Knowledge Management?

Žarko Dimitrijević[1]

[1]Public Enforcement Agent, Niš, Serbia

[1]dimitrijevic.zarko@gmail.com

Abstract—The IT revolution has made the adoption and utilization of the collective experience of an organization as the main principle of knowledge management at any point in the business process, anachronous and inapplicable in most situations. The basic principles of acquisition, use, and improvement of "own knowledge" are in need of modification. Multinational companies have a comparative advantage over other organizations in the utilization of the benefits of knowledge management. However, they too are limited by rigid international legislation, excessive traditionalism in the approach to certain legal institutions (known since the Roman times), and a general reluctance to replace the traditional with the new. In the present paper, the author points to the changes in society brought about by the rapid development of the digital technologies, which society has not yet understood properly. A strict adherence to the rule stating that knowledge management relates to organizations, i.e. certain groups of people, stems from the structure of organizations. However, the digital age erases all boundaries, including the boundaries of institutional structure. In this connection, the absurdities of today, resulting from the traditional notion of knowledge management as the knowledge of an organization (of any kind) can easily be removed, but they imply an entirely different approach both in the classical conception of social relations (taking account of the new relations – the digital ones – as well) and the scope of application of the principles of knowledge management.

Keywords – IT Revolution, IT law, digital knowledge management

I. INTRODUCTION

The "Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres [1]. The fourth Industrial Revolution (IR 4.0) has changed the landscape of educational innovation. IR 4.0 is controlled by artificial intelligence and digital physical frameworks that make human-machine interface more universal. Quick revolution in innovation has delivered another model of education for the future ─ Education 4.0. To prepare graduates for future life and work achieved by IR 4.0 where more smart robots will supplant people in certain activity divisions, education should harness on pertinent information and abilities that couldn't be replaced by robots. Innovation interruption that produces Education 4.0 that focuses on educational development and skill has made future learning more customized, hyper, intelligent, portable, worldwide and virtual" [2]. Therefore, the question must be raised whether knowledge management, the main principles of which arose in the previous century, is sufficiently equipped to take on this sort of change, which no longer refers to organizations and the markets they are oriented towards, but rather to the new age, new market, and new principles. In discussing knowledge management, it is big companies that are often provided as examples of good practice. However, what needs to be considered is using states rather than companies as such examples. Nowadays, the state/company relationship is no longer a relationship of subordination but

partnership. This is best seen in the implementations of numerous joint projects, very much like the recent project by NASA and SpaceX Demo-II: "Returning back to the adage, 'a picture is worth a thousand words'; sometimes the conveyance of meaning or essence of powerful experiences can be expressed effectively by a simple, still image, rather than trying to provide a verbal description" [3]. Precisely. However, the evident success of the technology developed by a privately owned company has revealed not only the development of technology but of society as well. The project, considered as state-run for decades, has stepped onto the global scene. The knowledge that was kept and shard among the "members" of the state apparatus, have been selflessly shared in the last decade with the private sector as well. Not only have the state and the companies joined hands, but also different capitals and different interests; knowledge has come into general possession for the purposes of implementing joint projects. More and more private-public partnership projects are launched, which is indubitably good. But, what if we were to observe this from a different standpoint?

The main principles of management are planning, organization, directing, and control: "Financial management consists of organization, planning, execution, control and directing the financial activities of the organization. The main decisions and steps taken in financial management are: evaluating helding funds, estimating total capital needs, identification of sources of financing, effectively procurement of necessary funds and effective use of funds" [4]. By adding the word 'knowledge', the phrase takes on a specific meaning. It implies the collection of methods relating to creating, using, sharing and managing the knowledge and information of an organisation [5]. Then what would the definition of knowledge management be for two or more organizations, seen as a single whole? And it is even necessary to consider general, or global knowledge management given that the knowledge an organization possesses constitutes a comparative advantage over another organization? Why should we consider general (global) knowledge management if this very process within an organization is the special value, quantifiable in the market?

The digital revolution provides its own answers. They can easily be obtained by pointing to a few topical examples from the life around the world, testifying to the need for developing new principles in knowledge management as a response to a) the development of new relations; and b) restructuring the long-standing ones.

II. TEARING DOWN PRINCIPLES

A. The Need to Develop New Relations

The state must monitor the development of social relations in order to be able to protect its constitutive elements: the territory, populace, sovereignty, and recognition by other states. Companies are similar in this respect. A company must follow market development trends, or else face being overrun by the competition. This is a continual process. Social relations develop, markets change, and organizations endeavour to respond in a timely fashion. As they do, they also learn and gain experiences which are in and of themselves a new value.

The digital revolution has sparked the need to reverse this process. Therefore, it is not a process going from actual social relations to their subsequent structuring. Rather, it is about a prior normative structuring which then results in the further development of actual social relations. The most representative examples of such a need can be seen in the recent technological advancements in the automotive industry (developing self-driving cars), medical robotics (developing autonomous robot systems for performing surgery procedures), digital technologies (developing virtual reality) etc, which require normative structuring in order to move from the technological conception phase to mass use.

The accelerated development in these areas has resulted in an absurd state of affairs where there are no generally socially recognizable relations for many possible life situations. Even if a state succeeded in structuring relations under a model proposed by some privately owned companies, which are involved in developing the above technologies, it would still be a unitary solution. As such, how feasible would it be?

Take the following example. Let a self-driving car travel through Serbia. Its control system receives instructions from a computer located in Germany, and maintained by a company in Australia. What sort of legislation could regulate the responsibility of the companies from Germany and Australia? Even if

it could, how would that regulation be implemented in practice?

Autonomous robot systems are similar in this respect. Let a patient be at a hospital in a country. A surgery must be physically performed by an automated robot at the hospital. However, the robot can be programmed from another location, by a doctor who can be physically outside the country in question. Furthermore, does the doctor sending the instructions to the robot have a medical licence in the country in which the patient is being operated on. Likely not.

The last example in this group is concerned with virtual reality. "Virtual Reality (VR) has become a trendy IT topic in the past few years. When Steven Spielberg turned Ernest Cline's popular novel, Ready Player One, into a film, VR became known to an audience of millions. Still, few people are aware that core VR technology has been available since the 1960s …" [6]. Many people start to commercialize their "digital life" in a virtual world. There are, therefore, multiple virtual worlds, and each player or a world's inhabitant, acquires their rights and duties. There are companies that sell real estate or movables, offer to build specific social relations with the other players, etc. in a virtual world. Moreover, more advanced players can make their achievements in a virtual world available to others with or without a fee. With the help of VR haptic suits and other devices, the sensations of a person in a virtual world are nearly identical to those in the real world. This holds for both pleasant and unpleasant sensations (physical and mental pain). Physical and mental pain certainly affect human beings. If a person intentionally inflicts on another, law has a solution for that. However, if mental pain is inflicted in the virtual world, what is the penalty and how do you make the case for it?

In addition to developing new relations, for which currently there are no adequate legal solutions, the existing relations are improving. Progress is certainly desirable. With the exception of negative phenomena like wars, destruction, pollution, etc., humanity is always progressing. This advancement includes an accelerated development of technologies which can be used for deviant behaviours as well.

B. The Need to Restructure the Existing Relations

Each reputable organization of any kind has its own procedures (rules, by-laws) which it used to tackle the most common forms of deviant behaviour. The results of these efforts are in fact effects of an active approach to resolving problems, as well as, likely, of many failed attempts. The totality of the knowledge gained in the process is the know-how that is protected and becomes ingrained in personnel as a special value of the organization. In each individual, this knowledge evolves and can be used to improve the protection process, as well as to undermine it. The answer to this is adding new rules of protection or adapting existing ones, which is a continuous process.

The digital revolution has resulted in the described principles of knowledge protection – if this is indeed an apt name – which have developed over decades, becoming anachronous. The revolution has brought so many new relations that the time-honoured system could not find an adequate response. Evidence of this is all around us, but here is another case in point.

The idea behind the recently adopted Convention on the Recognition and Enforcement of Foreign Judgments in Civil or Commercial Matters [7] (hereinafter: convention) is to establish a secure system of recognizing and enforcing foreign court rulings. The efforts of different countries to set up such a system are certainly commendable. However, it is based on very similar principles as those driving the adoption of the congeneric 1971 convention [8]. Article 13 of the convention stipulates as follows: "The procedure for recognition, declaration of enforceability or registration for enforcement, and the enforcement of the judgment, are governed by the law of the requested State unless this Convention provides otherwise. The court of the requested State shall act expeditiously." On the face of it, this is a very clear provision that can be easily enforced in practice. It aims to ensure greater legal certainty for all those who also work outside the borders of a single state. On the other hand, states protect their sovereignty by recognizing foreign court rulings by domestic courts, which renders foreign judgements equal to domestic ones, on condition of meeting all the requirements. Each state also has its own decision-making instruments, as well as its own know-how, which it manages it its own way.

The digital revolution often makes such efforts immaterial. Let company A be in one state, and company B in another state. Let company A have claims against company B,

confirmed by a final decision of the court. Company A initiates the process of acknowledgment and, before the process is complete, company B is already in a third country. How many times is company A willing to start the court ruling acknowledgment procedure to have it eventually implemented somewhere? Modern technologies make it possible for a business not to have an address, especially if what it offers is digital services. As long as there is no criminal offence, the instruments at one's disposal for exercising specific rights in a cross-border situation often yield no results.

III.   THE SEARCH FOR NEW PRINCIPLES

What drives the spread of new ideas is likely not the need for an accelerated development of social relations resulting from novelties introduced in the digital revolution. It is more likely that the changes of the global system will lead to something far simpler. The best candidate for the creation of new principles is the increased mobility of private individuals in the real rather than the digital world.

Nowadays, it is possible for a private individual to work at an organization without ever setting foot in the organization's premises (working from home). From selecting future employees, concluding contracts, meetings, and all other activities associated with employment, it is not necessary for an employee to ever see their immediate superior or employer. Moreover, this means that an employer can assess his or her employee's work results in the same way as in the traditional work routine, but what they cannot do is control arriving at work and leaving work. In addition, they cannot know the location of their employee. Unfortunately, not even the state can know the exact location of its citizens. Every state has its legislation regulating foreign nationals' residence and an extended absence of its citizens; however, even if this legislation is complied with (which is overwhelmingly not the case), the fact remains that a person's address is a relativized concept.

Addresses being relativized is not an issue until the person in question has a legal obligation. In such a case, it is necessary to serve them with a document, or invite them to join the proceedings, i.e., to communicate with them. Many states, Serbia included, have created email addresses for their citizens for the purposes of communication via their e-Government portals, but this has been shown to be insufficient in practice.

Specifically, according to a view held widely before, a person's passive conduct in any proceedings, be it an administrative procedure, a civil case, or any other proceeding, could not prevent the system from operating. Regardless of the fact that the person did not want to take part, upon completion of the proceedings they would receive a ruling which needed to then be adhered to. If a legal obligation was identified, the person or their property would be located, and the system would enforce the ruling in question. Nowadays this is increasingly not the case. According to the data of the present author's business office, 2020 saw a 700-percent increase in the number of persons with an inactive address, compared to 2012 [9].

Private individuals are highly mobile. An address submitted to a local registry can be old and out of date. A huge number of addresses can be rendered inactive (i.e. it is established that a certain person does not live at a given address and that the address entry in the registry is void). In this way, the person has no address although they certainly live somewhere. Where? In the country, or abroad? In several decades, someone might ask if they live on the planet or away from it. How should one go about finding the person and use their movables to collect the alimony that they are obligated to pay, for instance? What would be the next steps? Let the procedure reveal that the person has considerable amounts of different cryptocurrencies, the iCloud technology for renting space which certainly brings in income, as well as uncounted assets in multiple virtual worlds, which the person owns under unknown names (there is no registry). Further, in addition to the above, the person also owns multiple YouTube, TikTok, and other accounts in different social media, which also bring regular monthly income. How does one collect such a person's debt from these assets?

Currently, collection is impossible, even if the person owns millions, as in the examples above.

However, collection is not the biggest problem. There are many different phenomena which used to be associated with science-fiction film plots. Let us consider the fact that it is not possible for a single person to be at two or more places at the same time. This is a well-known axiom and, to the best of the present author's knowledge, the same principles have been

adopted in virtual worlds. However, what has been taken from science-fiction films are holograms. The hologram industry has had great progress in the last decade. "A fundamental characteristic of VR is creating presence, the experience of 'being' or 'acting', when physically situated in another place" [10]. How long until a person can appear in multiple places in three dimensions, in the same way as it is possible to do this in two dimensions (television)?

However, the key issue of the present paper remains: given that knowledge management includes organization and a group of people, what sort of response can it offer to such challenges? The only kind of tearing down the present author can see as a possibility is the tearing down of the principle of limitation to specific groups of people (organizations of any kind), and the establishment of knowledge management as a general category, a branch that will be concerned with managing knowledge globally. How can this be made possible?

IV. NEW SOLUTIONS

Let us go back to the example of the private individual who has financial obligations, often changes their place of residence, and owns assets in the digital world.

The first challenge is the place of residence. No state can monitor its citizens' movements continuously. Furthermore, microchipping all citizens is out of the question, at least for the time being: "If we don't understand today that, we cannot understand how the machine evolution tomorrow will influence the human evolution and planet biological environment, then we need to continue to study what machines do or can do, how they can do it and how the natural ones can be adapted safety in the synthetic minds of Machine Culture" [11]. This is why states should work together to try to find a way to keep track of its citizens and their whereabouts without infringing on their right to privacy. This can only be achieved by the global, joint development of knowledge and technology, not state-internally. States must be capable of exchanging information instantaneously (digitally), and not traditionally (via correspondence or letters of request). Nowadays, mobile telephone software developers have more information on people's movements than the countries whose citizens these people are. Is that not an absurdity in and of itself?

The second issue is the problem of the digital world. No state in the world is fully prepared for a complete legal regulation of the relationship between the digital world and the real world. Many of them do not understand the need to regulate the relationship. It is precisely this state of affairs that affords opportunities.

A true solution would be to take the institutional route, perhaps via the United Nations or new organizations, and manage the introduction of a new world order dictated by the Digital Revolution. This order does not refer to the rule or domination of the stronger or better; rather, it is about knowledge management and the need for organizations within which knowledge is acquired, shared, and improved to expand into the global scene. What could the "global scene" mean?

Above all, knowledge cannot be seen selectively and in a static fashion. Therefore, as new knowledge is acquired, it will develop in the digital world. There are two categories of this knowledge. One is technical knowledge, related to how something is made. This kind of knowledge will remain reserved for companies concerned with it, with the well-known principles of knowledge management (organizations and groups of people) continuing to apply.

The second kind of knowledge is related to what can be done with this technology and how to accept, use, and control that knowledge. In this connection, it is necessary to create new principles of knowledge management which a newly established body will need to consider. Above all, it is necessary to manage the knowledge of all the companies which are involved in development, with the aim of identifying the far-reaching effects of future technologies. Based on these findings, it is necessary to manage the process of adapting state legislation, preferably in a uniform fashion, with the aim of arriving at a single system of resolving various situations on the ground, as the digital world knows no boundaries.

V. CONCLUSION

It is clear that uniform solutions to the above problems at the global level will not be arrived at in a short space of time. The speed with which the readiness to introduce sweeping changes increases will be directly proportionate to the speed of technological development, and thus of the social problems that will arise.

In the meantime, developing a knowledge management model according to new principles – which would hold not only for an organization (of any kind) but the for the entire planet – may be rewarding. Such a model would suit all states as it would take account of the need to relinquish some sovereignty of all the states in the system for the benefit of increased presence in the digital world. Today, the digital has no statehood. All the participants are stateless, and such a state of affairs was left behind thousands of years ago.

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Public Debt Management in Serbia

Vesna Martin[1]

[1]National Bank of Serbia[a] , Belgrade, Serbia

[1]martinv0803@hotmail.com

Abstract— **Public debt management is a challenge for any country that wants to achieve and maintain stable public finances, because the financial strength of a particular country is reflected in the sustainability of financing public debt obligations. Public debt management should enable the analysis of key macroeconomic indicators (such as gross domestic product, public finances, country investment rating and many others) to look at costs and risks, but also market conditions that affect the level and structure of public debt. In Serbia, good coordination of monetary and fiscal policy measures, as well as the implementation of fiscal consolidation measures in the previous period, contributed to lower borrowing costs in the domestic and international financial markets, while reducing premium risks. The sustainability of public finances was not endangered even during the COVID-19 risk pandemic, and Serbia's public debt remained below 60% of the gross domestic product as required by the Maastricht criteria. The use of hedging instruments, extension of the maturity of issued securities and a more favorable currency structure of public debt contributed to this.**

Keywords - public debt management, hedging strategy, regulation, fiscal strategy

I.   INTRODUCTION

Establishing adequate public debt management is an important prerequisite for sustainable public debt and stable public finances. In order to achieve this, it is necessary to determine the amount of funds needed to finance current and future budget needs, then the market where the issue of securities will take place (domestic or international), as well as the characteristics of issued securities (currency, maturity, amount and frequency of coupon payments, type and scope of the auction). Of great importance is the use of hedging transactions in order to reduce currency and interest rate risk and to achieve savings in the cost of repaying public debt.

The paper is structured as follows. Besides the introduction and concluding remarks, there are three sections. Section 2 focused on literature preview, while section 3 analyzes the public debt management in Serbia with a focus on securities characteristics and the application of hedging transactions. In the fourth part of this paper, we will present proposals for improving public debt management in Serbia.

II.   LITERATURE PREVIEW

Literature regarding public debt management includes an impressive and still growing number of papers because this topic provides great opportunity for research. The research potential of this material is focused on a different topic, such as public debt management before and after the global financial crises, risk management, types of financing mechanism, but also securities characteristics. During the global financial crises 2007/2008, in order to combat against consequences of the crises, countries increased their level of public debt [1] and introduced different quantitative easing programs [2], as this was the case during pandemic COVID-19.

In order to form more stronger form of public debt management it can be proposed to create common Eurobond in order to provide greater liquidity, then to promote further market integration and achieving lower borrowing costs [3]. The important issue is planning the level of the public debt with the aim to keep sustainability of public finance. The level of outstanding public debt automatically increases each year by the amount needed to repay interest, unless that

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amount can be repaid from the budget surplus [4]. It is equally important to monitor risk measures for public debt, such as value-at-risk (VAR), cash-flow at risk (CFAR) and both measure together. The aim of considering these measures is to obtain a recommendation for public debt management regarding the choice of issuing securities in a given market [5].

The main goal of public debt management is to provide a sufficient amount of financial resources to the Government, as well as to keep the costs of repaying these debts at the lowest possible level, which is in line with a prudent degree of risk [6]. In order to achieve this goal, it is necessary to establish optimal public debt management which contributes to the reduction of total interest costs, as well as to the stabilization of economic activity [7]. On the other hand, if public debt management is not optimal, it leads to negative tendencies in the movement of macroeconomic indicators, such as crowding out of investment, rising inflationary pressures, instability of the financial system and increased exchange rate volatility [8]. If a country is unable to service its public debt obligations regularly, the consequences are direct (creditors can collect the debt by contacting the legal system to enforce their debt agreements) and indirect (affecting the country's reputation). All this affects the country's macroeconomic position, market access, as well as the increase in risk premium [9]. In order to achieve long-term fiscal stability, it is necessary for the Government to pursue a policy that will result in economic growth, while achieving a balance between risks (such as refinancing risk, liquidity risk, credit risk and others) and the cost of financing public debt [10]. An important part of public debt management is currency risk because few developing countries can issue long-term domestic debt at a reasonable interest rate, all with the goal of reaching a compromise between maturity and currency mismatch in the structure of public debt [11]. The next part of the paper is dedicated to the analysis of public debt management in Serbia.

III. PUBLIC DEBT MANAGEMENT IN SERBIA

Within the Ministry of Finance of the Republic of Serbia, on October 1, 2009, based on the recommendations of the World Bank, the Public Debt Administration was established, which is the holder of the public debt policy. Thus, the Public Debt Administration has a development and stabilization function and performs the role of providing state liquidity and offers support to Government bodies, public companies, and other state institutions in financing projects of public importance. The Public Debt Administration performs borrowing activities on the financial market in order to provide funds for financing the budget deficit of the Republic of Serbia and projects of public importance through the issuance of government securities and concluding credit agreements, then issues guarantee for public companies, Government agencies and local Government units, manages inflows and executes public debt obligations and prepares a public debt management strategy [12]. In Article 2 of the Public Debt Law, the public debt of the Republic of Serbia is defined as a debt of the Republic arising from a contract concluded by the Republic, a debt of the Republic based on securities, a debt of the Republic based on a contract or agreement rescheduling obligations under the previously concluded contracts, as well as issued securities under special laws, the debt of the Republic arising on the basis of a given guarantee of the Republic, or on the basis of direct assumption of obligations as a debtor for payment of debt under a given guarantee, as well as local Government debt the Republic has given a guarantee [13].

At the end of July 2021, the share of central government public debt in gross domestic product (GDP) was 55.2% (Fig. 1), and the share of general government debt in GDP was 55.9%. The public debt of the central level of government in July 2021 amounted to 28.4 billion euros. The share of public debt in foreign currency at the end of July 2021 was 69.3%, of which in euro 51.0%, in US dollar 12.2%, in special drawing rights 2.1%, in Swiss franc 0.3% and in other foreign currencies 3.7% (pound sterling, Japanese yen, Danish krone, Swedish krona, Norwegian krone, Australian dollar, Kuwaiti dinar, Chinese Yuan renminbi), while the share of public debt in dinar was 30.7% [14].

In order to remedy the consequences of the coronavirus pandemic in 2020, economic policy measures worth 5.8 billion euros were adopted, which is about 13% of GDP, while for this year an additional package of measures will amount to 2.2 billion euros (4.3% of GDP). The extensive package of economic measures affected the temporary increase in central government public debt in GDP at the end of 2020 (57.4%), which is 5.4 percentage points

Figure 1. Central government public debt (% of GDP) [14]
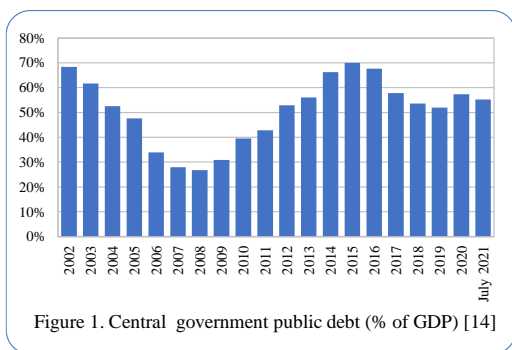
more than at the end of 2019. However, since the beginning of this year, there has been a downward trajectory of central government public debt, which at the end of July (55.2% of GDP) was below pre-pandemic levels. Thus, the Republic of Serbia managed to remedy the consequences of the pandemic with a timely reaction and preserve stable public finances.

The fiscal strategy for 2022 with projections for 2023 and 2024 envisages a reduction in central government public debt by the end of 2024 of 55.5% of GDP. At the end of 2021, the share of general government public debt in GDP is expected to grow slightly to 60.0% due to the implementation of the program of economic measures to support the economy and citizens affected by the pandemic caused by the coronavirus COVID-19. In the coming years, the share of central government public debt in GDP is expected to have a downward trajectory and to be 59.3% at the end of 2022, 57.6% at the end of 2023 and 55.5% at the end of 2024. [15]

A. Analysis of Issued Securities

In order to improve the primary and secondary trading of government securities, the Government of the Republic of Serbia has worked to improve the institutional and regulatory environment, then reduce the costs of secondary trading and simplify the procedure. On the domestic financial market, the Republic of Serbia issued dinar government securities, savings bonds and government bonds denominated in euros.

In the period from 2003 to mid-2010, short-term dinar securities (3, 6, 12 and 18 months) were issued, followed by longer-term dinar securities. In July 2010, the first issue of two-year dinar bonds was issued, and in March 2011, a three-year dinar bond was issued for the first time, while five-year dinar bonds were issued for the first time in January 2012. In 2013, the trend

of extending the maturity of the issue of dinar securities continued, when in March it issued seven-year government dinar bonds for the first time. In October 2014, ten-year dinar bonds were issued for the first time, and in February 2020, a twelve-year bond. The extension of the maturity of dinar securities is important due to the development of the dinar yield curve, which is the basis for establishing the price of long-term dinar instruments (for example interest rate on dinar loans), then the support of the dinarisation strategy jointly implemented by the National Bank of Serbia and the Government since 2012 in order to strengthen confidence in the national currency and its use in the financial system. Since November 2015, the Belgrade Stock Exchange has included long-term government bonds in dinar and denominated in euros on the Prime Listing market segment, which has expanded the base of investors in government securities, contributed to increased liquidity of the government securities secondary market and the development of other financial instruments.

Many years of commitment in the field of development of the domestic financial market and strengthening of the domestic macroeconomic environment in Serbia have resulted in the fact that from June 30, 2021, J.P. Morgan includes dinar bonds of the Republic of Serbia in the index of government bonds of developing countries (GBI-EM Global Diversified Index). The index includes three dinar benchmark bonds maturing on 11 January 2026 (seven-year bond), 6 February 2028 (ten-year bond) and 20 August 2032 (twelve-year bond).

In order to enable domestic adult individuals to invest in government securities of the Republic of Serbia in 2017, a new type of government securities was introduced - savings bonds. These bonds represent an affordable financial instrument because the minimum investment in dinar savings bonds amounted to 2,000 dinars and 100 euros for the purchase of euro-denominated savings bonds. Thus, this bond issue is a form of savings in government securities. Savings bonds were issued in dinars and euros, with a maturity of two, three, five and ten years. The total volume of the issue of dinar savings bonds amounted up to 3 billion dinars, and the euro of denominated savings bonds amounted up to 20 million euros.

The issuance of government bonds denominated in euros on domestic market began

in February 2011 when the maturities of twelve months and fifteen years were issued. The maturity extension occurs in May of the same year when government bonds denominated in euros with a maturity of three years was issued for the first time, and in July with a maturity of eighteen months. Two-year government bonds denominated in euros were first issued in March 2012, and the first five-year issue was in April 2013. In April 2014, ten-year government bonds denominated in euros were issued for the first time, and in June 2018, seven-year. The two longest maturities of government bonds denominated in euros of 20 and 12 years were issued for the first time in January and February 2020, respectively.

The Republic of Serbia issued on the international market Eurobonds in euros and dollars. The first dollar Eurobond was issued in September 2011 in the amount of 1 billion dollars, while in September 2012 the issue was reopened in the amount of 1 billion dollars. The next issue of Eurobonds, with a maturity of five years and a volume of 750 million dollars, was in November 2012. Then, in February 2013 a seven-year dollar Eurobond worth 1.5 billion dollars was issued. A five-year dollar Eurobond worth 1 billion dollars was realized in December 2013, with a maturity of five years. In June 2019, the Republic of Serbia successfully issued the first government Eurobond denominated in euros on the international capital market in the total amount of 1.0 billion euros, while in November 2019 the issue was reopened in the amount of 550 million euros. In May 2020, the Republic of Serbia issued a seven-year Eurobond in the amount of two billion euros, while in December 2020, it issued a ten-year Eurobond in the amount of 1.2 billion dollars. In March 2021, the Republic of Serbia issued a twelve-year Eurobond in euros in the amount of 1.0 billion euros. In September 2021 dual-tranche Eurobonds in euros was issued. For the first time in its history, Serbia issued a green Eurobond in the amount of 1.0 billion euros, with a maturity of seven years, and at the same time a fifteen-year conventional Eurobond in the amount of 750 million euros was issued, which is the longest-term bond that our country has ever issued on the international market.

B. Hedging Transactions

Since 2020, the Public Debt Administration of the Ministry of Finance has started using hedging instruments, i.e. financial derivatives, in public debt management, with the aim of protecting against foreign exchange and interest rate risk, which is in line with the best international practice of active public debt management. Hedging instruments are concluded in accordance with the International Swaps and Derivatives Association international standards (ISDA). So far, the Public Debt Administration has concluded three cross currency swaps (CCS).

The first cross currency swap was concluded by the Republic of Serbia in December 2020 after the issuance of ten-year dollar Eurobond in the amount of 1.2 billion dollars. With the optimization of the currency structure of public debt, all in order to protect against the risk of exchange rate changes, cross currency swap was concluded, which replaced dollar liabilities based on issuance of dollar Eurobonds into liabilities in euros and after conversion the nominal value of the issue was 1.016 billion euros. Following the implementation of this hedging transaction, the share of dollar debt in the total public debt portfolio decreased from 16.6%, as it was before the hedging transaction, to 13.4%. This cross currency swap the Republic of Serbia concluded with BNP Paribas, Deutsche Bank AG, J.P. Morgan Securities plc and Unicredit Bank AG (cross currency swaps in the amount of 300,000 dollars at the rate of 1.066% were concluded with each bank).

The Republic of Serbia concluded the next cross currency swap in January 2021, by which it converted liabilities under the Debt Reprogramming Agreement between the Republic of Serbia and the Kuwait Investment Authority from US dollars into euros, at a significantly lower interest rate. Liabilities based on the mentioned rescheduled loan, agreed in dollars at an interest rate of 1.5%, the Republic of Serbia will pay in euros at an interest rate of 0.393%. This cross currency swap the Republic of Serbia was signed with BNP Paribas and Deutsche Bank AG. This hedging transaction further reduced the dollar share in the total public debt (12.3% at the end of March 2021).

The third hedging transaction, using cross currency swap, was concluded by the Republic of Serbia in March 2021. The realized swap transaction, concluded with Deutsche Bank AG and Merryl Lynch International, is related to a loan from Export - Import Bank of China for the Belgrade bypass project the E70 / E75 highway, which was initially contracted in 2018 in Chinese

yuan. The said loan, on which a fixed interest rate of 2.50% per annum in Chinese yuan was paid, was converted into euros at a fixed negative interest rate of -0.07%. As the negative interest rate has been agreed, the Republic of Serbia will not have any interest expenses in the first five years of the swap arrangement, which is valid until 2030, but will receive additional income from the banks with which the transaction was concluded.

Due to the conclusion of hedging transactions, the currency structure of public debt was significantly improved, as there was an increase in the share of public debt in euros (based on issued Eurobonds in euros) and a decrease in debt in dollars (based on converting liabilities from dollars to euros based on issuing dollar Eurobonds). At the end of June 2021, the share of public debt in euros was 51.1%, which is an increase of 1.5 percentage points compared to the end of 2020, while in the same time the share of the dollar in public debt decreased by 1 percentage point (from 13.2% at the end of 2020 to 12.2% at the end of June 2021).

IV. PROPOSALS FOR IMPROVING PUBLIC DEBT MANAGEMENT IN SERBIA

In the previous parts of the paper, we analyzed the public debt in the Republic of Serbia, the characteristics of securities issued on the domestic and international markets, as well as the hedging instruments used so far. In order to improve public debt management, it is necessary to make a proposal for its improvement:

- Further reduction of the share of public debt in GDP – according to data from July 2021 the share of general government public debt in GDP was 55.9%. The fiscal rule, defined by the Law on Budget System [16], prescribes the obligation that the general government public debt cannot exceed 45% of GDP. In case the amount of debt exceeds that level, the Government is obliged to adopt a program for reducing public debt in relation to GDP, i.e. to return the debt to the legal framework.

- Introduction of the function of primary dealers - in Article 2 of the Public Debt Law, primary dealers are defined as financial institutions selected by the ministry in charge of finance to perform certain activities on the government securities market, as well as to improve the primary

and secondary market and whose participation in the government securities market, as well as other activities that improve public debt management and development of the government securities market, are regulated by an agreement with the Republic of Serbia. Applying this function would increase liquidity and development of the domestic financial market.

- Increase the dinar share in total public debt to support the dinarisation strategy – an increase in the dinar share of public debt would reduce currency risk and contribute to the dinarisation strategy implemented by the National Bank of Serbia and the Government of the Republic of Serbia since April 2012. This would increase the efficiency of monetary and fiscal policy, and thus overall economic policy on macroeconomic and financial stability.

- Further improvement of primary and secondary market – this proposal applies to all securities, especially for those issued in domestic currency [17]. This would contribute to lower borrowing costs in the medium and long term, as well as improving market efficiency in the process of valuing securities.

- Extension of the maturity of dinar issued securities - this suggestion is reflected in the extension of the yield curve, which may represent a relationship for establishing the valuation of long-term dinar products, such as a dinar housing loan. According to the Fiscal strategy for 2022 with projections for 2023 and 2024 at the end of 2012 the average maturity of dinar securities was 394 days (1.1 years), while at the end March 2021 1,452 days (4 years).

- Continued use of hedging instruments, especially in the case of dollar borrowing - in that case, there is exposure to currency risk due the change in the exchange rate of the euro against the dollar. Also, efforts should be made to borrow on the international market only in euros, and only in exceptional cases in dollars, and only when the price of borrowing in dollars is lower than in euros.

- Reduce the share of public debt with variable interest rate - lowering the share of public debt with a variable interest rate in

favor of debt with a fixed rate reduces the exposure to interest rate risk. At the end of July 2021, the share of debt at a fixed rate was 87.2%, and at a variable rate 12.8%.

- Use the possibility for foreign legal entities to perform clearing and settlement of transactions - Article 26 of the Public Debt Law provides the possibility for foreign legal entities (for example Euroclear) to perform clearing and settlement of transactions related to the purchase and sale of financial instruments in the domestic capital market. Foreign legal entities are hired on the basis of a decision made by the Government on the proposal of the Ministry of Finance. This gives the opportunity to increase the number of financial investors, then facilitates foreign investors access to the domestic capital market and increases its efficiency.

V. CONCLUSION

The joint action of monetary and fiscal policy should create a macroeconomic environment that will be a generator of economic growth and development. The orderliness of a country's public finances is measured through a large number of indicators, where one of the leading ones is the sustainability of public debt. In order to achieve this, it is necessary to have efficient public debt management that should enable the optimality of public debt in terms of its currency, maturity, and interest rate structure. Public debt management in the Republic of Serbia is entrusted to the Public Debt Administration, which was established on the basis of the World Bank recommendation in 2009 with the aim of being the holder of public debt policy, as one of the basic branches of macroeconomic policy.

By applying timely economic policy measures, the Republic of Serbia has given an adequate response to the remediation of the consequences of the corona virus pandemic. Although the increase in public debt in these circumstances was justified, its level was kept below 60% of the gross domestic product as required by the Maastricht criteria. In order to best manage public debt, it is necessary to define a borrowing strategy in the domestic and international markets. On the domestic market, the Public Debt Administration issues government securities in dinars and denominated in euros, as well as savings bonds in dinars and euro-denominated, while on the international market, Eurobonds in euros and dollars are issued. In the previous period, the Government has done a lot in terms of extending the maturity and declining costs of borrowing securities issued on the domestic markets, improving the institutional and regulatory framework for trading activity in primary and secondary market and expanding the institutional base. In order to reduce currency risk, cross currency swaps were concluded, which contributed to the decline in the dollar share of public debt and the increase in the share in euros.

In order to ensure the improvement of public debt management, it is necessary to work on further reducing the share of general government public debt to 45% of GDP, which is a legal obligation defined by the Law on Budget System, then on introducing the function of public dealers which should increase liquidity and further improve the domestic financial market. In addition, it is necessary to continue work on increasing the share of the dinar part of the debt in total public debt, then maintain continuity in improving the primary and secondary market, carry on with application of hedging instruments, and that foreign legal entities can perform clearing and settlement transactions on domestic financial market. These proposals should contribute to increasing and diversifying the investor base, lowering borrowing costs, further improving the secondary market, but also lowering currency and interest rate risk.

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Innovation, Competitiveness, and Entrepreneurship: Evidence from Emerging Market Economies

Funda H. Sezgin[1], Yılmaz Bayar[2]

[1]Istanbul University-Cerrahpaşa, Department of Industrial Engineering, Istanbul/Turkey
[2]Bandirma Onyedi Eylul University, Faculty of Economics and Administrative Sciences, Bandirma, Balikesir-Turkey

[1]hfundasezgin@yahoo.com, [2]yilmazbayar@yahoo.com

Abstract—**Today, entrepreneurship and innovation are key factors for sustainable growth and social welfare. Innovative entrepreneurship benefits the economic system by creating new jobs, increasing income, and increasing the potential of new investments. In other words, new and developing businesses that create innovative products to a large extent transform the world we live in and create new jobs. Today and in the future, innovation has to be a mentality and lifestyle that should be in every field of entrepreneurship. Therefore, the aim of entrepreneurship and innovation policies should be to provide the necessary incentives to facilitate the generation, implementation, dissemination and commercialization of new ideas and to create a favorable eco-system. The most important output of this success is increasing competitiveness. With the increase in competition conditions and the development of information technologies, businesses also need to change themselves in order to develop and keep up with the changes in the environment and to be able to show some differences compared to other businesses they are in competition with. Increasing competitiveness is of great importance in order to ensure growth, especially for emerging economies. The aim of this study is to reveal the causality relations for innovation, enterprise and competition for the emerging economies for the years 2008-2019 with the Dumitrescu and Hurlin (2012) panel causality test. As a result of the analysis, bidirectional causality between entrepreneurship and competition, bi-directional causality between entrepreneurship and innovation, and one-directional causality between competition and innovation were determined.**

I. INTRODUCTION

With the increase in competition conditions and the development of information technologies, businesses and countries need to change themselves in order to develop and keep up with the changes in the environment and to be able to show some differences compared to other countries in which they compete [1,2]. Although there are many areas where businesses can make a difference in competitive conditions, entrepreneurship is at the forefront of these areas. Today, as the effects of globalization are embedded in the structure of economic units, the search for policies regarding the future of nations is concentrated around the concept of competition [3]. Now, developments in management systems, economic law and technology establish a new world order and the economic units that adapt to it the fastest are entrepreneurs.

Considering today's market conditions, it is possible to say that entrepreneurs and entrepreneurial activities are needed relatively more than ever [4]. With the emergence of innovative technologies and globalization of competitiveness, it has been observed that some concepts such as knowledge, innovation and creativity have a critical importance in the management of businesses [5]. In parallel with this situation, the financial capital, which is at the center of industrial societies, has been replaced by intellectual capital, which can be

expressed with the concepts of "patent, license right, brand, know-how, business name and customer loyalty" in the information society, which can also be defined as the information age [6,7].

R&D and innovation is a factor that triggers entrepreneurs [1,3]. However, sustainable competition provides the most important environment for the entrepreneur who wants to commercialize his product and service. Entrepreneurship is a must for any country's economy that wants to grow and make a profit. For this reason, all countries aiming at continuous economic growth and development should give high priority to entrepreneurial activities and support all potential entrepreneurs [8]. In addition, both innovation and competition are closely related to entrepreneurship. The sense of competition in an existing or new market motivates the entrepreneur who aims to make a new breakthrough [7]. The motivation to differentiate from their competitors and their products/services through innovation activities is a very strong incentive for entrepreneurs.

The aim of this study is to determine the causality relations for innovation, enterprise and competition for the emerging economies for the years 2000-2020 with panel causality test.

II. THE RELATIONSHIP BETWEEN INNOVATION, COMPETITION AND ENTREPRENEURSHIP

The concepts of competition and innovation are of great importance for organizations and countries. Ensuring competitive advantage through innovation activities explains the harmonization of the environment in a way that will provide optimal benefit, while innovation activities that will occur with competitive advantage explain the source of the harmony with the environment.

The sustainability of the competitive environment depends on the competitiveness of the countries, and countries carry out innovation activities in order to achieve better. Apart from these, countries want to experience a different innovation process according to the competitive environment that will occur after completing their innovation processes [9]. Therefore, ensuring the relations between the dimensions of competition and innovation is of great importance for countries. The concepts of competition and innovation are in a positive relationship with each other. Competitiveness is

meaningless without innovation, and innovation by itself means nothing without competitiveness [10]. The importance of providing positive relations between competition and innovation, the concepts of competition and innovation, especially for countries, economic, social, cultural, science, technology, health, sports, justice, etc. [11]. It is due to the fact that it has indirect or direct effects according to each field. The relationship between competition and innovation has a dynamic feature. In this context, the concepts of innovation and competition have turned into a structure that complements each other due to their mutual relations.

In addition, if there is no reciprocal relationship between the dimensions of competition and innovation, which one affects and which one is affected varies according to the periodic and situational situation [12]. In the rapidly increasing competitive environment, products and services that are differentiated, have added value and provide more convenience in meeting the needs always hold. In this way, countries that attach importance to innovation will be able to provide competitive advantage by obtaining economic and added value [13,14]. In addition, innovation is the key to competitiveness. In a competitive environment, countries need new capabilities, methods and technologies to dominate the competitive process.

The differentiation of the organizations within the country and their global adhesion can ensure the economic growth and economic development of the countries to which the organizations belong. Accordingly, countries can increase their welfare and quality of life through innovation. As a result of competition, qualified learning and know-how, industry culture, expertise and entrepreneurship that will emerge as a result of the relations between organizations, R&D, technology, support offices and organizations gain meaning in the organization [15, 16]. This will lead to innovation. For example, the Japanese economy has achieved competitive advantage thanks to the innovation activities created by the factors that provide qualified learning. In this sense, other countries that have noticed this transformation have started to carry out innovation activities in order to maintain the competitive environment and not withdraw from the markets.

Entrepreneurial activity can be seen as a mechanism for transforming knowledge into an economic production. Innovation is one of the important elements of entrepreneurship in providing them. In other words, one of the important factors that increase the importance of entrepreneurship in the growth and development of countries is that entrepreneurship is an activity based on innovation [17,18].

Innovative economy means more productive, more flexible, more adaptable to change and higher standard of living [19]. Entrepreneurship and innovation must be intertwined activities for a sustainable life. In short, innovation is creating something new and successfully applying it in the market. Innovation is the foundation of entrepreneurial businesses that provide competitive advantage and is the way to bring innovation to market in entrepreneurship. In other words, in innovative entrepreneurship, entrepreneurship has the feature of a process where innovation transforms into market opportunities or creates competitive advantage [20-22].

III. DATA SET AND ANALYSIS

A. Data And Variables

In this part of the study, the interaction among entrepreneurship, competitiveness, and innovation was analyzed through causality test in 13 emerging economy countries (Argentina, Brazil, Chile, China, Colombia, Greece, Hungary, Malaysia, Mexico, Peru, Russia, South Africa and Turkey) for the period 2008-2019.

B. Method and Results

Before examining the relationship between the series related to the variables in the model, the cross-sectional dependence forming the panel was tested. The unit root and causality analysis used for the panel data analysis are sensitive to the characteristics of the cross-sectional dependence among the units that make up the panel.

In this context, econometric analysis began with Lagrange Multiplier-LM test which was developed by Breusch and Pagan [26], the Pesaran [27] CD test and Adjusted Crosssectionally Dependence Lagrange Multiplier (LMadj) test developed by Pesaran et al. [28] to determine the characteristics of cross-sectional dependence of the variables in the established model.

TABLE I. VARIABLES AND DATA SET.

Notation	Variable	Source
lnGEI	Logarithm of Global Entrepreneurship Index	Global Entrepreneurship and Development Institute [23]
lnGII	Logarithm of Global Innovation Index	World Intellectual Property Organization (WIPO) [24]
lnGCI	Logarithm of Global Competitiveness Index	World Economic Forum [25]

TABLE II. DESCRIPTIVE STATISTICS FOR VARIABLES.

	GEI	GII	GCI
Mean	34.90404	39.69949	62.66269
Median	33.67500	38.46500	61.70000
Maximum	63.20000	58.00000	74.65000
Minimum	16.10000	30.24000	53.76000
Std. Dev.	9.799960	5.635194	4.860445
Skewness	0.941865	0.726019	0.723187
Kurtosis	3.698003	3.043500	3.000651

Second generation unit root tests used in panel data analysis were run for the series. CADF (Cross-Sectionally Augmented Dickey Fuller) and CIPS (Cross Sectionally Augmented IPS) unit root test procedures developed by Pesaran [29] were used because these tests take into account cross-sectional dependence on the one hand, and the structural breaks in the series on the other, and they can be used for situations where the homogeneity assumption cannot be achieved. Then, the homogeneity test developed by Pesaran and Yamagata [30] was performed to determine the homogeneity of the slope coefficients in the cointegration equations. The stationary of the variables at the level was effective in choosing this method. Dumitrescu and Hurlin [31] panel causality test was performed to determine the causal relationship between the dependent variable and the independent variables in the model.

Testing of Cross-Section Dependence: LM test, adjusted LM test and LM-CD test were performed to test for the cross-section dependence, and the test results are presented in Table III. When evaluated in general, it is seen that the null hypothesis, which means that there is no cross-section dependence for each variable and for each model, is rejected at the 1% significance level. In this case, we can accept that there is a cross-sectional dependence in the

TABLE III.	CROSS-SECTION DEPENDENCE LM TEST RESULTS.	
	Test Statistics	**p**
LM	38.88	0,007*
LM adj	10.29	0,000*
LM CD	4.043	0,001**

* %1 sig. level, ** %5 sig. level

panel according to the variables included in the analysis and the established model.

Slope Homogeneity Test: Homogeneity and heterogeneity were tested with the slope homogeneity test, and the results are given in Table IV. When the p values are examined, the null hypothesis is rejected (p<0.05). That means that the slope coefficients are not homogeneous. The homogeneity test results indicate that the slope coefficients for the variables are heterogeneous.

Unit Root Test: Since the cross-section dependence between the units forming the panel was determined, unit root analysis was carried out with the second-generation panel unit root tests. These tests, unlike first-generation tests, have been developed in order to eliminate the deviation in the finite sample properties that may occur as a result of this relationship, in case of cross-sectional dependence between cross-section units. These tests also perform stationary analysis within the scope of cross-sectional dependence between units. The parameters used in the study were tested with CIPS (Cross Sectionally Augmented IPS) tests. Unit root test results are presented for CIPS Tests in Tables V. According to the results of Pesaran's CIPS test, stationarity was provided for the first-order difference for all variables used in panel data analysis.

TABLE IV.	SLOPE HOMOGENEITY TEST RESULTS.

lnGEI		**lnGII**		**lnGCI**	
$\tilde{\Delta}_{adj}$	**p**	$\tilde{\Delta}_{adj}$	**p**	$\tilde{\Delta}_{adj}$	**p**
4.490	0.000	4.889	0.000	2.807	0.000
4.490	0.000	5.212	0.000	2.993	0.000

TABLE V.	CIPS UNIT ROOT TEST RESULTS

Variables	**Pesaran's CIPS test**
∇LnGEI	-4.773*
∇LnGII	-4.299*
∇LnGCI	-3.826*

stationary series for first order difference

Note: Pesaran [29] p. 281 for CIPS The critical value at 5% significance level in Table IIc = -2,987. The number of delays was determined according to the Schwarz Information Criteria. Trend+constant model has been studied.

TABLE VI.	DUMITRESCU AND HURLIN TEST RESULTS.		
H_0	**W-bar Stat.**	**Z-bar Stat. (p)**	**Z-bar tilde (p)**
GEI $\not\Rightarrow$ GII	7.8069	7.381 (0.000)*	8.098 (0.000)*
GII $\not\Rightarrow$ GEI	7.8657	7.511 (0.012)**	8.800 (0.000)**
GEI $\not\Rightarrow$ GCI	8.8163	8.880 (0.000)*	9.907 (0.000)*
GCI $\not\Rightarrow$ GEI	8.3954	8.990 (0.321)	9.704 (0.006)*
GCI $\not\Rightarrow$ GII	1.8296	1.411 (0.339)*	1.516 (0.130)
GII $\not\Rightarrow$ GCI	8.4859	9.492 (0.006) *	9.211 (0.000)*

*Note: * and ** indicate the Granger causality at %1 and 5% significance level respectively. ($\not\Rightarrow$) refers "does not Granger-cause"*

Variable	**The direction of The Causality**	**Variable**
GEI	$\Leftrightarrow$	GII
GEI	$\Leftrightarrow$	GCI
GCI	$\Leftarrow$	GII
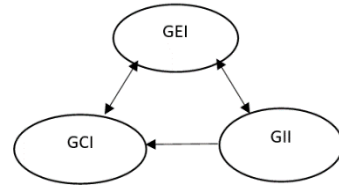
Figure 1.   The direction of the causality.

Dumitrescu Hurlin Panel Causality Test: Dumitrescu and Hurlin [31] panel causality test, which is an extended version of Granger [32] causality test, has many advantages as a test that can give effective results in both balanced and unbalanced panels, and also allows for cross-sectional dependence. The stationarity of the series is a prerequisite for the application of this test, and the stationary states of the series were used in the analysis. Test results are presented in Table VI.

As a result of Dumitrescu and Hurlin [31] panel causality test, there is; a bidirectional causality between GEI and GII, a bidirectional causality between GEI and GCI, and a unidirectional causality from GII to GCI.

IV. CONCLUSION

The place that developed countries have gained in the global competitive market and the high share they allocate to innovation activities; greatly influences entrepreneurship. Entrepreneurs in developing countries transfer

the innovations made by developed countries and especially the new technologies they use to their own countries in order to produce added value with superior and new technologies. In fact, the developed country enterprises in the contract manufacturing chain direct the developing country enterprises to produce the more developed and the new. Thus, it keeps businesses in a dynamic competition process among themselves and provides them with technology and technical knowledge to gain a great deal of profit. In addition, developed countries generally keep the most advanced and latest technology they produce in their own infrastructure, while transferring their previous technologies, which are outdated for themselves, but new for developing countries, to the enterprises of developing countries. As a result, in developing countries, the fact that R&D and innovation are directed, managed and subject to limited processes by developed countries and their businesses prevents or restricts the economies of developing countries from doing R&D in line with the needs of the countries. While this situation causes the gap between developed and developing countries to be closed, on the other hand, it reinforces the one-way technological dependency relationship between them.

The aim of this study is to reveal the causality relations for innovation, enterprise and competition for the emerging economies for the years 2008-2019 with the Dumitrescu and Hurlin [31] panel causality test. As a result of the analysis, bidirectional causality between entrepreneurship and competition, bi-directional causality between entrepreneurship and innovation, and one-directional causality between competition and innovation were determined.

Entrepreneurship activities in both developed and developing countries are supported by grants and incentives by national and international government supports. These financial aids have a strong impact on entrepreneurship. The strategy to be adopted in order to increase entrepreneurial activities should include state supports. National and international calls should be made in the fields of R&D, education and physical capital, and entrepreneurs should be trained in this regard. Developing countries should offer entrepreneurs a chance to cooperate in international calls for support, while maintaining transparency in national support. Thus, the entrepreneur, who is

given the chance to take a place in the global market in his first step, will start his journey in the market ahead. The positive impact of well-coordinated foreign relations on economic and monetary policy should be exploited. International supports to be provided to entrepreneurs should be carried out in cooperation with the national funders of the countries. Thus, the state will be a bridge between the entrepreneur who will increase its commercial share and the countries where it will provide cash flow. In this way, the goal of getting a large share from the competitive market will be realized for the entrepreneur, and the chance of import and export will arise for the countries.

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The Importance of Organizational Climate in Cultural Organizations

Dinko Jukić[1]

[1]Trade and Commercial School "Davor Milas", Osijek, Croatia

dinkojukic.phd@gmail.com

Abstract— **The paper presents, analyses, and discusses the importance of organizational culture and climate in cultural organizations. Special emphasis was placed on the importance of building an organizational climate in non-profit, cultural organizations such as theatres, museums, libraries, and schools. Human resources are the most important segments of any organization, especially when it comes to the non-profit sector that provides services. Building the culture and climate of the organization was observed from the aspect of corporate branding, but also from the aspect of KM. The aim of this paper is to provide insight into the importance of building culture and climate, but also its connection with building the identity of the organization. Satisfied employees create an open and positive climate of the organization, create an identity, and provide a better service. The contribution of this study is manifested in an interdisciplinary approach to work through marketing, management, psychology, and cultural theory.**

Keywords – brand, climate, culture, employee, identity

I. INTRODUCTION

Employees are the most important resource in management and marketing in culture, especially when the service is intangible and inseparable such as theatre, concert, artistic performance, or some other intellectual service. Of course, other elements are important, but the role of employees is unquestionable. In a provider-dependent non-profit organization, the specificity of the service itself is highly variable [1]. The play repeatedly performed by the same actors, or the concert repeatedly performed by the same orchestra is not always the same.

Regardless of whether the same show, concert, gallery, lesson, or intellectual service is planned, it strongly depends on many factors and, as such, is subject to different perceptions of the users, but also of the employees themselves [2]. The quality of such a service depends on who provides it, as well as on the time, the place where it provides them. Satisfied employees create an open and positive climate that further separates the cultural organization and turns the organization itself into a cultural centre which, from a sociological aspect, we view as a cultural object [3]. Also, satisfied employees create the identity of the organization [4,5], but also promote the brand [6,7].

In other words, the role of employees is twofold: they create and maintain an organizational culture and climate, while creating a positive image of the organization, but also realize themselves in a psychological sense [8,9]. In such an environment, "knowledge squares" are created [10] in which the manager manages the employees and creates the condition for building a corporate identity.

II. KNOWLEDGE AS A STRATEGIC RESOURCE

Knowledge is a factor of production [10]. The very concept of knowledge is much discussed: from a psychological [11], sociological [12], communication [13] and economic aspect [14]. What the knowledge construct has in common is certainly its content units: information, data, and knowledge. Data represents a set of objective facts [15], and information can be presented as a set of specific messages.

Therefore, information has its form and purpose, unlike data, which is metadata and has meaning only when it is assigned to it. However, the very concept of knowledge is difficult to define [16], at least from the aspect of information sciences and economics, because

then we understand knowledge as a meaningful set of information that we come to through communication and experience [17]. Knowledge is a fluid mix of work experience, values, information, and expert opinions that provide a new framework for evaluating information and experience [15]. In other words, the knowledge possessed by employees is crucial to the development and business of the organization.

There are three basic types of resources in organizations: tangible, intangible, and human resources [18]. We identify tangible resources through financial statements and physical resources. Intangible resources create technology. In the context of cultural organizations, these are copyright, the reputation of the organization and the brand. Human resources are not shown in the balance sheet of the organization because cultural organizations enter employment contracts with their employees and in this way, they hire their time and knowledge [10]. Human resources are assessed at the time of employment based on qualifications and skills.

Knowledge is increasingly described as a factor of production [10]. Knowledge, in this context, has different characteristics than material factors of production that relate to criteria such as ownership, pricing, costing, multiplication, and dissemination. Therefore, we will look at knowledge in the context of cultural organizations as a strategic factor of competition. In such a context, we view knowledge from the perspective of environment and resources.

The environment-oriented approach starts from the assumption that the advantages in competition can result from the unequal distribution of information and knowledge [19]. The resource-oriented approach starts from the assumption that competitive advantage is achieved so that companies are different from the competition. In other words, knowledge becomes the existential basis of any organization, especially when it comes to the service sector.

Can the persistence of cultural organizations be explained from the point of view of knowledge? If we look at knowledge as a strategic resource of any organization, then the place where individual knowledge and intelligence merge into collective, creative intelligence, then we can. In this context, the success of the organization is based on the fact that there is individual knowledge with a certain specialization and quality of the knowledge

transformation process from individual to collective [10,16,17].

We can conclude that an important task of running a knowledge-oriented corporation is to create the framework conditions so that employees with their specific knowledge can build collective knowledge. Of course, for KM to contribute to the success of a corporation, employees need to be motivated to participate and transform into a knowledge-based organizational culture. One of the ways proposed by Frese [20] is the incentive system.

The concept of incentive system includes all measures whose primary goal is to increase employee motivation. Intrinsic motivation is increasingly important for the division and development of knowledge because it enhances the learning process. Knowledge-based value creation largely determines the ability to mobilize shared knowledge and generate value from it. Such a form of learning and knowledge exchange is considered under the term communities of practice [21], which he understood as groups of persons who exist in a certain period and have an interest in building and exchanging knowledge together.

Such knowledge communities [10] develop competencies and bring the latest processes into organizations, but they also form the identity of the organization [4,5]. The construction of the identity of a cultural organization will be presented according to the integrated model of brand theory [6,7,23] and corporate marketing [4,5,22]. Since each cultural organization is unique and specific, unlike for-profit organizations, the school, museum, theatre, and gallery can be viewed as a unique social environment. For its proper functioning, management and transfer of knowledge, the interrelationships of employees play a very important role.

Knowledge is related to people by their interests, preferences, skills, and abilities. The concept of "knowledge market" means that the organization must be tied to the goals of the company. Knowledge has a market value [10]. To form a knowledge market, it is necessary to develop employee competencies, define market settlement mechanisms and implement KM in work processes.

III. Cultural Organizations

Cultural organizations are constantly changing and evolving. The development of theatres, libraries, schools, museums, and galleries has always been determined by social, cultural, and economic changes. This means that the development of cultural organizations can be observed from the aspect of management, sociology, and anthropology, but also from the aspect of psychology, informatics, and cultural trends.

Culture is, in a broader sense, a mediator between different parts of society and represents the fundamental value of the individual. From the aspect of cultural organizations, the notion of culture can be related to the interaction of employees and their joint relationships. Although culture is, in the broadest sense, a multidimensional construct because it encompasses all aspects of cultural syndromes [24], culture also represents identity. In other words, the cultural background includes the ways employees think and create mental images.

Problems of psychosocial and emotional climate are observed through several aspects, emphasizing the role of service providers in creating a positive atmosphere of the organization. The quality of interpersonal relationships between participants in cultural activities influences the creation of an emotional climate. The socio-emotional climate is influenced by employee behaviour. Also, the climate of the organization is influenced by management. An indifferent leadership style creates an indifferent climate that is unfavourable for building an employee's identity and image.

Another specificity of cultural organizations is, with the exceptional layering of social relations, its tradition. In other words, libraries, schools, theatres, galleries, museums are recognizable by certain stereotypes, standards, and ways of communicating. Also specific are certain rituals, ceremonies, and beliefs of employees that all together create an organizational climate. Table I shows the peculiarities of cultural organizations.

TABLE I.   SPECIFICITY CULTURAL ORGANIZATIONS

Frame	Norms	Identity
Services	Symbol	Experience
Expressions	Story	Image
Act	Ceremonies	Adventure

As can be seen, the first group forms the framework of organizational culture and represents the specific values of cultural organizations. Norms have a strong influence on employee behaviour. They also include the values of the organization that point to identity. Identity is analysed here according to brand theory [6], where it is integrated into value frameworks. This means that norms and values, such as collegiality, expertise, and job satisfaction, form the core of building the identity of a theatre, school, museum, or library.

The second group consists of services that include employees, but also specific symbols that serve as tangible elements of the service, such as theatre subscriptions, gallery interiors, library periodicals, school diplomas or museum exhibits. Of course, symbols, like artefacts, take on meaning only in interaction with the service. This means that the experiential component is crucial when creating symbols, meanings, and positive impressions. The consumer experience creates impressions about the service and the organization. The notion of perceived quality is a conceptual model that is related to the user experience [25].

The third group consists of stories and traditions about the success of employees in a cultural organization. Through the model of tradition that is inherent in school management and library management, employees identify with the organization through models of external and internal motivation [26]. Employees are an important element of the marketing mix in service organizations. This term is often called as human power [27]. The image of a service organization depends on the employees as they come into contact with the customers.

And finally, the fourth group are models of rituals and ceremonies that establish unique opportunities in cultural organizations. These are integrated models of ceremonies that become routine, such as specific rituals of a theatrical performance, studio work in reading rooms, or a visit to an opera. It is crucial to note here that employee interaction is extremely important because they affect the organizational climate, but also the experience of the service provided. The user's experience with the service is important when forming impressions.

A. Organizational Culture and Climate

Culture is more a process than a distinctive whole and therefore it is very difficult to define

it. However, culture consists of knowledge, beliefs, values, and skills. Culture is the collective imprint of employees [24, 28] and cannot be viewed solely through the framework of physical characteristics. Culture also has a symbolic value. However, culture is a dynamic concept: it is learned, and its value is increased by more frequent use.

The cultural and educational context is crucial in creating a market for cultural organizations. It is not just a goal to buy a ticket for a theatre play, opera, concert, or art gallery, it is crucial to influence the educational curriculum so that schools incorporate art and culture at all levels. Cultural organizations, such as theatres, galleries, operas, or concerts, start from user satisfaction, and aesthetic enjoyment.

In the case of the performing arts, service is an experience in the broadest sense. Therefore, one of the most important elements is the choice, acting, performance, knowledge, and skills of employees. This also assumes many variables such as social, psychological, and other skills that contribute to the quality of service.

We build the branding of cultural organizations through four dimensions. First, the identity of the organization is built, i.e., a service is created, such as an opera, a theatre play, a dance, or a concert. The service must be specific, unique, and striking. In this way we create a cultural object [3]. Second, integrated marketing communication promotes service. The messages it sends to users create a specific picture and builds reputation, image, and recognition [6,7]. Third, in such a discourse of identity, i.e., the creation of positive user impressions, users interpret the image [7,8,23]. Eventually, users send feedback that can be positive or negative [8]. It is important to note that cultural organizations may have different types of brands in the same organization (Table II). Organizational culture is a system of beliefs and

TABLE II.   TYPE OF CULTURAL ORGANIZATIONS BRAND

Type of brand	Example
Artist brand	Actor, performer, artist
Event brand	Festival, conference, symposium
Provider brand	Contractor, printing house, media house
Character brand	The personality of the performer, his character

expectations in an organization that creates norms that strongly shape employee behaviour. The very concept of organizational culture is defined differently, and the first systematic research appeared in the 1980s. There are numerous definitions of organizational culture, and what they have in common includes a set of organizational values, a strong impact on employees, and a symbolic means of sharing common attitudes and values of employees.

In other words, organizational culture emphasizes the unity of the collective, "holds" the organization and gives it an identity. However, the fundamental question is: what do cultural organizations have in common? Are they norms, beliefs, expectations, ceremonies, or employee myths? Finally, is there a mismatch between organizational culture and employee identity? If a culture manifests itself through the norms, shared values, and core goals of the organization, does that mean it can be managed?

Because it occurs as an abstract phenomenon, organizational culture is a collective projection of employees and can be influenced. The tacit assumptions of organizational culture are difficult to identify because they are abstract and unconscious. However, if organizational culture is an abstract phenomenon of shared values of employees, it is the values that define organizational culture because they direct employees to desirable characteristics of the organization. This means that values give a sense of identity and mission to the organization. That is why myths, ceremonies, rituals, and stories create an organizational culture.

Organizational climate is a relatively enduring quality of the corporate environment. It affects the behaviour of its members. It is based on a shared perception of behaviour in cultural organizations, and is influenced by formal and informal organizations, employees, and management. The organizational climate includes the spectrum of relationships between cultural management (principals, curators, managers, stewards), employees, users, and all other employees in cultural organizations.

In other words, the organizational climate in cultural organizations, such as theatre, museum, orchestra, gallery, film, ballet school, etc., is a specific "imprint" of the cultural community, life shaped by employees, artists and equally experienced by employees and users. Therefore, the effectiveness of cultural organizations

depends significantly on the organizational climate.

In conclusion, organizational culture is the way employees work, and organizational climate is a perceptual creation that encompasses all aspects of the environment. If we look at the relationship between culture and climate from the aspect of affiliation, then we can observe organizational culture from the sociological and anthropological aspect because they question deeper employee relations, while organizational climate belongs to the field of psychology because it represents its manifestation on individuals.

The role of organizational culture and climate is very important because it depends on building the reputation of the company or building an identity that consequently leads to the construction of the image. The role of employees is imposed as a key segment in developing, building, and encouraging image building and creating a positive atmosphere. Organizational culture is the way employees work, and organizational climate is a perceptual creation that encompasses all aspects of the company.

Organizational climate is one form of social climate. Since the organizational climate is created in interaction with other employees, we can also interpret it as the employee's thoughts, emotions, and perceptions. From a psychological point of view, climate is a learned response to group problems within an organization. Also, it is important to note that the organizational climate is a relatively stable feature of the organization and it, as an employee experience, also represents a process of communication, learning, knowledge, thoughts, motivation, and job satisfaction.

For employees to fully exploit their potential and be interested in constantly learning and deepening their knowledge and skills for organizational purposes, it is necessary to create a good organizational climate. The organizational climate is closely related to the identity of the organization.

Brand identity is a unique set of associations found in the impressions of consumers and other interested stakeholders [29] and is one of the key factors in brand building. The corporate brand is a special form of marking strategy, where different segments of management and marketing play a very important role. Building a corporate brand most often implies the organizational value of the corporation, core and added value [30].

To build a corporate brand, an organization must first build a corporate reputation. Since the culture of an organization is deeply rooted in employee perception, it is a priori to develop brand identity on cultural reputation and coherence between brand promise and the performance employees provide.

The C^2ITE model [4,5] represents five characteristic features of a corporate brand. The model is conceived as a mnemonic representation of reflections of the characteristic features of the corporate brand, and consists of: Culture, Commitment, Intricate, Tangible and Ethereal.

In Table III, we show the C^2ITE model [4,5] of the corporate brand of a cultural organization, which will serve as a kind of identification of the identity elements of non-profit organizations in culture and art. The characteristics of the organization are presented as specific features that are analysed in the context of Kapferer's brand identity [6]. The relationship between employees and users is intertwined with the relationship between the provision of the service, the way the service is provided, but also with the user's perception of the quality of the service.

As can be seen, the C2ITE model [4,5] shows the characteristics of a corporate brand within a cultural or artistic organization, but it can also serve as a kind of form of identifying elements of the identity of a cultural institution. The characteristics of the organization are presented as specific features that are analysed in the context of brand identity [6,7]. In particular, the relationship between employees and users is intertwined with the relationship between service delivery, the way the service is provided, but also with the user's perception of the quality of service. At the same time, the style of the organization, i.e., its visual identity, represents a reputation that can also depend on the way of

TABLE III.   MODEL C^2ITE IN CULTURE ORGANIZATIONS

Characteristic	Features of the organization
Culture	Employee-user relationship
Commitment	Reputation of the organization and employees
Intricate	The image of the organization
Tangible	Visual identity
Ethereal	The style of artistic organization

providing the service and the relationship with customers, but also the reflection of management towards employees.

From all the above, we can conclude that the identity of a cultural organization is a multidimensional construct that depends on various aspects: management, corporate marketing, service marketing and corporate image. All listed constructs are correlated with each other. After all, to build the identity of a cultural organization in general, and consequently a positive image, it is necessary to invest in employees, because they are the most important segment in creating and shaping future users.

B. The Importance of the Employee

The image of an organization depends on the employees as they encounter the customers. Employee satisfaction and customer satisfaction are often highly related [31]. The user's experience with the service forms positive or negative experiences and creates the image of a cultural organization.

Every contact with the user, the experience of consumption and communication creates an experience in the mind of the consumer [25]. The perceived quality of the organization includes a positive attitude of employees, organizational climate and culture and personal contact. The identity of the service is built with users who have had experience with the service.

Organizations in cultural activities build emotional connections with users. The construction of brand identity [6,7,23] in the minds of employees must be based on an emotional connection. In other words, the service brand [2] becomes as strong as the employees [32]. Therefore, the role of employees is so important because they are the bearers of image, identity, and complete impression of the organization.

The culture of an organization affects KM in many ways. In particular, the positive aspiration and motivation for knowledge exchange will have a positive effect on KM, while, on the other hand, negative competition, and lack of desire for knowledge exchange will negatively affect KM. The question arises: who owns and manages the knowledge, the employee, or the cultural organization? Sometimes knowledge is formal, but it has a formal and causal connection with the consequent behaviour in the organization.

Therefore, a sense of trust in employees is of great importance [33].

Successful service companies focus their attention on their employees. Such organizational cultures understand the service profit chain that links company profits to employee and customer satisfaction [34,35]. Because in service companies, employees and customers are in contact and enter direct interaction, it is important to understand employee behaviour. The effectiveness of the interaction depends on the skills, knowledge, and support processes that the manager provides to the employees. The service profit chain has five links [35]: internal service quality, employee satisfaction, higher service value, customer loyalty, and superior service performance.

Therefore, making a profit from services and growth goals begins with caring for customers. This means that service marketing in culture requires internal marketing and interactive marketing. Internal marketing means that a theatre, gallery, or museum must invest in employee quality and service performance. They must motivate employees who are in contact with customers.

In fact, internal marketing must precede external marketing [34]. Whether it's a theatre, museum, ballet school, or concert, interactive marketing means that the perceived quality of service depends on the interaction between, the actor, the director, the curator, the teacher, the performer, and the user. It is this perceived value that creates the notion of service quality [2,36]. Quality of service is what the user perceives [2].

Effective customer-employee interaction ensures consumer satisfaction. Therefore, relationship marketing is very important as it involves creating, maintaining, and strengthening strong customer relationships. Relationship marketing is goal oriented. The goal is to deliver long-term value to customers, and the measure of success is customer satisfaction.

Image plays a central role in customer perception of service quality and is as important to a service firm as to any other organizations. Hence, it is imperative that image be managed in a proper manner [2]. The role of emotions is important in cultural organizations. It is important to take affective functions into account in service quality management [37,38,39]. Mood also has a decisive effect on how the quality of a service is perceived. Customer's mood, positive

or negative have some effect on their evaluations and behavioural response to service encounters [40,41].

IV. CONCLUSION

Organizational culture is a "mental model" that tells managers how an organization works. It is intertwined with the goals and mission of the organization, and is expressed through corporate identity, corporate brand, and corporate reputation. Knowledge of organizational culture is essential because it allows you to customize, shape, and create a company identity. This is also a crucial factor in the survival of the company.

One of the key functions of organizational culture is to convey employee identity and focus on knowledge and values. Organizational culture is an important source of control because it enables the implementation of control and the creation of a strong cohesion of values, norms, and knowledge of the organization itself. The culture of the organization enhances employee commitment and increases the quality of service.

Organizational climate is "perception", the image of the organization and it is a way of seeing, experiencing and everything that happens in the organization. Organizational climate is very important because it represents the "atmosphere" and plays a significant role in shaping employee behaviour and influencing their attitudes. One of the ways in which organizations can maintain competitiveness is to constantly encourage "knowledge markets", i.e., to create an innovative atmosphere. Organizations can encourage employees to participate in creating the climate, presenting their ideas, thoughts, and offering solutions.

An innovative climate increases social interaction between employees. The development of social interaction between employees is very significant. Also, companies should encourage employees and provide support to build a collaborative climate. Organizational climate and culture are interconnected. Employee attitudes, values, and beliefs influence the construction of corporate identity and corporate brand. Sustainable organizational change is ensured when climate and culture change [2,31,36]. In other words when employees feel and consider their organization valuable.

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Modern Characteristics of Knowledge Firms

Oleg Sukharev [1]

[1]Institute of Economics of Russian Academy of Science, Moscow, Russia

[1]o_sukharev@list.ru

Abstract— **The report examines the characteristics of the knowledge firm, which is today a rapidly spreading form of economic organization. The purpose of the study is to determine the distinctive characteristics of the knowledge of a classical firm, which is reflected in the theory of the firm. The methodology is presented by comparative analysis, the method of taxonomy, review and analytical generalizations of modern literature sources. As a result, it is proved that a knowledge firm is a new type of firm whose work is mainly focused on creating new knowledge, expanding the scope of existing knowledge, and preserving and structuring knowledge. Thus, the main task of the production of such a company is to generate knowledge, fix it on a certain medium and deliver it as a kind of product to the knowledge market. This type of firm becomes an attribute of a new form of economic organization – the "knowledge economy". In the knowledge market, such firms form not only a competitive struggle, but also generate new forms of knowledge dissemination through training, providing consulting and other services. In contrast to the classical production firm, the knowledge created by the knowledge firm as a product can have the fundamental property of no series (mass production), as well as "deferred value", which increases over time. The reason for this effect is the replication of specific knowledge, covering a large number of economic agents, firms, as well as the inability to give an accurate cost estimate of the knowledge created at the moment.**

Keywords - knowledge economy, firm, intelligence, knowledge management, distinctive characteristics of a knowledge firm.

I. INTRODUCTION

Today, a new era of knowledge-based economic development is being formed, and the form of organization of the economic system is called the "knowledge economy". Knowledge is becoming a key factor in creating value and modernizing economic organizations [1]. Previously, only tangible assets were a factor in the transformation of firms, now intangible assets come to the fore in the form of knowledge that determines open in-novation, forming firm values and influencing ecosystems [1-3]. In this regard, knowledge management becomes the main agenda not only in research, but also in the practice of the functioning of firms [4-7].

Firms that create knowledge, specializing exclusively in this process, are considered as knowledge firms. It is this type of firm that is shaping the new economy as the "knowledge economy". The emergence of such firms requires not only a change in approaches to managing their development, but also standard theoretical approaches [8-12], since a knowledge firm shows a different behavior than a classical production or transaction firm (a transactional firm is a firm primarily engaged in providing various services, specializing in services), described within the framework of behavioral theories of the firm. In this regard, approaches in the theory of the firm [10,13,14], in the field of information, the distribution of property rights, moral risk, the assessment of the size of firms [15], open innovation, their productivity, research and development (R&D) [16-18] and other aspects [19-21] should change.

This article aims to show the main characteristics of the knowledge firm in the modern economy, which determine the movement towards the "knowledge economy".

II. Main Characteristics of the Knowledge Firm

Knowledge is an intangible asset of a firm – it is used by both a classical manufacturing firm and a knowledge firm in different ways. In the first case, knowledge is applied to ensure that the most productive combination of production factors is provided, in the second case, knowledge becomes the goal of the company's functioning, as well as the search for ways to apply it, which can form independent methods and techniques sold by the knowledge firm in the knowledge market [1].

We present, based on the study of numerous sources [1,3-8,10], the basic characteristics of the knowledge firm.

First, the application of its efforts is the creation, preservation, replication, application of knowledge, or the creation of a special interface that promotes this application. The production company has the goal of creating a product, mass production and development of a specific market. The transactional firm, which is the closest in terms of its characteristics to the knowledge firm, nevertheless provides services that can be provided in a routine mode, in particular, consulting services, household services, pre-registration or registration of various documentation, vacation packages, tourism, etc.

Second, a knowledge firm can specialize exclusively in creating knowledge, without creating products, but it can combine all types of activities, that is, create both knowledge and new products and provide services, including in the field of consulting and training. In this regard, the boundary between the production firm and the knowledge firm be-comes conditional. However, when defining a knowledge firm, it is important to focus on the fact that new knowledge is created, or knowledge arises from the use and application of existing knowledge. If such an activity occupies a fairly significant place in the activities of a company that is engaged in the creation of products and the provision of services, then it is rightfully considered a knowledge company. Therefore, large corporations of the IT sector, such as IBM, Microsoft, Intel, Huawei, are referred to as knowledge firms.

Third, by creating new knowledge, the knowledge firm, unlike the production and transaction firms, falls under the "deferred value" effect of new knowledge, in which the market value of knowledge cannot be accurately determined in the current mode of operation. In this regard, the prospects for the application of knowledge change over time, which creates a certain and rather high uncertainty of the functioning of such a firm. If for a manufacturing firm the uncertainty of its work is related to factors of production and specific markets, then for a knowledge firm the risks are generated by the created knowledge itself, the cost of which is not predetermined by the cost of its creation and the capital costs of scientific research that must be carried out in order to create new knowledge in the future.

We will highlight the most important characteristics of the functioning of a production and knowledge company according to the following criteria: performance, style, strategy, structure, and management scheme, control.

Table I shows the fundamental difference between the main characteristics of a classical production and knowledge firm. The characteristics in the tables are given according to D. McGregor's theory of types X-Y of the organization's human resource management [22]. The production firm is more in line with type X, the knowledge firm with type Y. Working with knowledge requires a democratic style of management, stimulating control, reproducing the motives of knowledge generation, creativity., the counter-attacks are mostly implicit, the structure of management is represented by project groups. (Table I).

According to the theory of organizational factors Ouchi [23], the functioning of a knowledge firm is very different from a production firm. The reason is that the routines and rules governing the creation of knowledge differ from similar aspects governing the development of a manufacturing firm. Working with knowledge requires a higher social responsibility, shared values, and sometimes a special creative work environment. The routine of activity in this case is significantly lower than in a production company. The requirements for professorial training are also different, which are much higher for a knowledge firm. In addition, it is not very easy to separate the employee's contribution to the creation of specific knowledge, in contrast to the production company, where the employee's contribution is completely determined by the creation of the product. The created knowledge has the effect of

Company	Result of activity	Management Style	Strategy	Structure	Control scheme	Control
Classical production (X)	Production of products	Autocratic	Entering the market	Functional	Centralized	The "carrot and stick"
Knowledge (Y)	Knowledge, intelligence, creativity	Democratic	Creative goals and objectives,	Project information	Decentralized	method of stimulation

Source: compiled by the author.

"deferred value", that is, at the time of creation, the value of knowledge can be many times lower than after some time, when there is an awareness of what was created and how to expand the use of this new knowledge.

Thus, there is a significant difference in basic characteristics between production and knowledge firms. This difference is created by the object of the application of effort, the goals associated with it, and for a knowledge firm this largely follows from the intelligence that it possesses. Below are the main components of the intelligence of a knowledge firm.

III. THE INTELLIGENCE OF THE KNOWLEDGE FIRM

Knowledge capital, as well as the configuration of knowledge, have a strong impact on the development of the firm, with investment in knowledge determining future productivity, and the configuration of knowledge is important in the internationalization of the business [24,25]. This significantly focuses attention not only on the volume of knowledge, but also on its structure, since innovative development, sustainability, in-vestment, including foreign ones, and organizational capabilities depend on it [26-29]. However, not only the internal knowledge of the firm affects innovation, but also the external knowledge obtained [30]. The possibility of adsorption of external knowledge de-pends on internal knowledge, which in turn is predetermined by the intelligence of the firm and the overall potential for the development of the "knowledge economy" in the country [31].

The knowledge firm provides knowledge-intensive business services, conducts consulting activities [32], and its various types of activities in this regard are determined by the intelligence of the knowledge firm. Intelligence refers to the ability of a firm to study the external environment, make decisions, and generate managerial knowledge that is subordinate to the task of generating knowledge in specific areas of activity. The basis of intelligence is created knowledge, accumulated knowledge, and applied knowledge, which involves creating ways to apply knowledge.

A modern knowledge firm can, in addition to its intelligence contained in its personnel, as well as its management system, use artificial intelligence, which expands the boundaries of finding solutions from a set of many alternatives. This approach allows us to solve the current problems of resource allocation between various R&D and knowledge generation projects [33], which, in addition to rational decision-making criteria, involves the introduction of social responsibility of the firm. The literature shows the relationship between the intensity of R&D and the specialization of the firm [33]. But the relationship between a firm's intelligence and R&D performance or intensity is not explored. In addition, the unsolved problem is the inclusion of artificial intelligence not only in the management of the firm, but in the description of the functioning of the knowledge firm. These questions are the perspective of scientific research, focused on the future development of the theory of the firm and the practice of firm management, and not only the knowledge firm.

The intelligence of a firm is an integral concept. When applied to a person, intelligence is a psycho-physiological term that reflects a person's cognitive abilities, which de-pend on accumulated knowledge, experience, memory, thinking, learning aptitude, and other psychological and even situational characteristics. The company is always represented by its staff, so its intelligence is the ability, experience, capabilities and knowledge of employees. Their application also depends on

the organizational effectiveness of the company, that is, on how the internal rules are deployed, what decision-making methods are used. It is in such methods that the ability to learn about the changing environment of the company, internal problems, perceive information, process it, use the accumulated knowledge and build up new knowledge, apply existing experience is contained. Therefore, to describe the functioning of a knowledge firm, in contrast to a production firm, it is not so much the production function in the classic Cobb-Douglas form, which connects output with labor and capital, but the intellectual function that is appropriate. The latter should reflect not only the influence of intellect on the creation of final knowledge, but al-so the influence of intelligence on the use of factors of production, if the zany firm carries out, in addition to the creation of knowledge, also the production of products and/or the provision of services [31].

Thus, the use of the concept of firm intelligence depends on the scale of the firm itself, the number of participants and the distribution of power between the owners and managers of the firm. For those firms where there are many owners, as well as a large number of people, including managers, are employed, it seems that the total intelligence of the firm is formed aggregately, but does not amount to a linear sum of the intelligence of employees, owners and the accumulated knowledge and experience in the firm.

An important parameter of the firm's characterization is how intelligence is trans-formed into knowledge and how much it allows the firm to obtain and create new knowledge, as well as apply it. These issues are studied in the literature very locally, and form an important perspective. Contract theory or ideas about changing institutes that affect how knowledge is reproduced and applied, outside of ideas about intelligence, as well as without the inclusion of artificial intelligence, do not give a complete picture of the relationship between the firm's intelligence and the knowledge created on its basis [34-35].

In the classical theory of the firm, it was represented as an object, at the input of which there are resources, at the output – the final product or service that is created due to the use of these resources. At the same time, the internal organization of the company, routines, personnel composition, management, institutional and legal aspects of the activity-cannot but affect the process of creating benefits and the competition that arises in this regard between firms. In connection with the weighty effect of these factors, the theory of the firm acquired various forms and content.

Management theory considered the firm as a complex controlled system. Evolutionary economic theory saw the firm as an evolving within a population of its own kind and as a complex system of changing routines, that is, internal rules interconnected with external rules, which determines mutual changes. Numerous institutional theories of the firm presented it from the point of view of legal institutions, or as a system of contracts, and without much changing the neoclassical ideas about the firm as a purposeful system for profit and financial stability, well-being. The exception, apparently, can be considered the theory of the business enterprise of T. Veblen. The system-integration theories of the firm interpret it, not highlighting any aspect or group of aspects, but focusing on all aspects of the functioning of the firm, with an attempt to find connections between them. This makes this approach related to cybernetic ideas about the company.

The theory of systems allowed us to formulate the so-called system theory of the firm, which can still be attributed to the class of management theories of the firm. All of these theories, from the above incomplete list, somehow explained the main activity set by the production function of the company, through various factors. Thus, the company was considered either through the analysis of labor relations and capital, the implementation of innovations, the conclusion of contracts and the execution of projects, the exchange of information and the implementation of the functions of the management system or the agents involved in the work of the company – employees, managers, employees – per-formers. One way or another, but the influence on the elements of the production function, which combines various factors in their influence on the final parameter of its functioning – the value of production, income(profit) or other resulting parameter that makes up the goal of the company's work, was studied. Of course, the nature of the firm is not to resist the market, but to organize the factors of production in such a way as to achieve the goal of creating various goods, for the creation of which these factors of production are combined. The intelligence of a

firm largely depends on the level of development of the intellectual abilities of the staff (as previously mentioned, on the quality of the labor resource in a broad sense), as well as on the methods of analysis and decision-making that allow us to perceive information, process it, perceive, remember, and learn the current situation.

When knowledge became not only a factor of production (it has always been so, even in the most backward agricultural economy of the feudal type), but also an independent product, and this happened about a century ago, then after a while this factor began to be considered as an independent one in the development of the firm. And there were firms that are purely engaged in the creation-production of knowledge as a type of goods, selling them on the market. Therefore, for them, the target function is knowledge, of course, of a certain type and purpose. In connection with such changes, it was necessary to include knowledge in the quality of the factor in the production function, the form of which has changed significantly since the classic marginalist theories of the firm. A knowledge-based firm emerged and a theory began to form that would cover aspects of the functioning of such a firm. The core of this theory was the representation of the firm's knowledge as a production factor and a finished product, and these types of activities are represented in different firms in different volumes.

IV. CONCLUSION

The knowledge firm symbolizes the beginning of the era of the "knowledge economy" [1]. Its activities are related to the generation of knowledge, its accumulation, dissemination and creation of methods for the application of knowledge. At the same time, the issues of developing and improving the theory of the knowledge firm and knowledge management remain highly relevant. The reason is that the characteristics of the knowledge firm are fundamentally different from the characteristics and behavior that the production firm shows, as well as the transaction firm (provides services). This is due not only to the difference in the object of application of efforts for the firms under consideration, but also to the specifics of how to implement the goals of the firms. For manufacturing and transactional firms, knowledge is one of the factors of their development, together with labor and capital.

For a knowledge firm, knowledge is both a factor and at the same time the goal of activity, either in terms of their generation or application, ways of obtaining knowledge (the firm creates knowledge about obtaining knowledge).

In the knowledge economy, many countries show a relationship between the number of researchers, that is, specialists whose work is related to knowledge creation, R & D, innovation, standard of living and economic development [36]. This suggests that the focus on knowledge, the emergence of knowledge firms have become an attribute of modern development. In this regard, knowledge management in individual industries [37, 38] and corporations has become an independent discipline, which highlights the features and differences of knowledge firms from the classic version of corporate organizations operating in the period preceding the knowledge economy [39].

The perspective of knowledge-intensive firms in the knowledge markets depends on the accumulated amount of knowledge and available intellectual abilities of both individual employees and integral to the management of the company as a whole. The company's knowledge is usually embodied in the form of its developments, design and other documentation, patents, copyright certificates, innovation proposals of employees, utility models and product samples, R&D, structured information obtained, software products created by the company, etc. The listed activities of the knowledge firm constitute the portfolio of the knowledge firm's activities, and these activities may accompany the creation of products and services. The share of knowledge firms is increasing, influencing the development of the knowledge economy [1], and the number of researchers is also growing [31]. However, the methods of measuring the knowledge economy require improvement both in relation to the firm and to the economy of countries, since the total number of educated personnel, as well as the value of intangible assets for the firm, do not already constitute an exhaustive indicator of measuring both the scale of influence of such firms and their contribution to economic development [1,31,33].

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Application of Blended Teaching in Schools – Preconditions, Possibilities, and Effects

Marija Marković[1]

[1]Faculty of Philosophy, University of Niš, Niš, Serbia

[1]marija.markovic@filfak.ni.ac.rs

Abstract—**The application of modern technology in the teaching process has long been the subject of scientific considerations and empirical studies. In our country, however, the implementation of the teaching process in secondary education exclusively through online teaching has been prompted by the COVID19 pandemic. Compared to traditional teaching implemented at school, online teaching has its advantages and disadvantages. It is, therefore, considered that the preference should be given to the so-called blended teaching which appears to combine most adequately various advantages of traditional and online teaching thus overcoming their perceived shortcomings. The paper aims to point out some specific features of blended teaching and some basic assumptions of an efficient blended teaching process in school education, as well as to consider the effects of such teaching. If implemented properly, blended teaching can have positive effects on students´ achievements and motivation. Some basic preconditions, however, include a certain level of preparedness of teachers and educational institutions, as well as the application of appropriate teaching procedures.**

Keywords – blended teaching, school education, digital media, application effects, teaching procedures

I. INTRODUCTION

Modern technology can be applied in various ways in school education. Until now, in our country, its application has mainly been based on the use of modern technology in the form of teaching tools during classes implemented at school. However, upon the outbreak of the COVID19 pandemic, education institutions were compelled to switch to a virtual environment (i.e. to resort to full online teaching) since direct interaction was no longer possible. Traditional and online teaching have their advantages and disadvantages. Online teaching offers the following advantages: flexibility, personal approach, interactive communication and adaptability of the teaching process according to different student abilities, etc. Advantages of traditional teaching relate to the emotional component of personal communication, spontaneity in sharing interconnected ideas and conclusions, direct interaction between participants, etc. [1]. Advantages of one type of teaching can be observed as disadvantages of the other. Bearing in mind that both traditional and online teaching have certain advantages, but also disadvantages, it is a prevailing attitude nowadays that one should resort to blended teaching which appears to overcome the perceived shortcomings of traditional and full online teaching and produces better effects in the process of school education. It is possible to distinguish between *synchronous* (students and teachers are not in the same space, but they meet in a virtual classroom at the set time using video conferencing tools) and *asynchronous* (involves the use of suitable digital materials, platforms, and the like, when it suits students) models of online teaching which can be combined with traditional methods of teaching and learning [2]. It is considered that blended teaching will become a dominant model in the future, bearing in mind the place and importance of technology in modern society [3]. In this paper, we will try to point out some specific features of blended teaching, as well the possibilities, preconditions, and effects of its successful application in school education.

Blended teaching is defined in different ways. The existing definitions differ in terms of whether they merely refer to the specific environment in which the teaching process takes place or whether they also indicate some pedagogical aspects of this type of teaching [4]. Thus, for instance, by pointing out specific features of the teaching context blended teaching is defined as "any formal education program in which a student learns at least in part through online learning, with some elements of student control over time, place, path, and/or pace" [5]. As an example of a definition that emphasizes pedagogical aspects of blended teaching one can point to a definition stating that blended teaching implies the application of two or more different types of learning the final aim of which is to ensure that students acquire new knowledge to improve their educational outcomes [2].

Blended teaching is sometimes referred to as personalized teaching because it combines traditional and online methods to personalize teaching and enable differentiation in teaching [3,6]. With blended teaching teachers are empowered by technology to provide differentiated teaching in small groups or one-on-one teaching, they are provided with faster and more meaningful interaction with students, they can assess students´ progress every step of the way, they intervene if problems occur and they lead students towards success. Various software can offer data and resources to motivate students to continue with learning to be able to make progress in ways that had not been possible before [7]. Introduction of blended teaching in the system of education produces solutions to a series of tasks: a) *expanding students´ educational possibilities* by increasing availability and flexibility of education, taking into account their individual educational needs, as well as the speed and rhythm of acquiring new teaching contents; b) *encouraging the formation of students´ subjective position*: increasing their motivation, independence, social activities, including the development of teaching materials, thinking, introspection and, as a result, increasing the efficiency of educational process as a whole; c) *a change in teachers´ teaching styles*: transition from knowledge transfer to mutual interaction with students, encouraging students to create their own knowledge; d) *personalization of the process of education*: students autonomously define their education

goals and the manners to achieve them guided by their own educational needs, interests and abilities, while teachers are there merely to offer a support in the process [1]. Therefore, in the process of blended teaching students have the experience of direct interaction with the teaching content and they take responsibility for their own learning process [8]. Such learning, if conducted properly, can contribute to a redesigned model of teaching which could have the following characteristics: a) transition from a content-centered teaching process to a student-centered teaching process whereby students become active and interactive participants in the process (which relates to both online and traditional part of the process); b) increased interaction between students and teachers, students and students, content and students and students and external resources; c) integrated formative and summative ways of assessing students [3]. Osguthorpe and Graham [9] described the following reasons to apply blended teaching: a plethora of pedagogical approaches, the efficiency of learning, optimal access to knowledge, optimal cost, and ease of innovation.

Combining online and traditional teaching can be done at the level of a teaching course. In addition, such a combination can be done at an institutional level. For instance, online schools gather their students according to the regular schedule, and a teacher can be physically present or remote. Finally, individual students can attend one or more online classes or one or more traditional classes, which is a special form of blended learning. In blended learning at the level of a teaching course, depending on its specific nature, the share of online and traditional teaching activities can be different, whereby it is possible to distinguish between three such combinations: 1) within classroom teaching one can apply elements of online teaching through innovative use of information and communication technologies to improve students´ engagement and spend the teaching time efficiently; 2) realization of a teaching course implies that a significant part of teaching contents is realized online, most frequently by resorting to online discussions, as well as to face-to-face meetings, 3) combining both teaching approaches through fairly equal use of virtual and physical resources [3].

It is possible to distinguish between the following six models of blended learning [1]:

1. *Face-to-face driver model* – A significant part of the curriculum is realized at school in direct interaction with teachers. Electronic teaching is used as a teaching aid, whereby the aforementioned use of electronic resources is most frequently reflected in the use of computers during classes.

2. *The Rotation model* – School classes are divided between individual electronic teaching and direct teaching in the classroom. The teacher who realizes traditional teaching also provides remote support within electronic teaching. Within this model blended learning is realized within a single course and class and it relates to alternating between direct contact between teachers and students and interaction during the teaching process mediated by telecommunication technologies. The alternation order can be fixed or flexible according to the teacher´s estimate. The processing of the new teaching content, its revision, and practice can be realized through classroom interaction or distance learning. For instance, the processing of new teaching content can be done by using online resources, while revision and practice can be done in the classroom, and vice versa.

3. *The Flex model* – A larger part of the curriculum is adapted to electronic teaching conditions. A teacher remotely monitors every student. In the event when students encounter difficulties understanding some teaching content the teacher organizes direct consultations for small groups or individual students. This model is used when students in the classroom exhibit significant differences concerning psychological characteristics, motivation levels, acquired ICT competencies, and learning styles. In this case, a class is divided into two groups. In one of them, the main teaching activity is done online, while direct communication is reserved for either group or individual consultations. In the other group, the main teaching activity is done traditionally, while electronic tools are used for support and skills development. The class spatial organization has to include two zones – for traditional activities and online activities. When applying this model, a teacher needs to possess the skills of dividing attention between two groups, organizing activities of learning through the system of individual and group tasks, introducing new teaching content, performing an assistant function during tasks and exercises, etc. It is possible to transfer the zone of online training to the ICT classroom. In that case, one needs an assistant (a tutor, a lab technician) to monitor students´ group activities and thus implement the model.

4. *Online lab model* – The curriculum is adapted to the conditions of electronic training which, as a rule, is organized at school in classrooms with computer equipment. In addition to online courses, students can also be taught according to the traditional model. This model is used when students in the classroom are not so diverse in relation to their psychological characteristics, motivation levels, ICT competencies, and learning styles. In this case, the classroom works as one group while synchronous and asynchronous components alternate. Thus, implementation of electronic teaching is done outside school: the teacher enables access to electronic educational resources for preliminary theoretical preparation at home. Practical activities intended to expand knowledge and develop skills are realized in class. While working according to this model students´ level of responsibility is increased, they develop personal characteristics (activity, reliability, initiative, etc.) and the skills of meta-analysis (self-organizing, managing temporary resources, etc.). The indispensable condition for resorting to this model is the availability of computers with a stable home Internet connection.

5. *Self-blend* m*odel* – This model characterizes higher education institutions in the USA. In addition to mandatory courses, students choose electives. Educational content at their disposal can come from different schools and educational institutions. The application of this model is the most difficult in terms of organization and realization. In a certain sense, this model is a developed form of the flex model, but the number of groups can be increased depending on the number and types of educational activities (online teaching, group work, individual work, work with a teacher). The application of this model requires multiple zoning of a large classroom or the use of additional rooms, as well as the participation of an assistant (a tutor). The advantage of this model is that a certain type of activity is tied to a certain place which gradually reduces the time spent to include students in relevant activities.

6. *Online driver model* – The largest part of the curriculum is realized through electronic information sources and an online education environment. Online meetings with a teacher are periodic, while consultations with students,

149

discussions, exams, etc. are mandatory. This model is suitable for students of senior classes who exhibit higher motivation, advanced ICT skills, personal and meta-subject skills. Within this model educational activities and responsibility for the outcomes are on students, because the process of teaching is mostly conducted by resorting to electronic educational resources. School tasks are mostly reduced to securing temporal (hours spent attending online training) and spatial (computer rooms with suitable Internet connection) resources, and simultaneously providing psychological and if need be pedagogical support. Under certain circumstances, a student can master online subjects offered outside his/her home school.

Generally speaking, when organizing blended learning it is necessary, depending on students´ characteristics, to find the best possible balance between online and traditional elements of such teaching, to achieve suitable educational outcomes [9,10]. Furthermore, in choosing a certain model of blended learning one needs to ponder over the skills one wishes to develop in students, learning resources, the time and cost, the abilities and characteristics of students, and suitable learning theories [4].

To successfully realize blended learning, one needs to secure suitable resources, and to make sure that teachers are ready and motivated to implement it. Research in Tanzania which related to the study of teachers´ readiness to implement blended learning in secondary schools the following impediments to using modern technology in education were perceived: personal perception of teachers and their competencies related to the application of modern technology, the lack of availability and access to relevant resources (hardware and software), the lack of institutional strategy which would relate to the application of modern technology in the teaching process and unstable Internet connection [11].

An important precondition for the application of blended learning is a suitable infrastructure at the level of an institution, as well as the availability of digital devices at home. A lack of computers and Internet access in many students´ homes is one of the main limitations which could create impediments when one plans the realization of blended learning. Therefore, to overcome such a problem, it is possible to offer various benefits to families concerning Internet services as well as to offer them support when it comes to procurement of the necessary digital devices [12].

The main precondition for applying the given teaching model, in addition to suitable resources, relates to fairly developed teachers´ competencies which require previous training to equip teachers with adequate skills to apply this model of teaching [13]. Furthermore, a teacher should offer individual support inside and outside school, including emotional rewarding and monitoring of students. It is very important for the teacher that students have the impression that he/she is present even in remote work conditions. The main purpose is that students understand that they will receive timely assistance as well as that they are not alone in this virtual educational environment. The most efficient support in mediated interaction is to provide feedback by commenting on the progress and speed of processing the teaching materials, success in applying the acquired knowledge, etc. This can be done by resorting to different digital tools: forums, personal messages, video conferencing, etc. [1].

Blended teaching can be applied at various education levels and in the process of implementation of different subjects. For instance, a study was conducted to create a blended project-based teaching model through a virtual science lab within a science course for high school students. The research was based on the assumption that the model could help students understand the teaching content more easily and enable them to perform experiments in a shorter period, and that it could encourage them to engage their curiosity to create new experiments. Furthermore, the model combines face-to-face and online learning to optimize the advantages of both teaching models. Five experts assessed the proposed teaching model and pointed out that the developed model was quite suitable and that it could be used to improve analytical thinking skills and the assessment of abilities to perform science projects in high school students [14].

When it comes to effects of blended teaching it has been established that, when suitably applied, this type of teaching could contribute to the personalization of the teaching work and better academic achievement in primary school students (especially in the field of mathematics, which particularly applies to students who need additional educational support in this field) [6]. In mixed-method research, authors inquired into

150

whether blended learning could increase students´ achievements in junior high school. The data indicated that blended learning contributed to students´ achievements in the field of mathematics, as well as that they were highest when teachers resorted to data from adaptive digital contents for differentiating the processes of learning and encouraging students´ development, which was especially significant for students who encountered difficulties acquiring the content during traditional teaching. Such progress was not observed in the field of reading skills development [15].

In a study conducted in Turkey [4], authors inquired into the effects of blended learning on the level of academic achievement in students. The research was conducted on a sample of 53 sixth-grade students in a junior high school in the southwest of Turkey. Respondents were divided into experimental and control groups. The intervention lasted for seven weeks. During that time the teaching topic "Problem solving, computer programming and software product development" was processed within the course Educational Technologies and Software which was realized through blended teaching. The experimental group was taught through a blended model whereby traditional teaching was enriched by resorting to web technologies (video conference, learning management system, discussion blogs, etc.). While the experimental group had access to all those enriched contents, the control group applied only existing teaching methods. The results showed that blended learning significantly contributed to differences in academic achievements of students in the experimental group when compared to students in the controlled group.

Blended learning can be especially efficient in developing countries as well as for low socioeconomic status students. Research conducted in India dealt with the application of blended teaching through an Internet platform which involved combining traditional models of interaction in the classroom with synchronous e-learning. The results showed that it was possible to provide quality education to impecunious students by resorting to the suggested platform. Findings indicate that suggested platforms in classrooms, competent teachers who implement online teaching and teaching assistants as coordinators of blended learning at a class level create a learning environment that can significantly improve learning achievements and contribute to students´ welfare, independent of

their socioeconomic status. It has been shown that even low socioeconomic status students who lack family support in the process of education and experience a negative school environment could make good progress if one applied the suggested methods of blended learning [2].

The aim of a research study conducted in South Florida, USA, was to establish the effects of traditional teaching and blended learning on STEM achievements of 129 low socioeconomic status primary schools students. Research results show that students with low socioeconomic status achieve better STEM results when they attend blended teaching. It has been shown that the achievements of students with low socioeconomic status are significantly higher in the four STEM fields of science, technology, engineering, and mathematics when they attend a blended model instead of traditional teaching [8].

It has also been established that, in addition to a positive impact on students´ achievements, blended teaching at a primary school level also contributes to increased motivation. The aim of research conducted by Firdaus, Isnaeni, and Ellianawati [16] was to increase the motivation and achievements of students in thematic learning by applying a blended learning model in primary schools. Results of this study show that there has been a great increase in students´ motivation and learning achievements. One could infer that there is an increase in motivation and students´ achievements after applying thematic learning based on a blended learning model. Students also reacted in a great manner to this kind of learning. Thus, one can conclude that thematic learning based on blended learning in primary schools is very efficient and it is recommended in primary schools, especially in junior high schools.

The application of blended learning at a high school level provides significant results in terms of valuable academic achievements in students. For instance, in a research conducted by Utami [13], they intended to establish whether there is an impact of the blended learning model on students´ achievements at the senior high school level. The research study resorted to an experimental method with a randomized pretest-posttest design of the control group. The study was conducted on a sample of 63 students who attended the course related to the application of information technologies, whereby 31 students were in the experimental group and 32 students

were in the control group. In the experimental group, the teacher resorted to a blended learning model, while in the control group the teaching process was realized by applying the traditional learning method. The research showed that the achievements of students in the experimental group were higher than those of students in the controlled group.

Various research studies were focused on studying the effects of the application of specific platforms for online learning. For instance, the goal of a research study conducted within the biology course for the topic "Classification of living beings and biodiversity" on a sample of 47 ninth-grade students who attend the Anatolian Grammar School was to establish the attitudes of secondary school students towards blended learning. Teaching units were processed through traditional and online teaching. The online dimension of a model of blended learning was Moodle, as one of the learning management systems. The application lasted for 10 weeks. The results show that students valued highly this model of teaching, that blended model of learning provides students with different possibilities such as class preparation, an overview of lessons as many times as necessary, the availability of teaching materials regardless of time and place, self-testing, and communication with teachers and other students outside the school context. Potential difficulties encountered along the way have been identified and they are as follows: unstable Internet connection, issues with video reproduction due to poor Internet connection, parents´ attitudes that children should not spend that much time online, while some students found reading on the computer tedious, etc. [12].

During a two-year study of the Geography Institute of the University in Innsbruck 176 students aged between 15 and 19 comprised a sample inquired with regards to motivation levels. Students attended four schools in four countries. Their task was to do a comparative regional study about the quality of life of young people in their respective regions. To facilitate communication and cooperation they resorted to Moodle learning management system. The findings indicate that their average motivation was high during certain periods, but lower than expected in the long run. Among the factors which influenced students´ motivation the most important were the following: characteristics and usability of Moodle learning management system (complexity, opacity, difficulty navigating the system), local parameters in school, and general workload of students. Although this cannot be influenced directly for a long time and it is not a specific problem of blended learning, it is possible to improve the performance of Moodle learning management system and local parameters. Therefore, one can expect that average student motivation can be improved by further development of Moodle learning management system. [17].

In Yapici and Akbayin's [18] research study the authors studied the impact of the blended learning model on the achievement of secondary school students in the field of biology as well as on their attitude towards the Internet. The research was conducted on a sample of 107 students (47 of them were in the experimental group and 60 of them were in the control group) who attended a grammar school in Turkey. In the experimental group, the teaching was realized on the basis of a blended learning model by resorting to the web page (www.e-biyoloji.net), while in the control group the subject was realized through traditional teaching methods. Research results show that blended learning contributed more to students´ achievements in the field of biology than traditional teaching and that students´ attitudes towards the Internet have been statistically significantly improved (especially concerning the use of the Internet in the process of acquiring knowledge, conducting research and sharing information with others). The application of blended learning provided the opportunity for students to prepare for the class. They had the opportunity to review teaching contents at any point as many times as they needed and they understood the topic much better by resorting to teaching aids such as video clips and animation. They were allowed to take the tests and to use quizzes on a web page to establish what they failed to understand properly and what they should improve. They tried to overcome the stated difficulties by posing questions on a web page that they could not ask the teacher during the class, as well as by discussing issues with their friends. They had the opportunity to learn at their own pace. All these facts contributed to the improvement of students´ achievements in biology. Therefore, an effective teaching process can be achieved by joining the advantages of the web environment with face-to-face interaction in teaching subjects that have more visual elements, such as biology, as well as within some other courses.

III. CONCLUSION

Blended learning can be successfully applied in primary and secondary education. It can be applied in various ways (by applying different blended learning models, as well as by realizing contents in different teaching courses). Special positive effects have been noted in applying this type of teaching when realizing teaching contents full of visual elements, which contributes to the efficiency of teaching and realizing expected educational outcomes in students.

In an attempt to apply blended learning at the level of educational institution it is necessary to previously secure suitable infrastructure, institutional support, as well as to develop in students and teachers suitable competencies to apply this model of teaching.

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Practical Application of the Tourism Carrying Capacity Concept in Cultural Tourism in Montenegro

Aleksandra Petronijević[1]

[1]Faculty of Economics & Business, University Mediteran, Podgorica, Montenegro

[1]aleka@t-com.me

Abstract—**Until 2019, picturesque nature, interesting geographical position and rich cultural heritage of Kotor kept attracting many visitors, resulting in an increasing number of visits to the Old Town and Maritime Museum of Montenegro, situated in Kotor. Currently, the global pandemic brought everything to a halt, but once tourism starts recovering again the issue of sustainable management of tourism flows and use of cultural resources in Kotor will inevitably arise again. Since the Maritime Museum is included among the most popular visiting points in Kotor, this research aims to assess its real carrying capacity in order to compare the results to the official visitor statistics and determine whether the Museum, once the noble captain family Grgurina's home, with its valuable collections is exposed to high tourism pressure. The results indicated that, although the number of visitors during 2019 was significant, the Maritime Museum, together with its valuable collections, was not subject to overconsumption or "overtourism", since the total number of realized visits in general, and visits by tourists organized in guided groups during 2019, was below the Museum's real carrying capacity. This paper builds on existing knowledge about the tourism carrying capacity in cultural tourism in Montenegro, suggests and elaborates concrete and replicable calculation methods, and offers useful data for sustainable management of heritage sites and strategic planning of tourism flows.**

Keywords – cultural heritage, real carrying capacity, sustainable management

I. INTRODUCTION

Rapid development of cultural tourism, followed by increased numbers of visits to the cultural sites, old towns, fortresses and other attractions, may significantly affect cultural and natural resources. Since resources are often limited in nature, finding the balance between their capacities and the level of their consumption by tourism has become one of the most important tasks in preventing disturbances and encouraging a steady and optimal utilization of all resources. Therefore, strategic monitoring of the development of cultural tourism and management of tourism flows needs to remain in line with the postulates of sustainable development, taking into account the results of the assessment of the tourism carrying capacities of old towns, cultural institutions, attractions or other relevant sites. During the previous decade, the number of individual tourists, cruise ship guests and organized groups accompanied by licensed tourist guides visiting Kotor Old Town was constantly growing, therefore, the purpose of this paper is an assessment of the tourism carrying capacity of one of the most popular visiting points of the Old Town, the public cultural institution, the Maritime Museum of Montenegro in Kotor, to fulfil the following research goals: 1) determining the real carrying capacity of the Museum; 2) comparing the officially published number of realized visits during 2019 with the Museum's real carrying capacity, and 3) assessing whether the cultural heritage is exposed to overconsumption. The hypothesis of this paper is that this Museum and its collections are not exposed to a high tourism pressure, but at this stage, it is necessary to start defining and putting into practice measures that will keep ensuring further balanced and rational use of its cultural resources. In general, the presented calculation methods, data and drawn

conclusions can be useful for destination managers, policy makers, marketers and other tourism stakeholders managing destination flows and creating strategies linked to sustainable use, valorization, enhancement and protection of cultural heritage from overconsumption.

II. LITERATURE REVIEW

The term "carrying capacity" [1] was first brought up by the Belgian statistician Verhulst who was interested in population growth and defined that new term as the maximum number of people who could use a recreational environment without unacceptable decline in the quality of the recreational experience. In time, this new term has started attracting more and more attention and several members of the academic society started giving their contribution to its definition. As a result, it was defined as the level of use of an area offering a high level of satisfaction with a small impact on resources [2], as the maximum number of visitors that could physically fit into a defined space over a particular time [3], as the maximum number of visitors who could physically be present at a given place at a certain time [4], and WTO defined it as the maximum number of people that could visit a tourist destination at the same time, without causing destruction of the physical, economic or socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction [5]. Due to offering practical data and being more a type of logical thinking than a metric issue nowadays, it is applied in a wide range of disciplines, including biology, ecology, anthropology, geography, tourism and business management [6], which illustrates how much this concept is generally accepted [7].

Since tourist destinations can become fragile environments [8], raising levels of tourism activity started increasing the level of interest in sustainable development of tourism and drew more attention to the application of the concept of carrying capacity in tourism. An increase in cultural tourism also revealed the vulnerability of heritage resources during the phase of tourism exploitation, which resulted in the need to set limits and establish visitor management tools to ensure the conservation of heritage resources and visitors' satisfaction [6]. To apply this concept in tourism, calculation methods have been modified in terms of taking into consideration the tourist flows, the size of an area, the optimal space available for each tourist to move freely, and visiting times [4]. The tourism carrying capacity assessment became essential in order to regulate and manage visitors, since only if tourism is undertaken responsibly it can become a driver of preservation and conservation of cultural and natural heritage and a vehicle of sustainable development [9].

Carrying capacity can be measured either at the level of a tourist destination as a whole, with all its associated contents, or at the level of individual, specific services or facilities. Each type of capacity may significantly vary from one destination to another, depending on the natural and ecological characteristics of a given area, the manner of its use and developmental goals to be achieved. Each capacity type is characterized by the tolerance limit of a destination as a whole or of individual buildings and facilities [10]. According to several authors [11, 12, 3, 13, 4], the basic two dimensions of carrying capacity that need to be taken into consideration in managing tourism flows are: a) the physical carrying capacity, and b) the real carrying capacity. They describe the physical carrying capacity as the maximum number of people who can use a site without an unacceptable alteration in the physical environment and without an unacceptable decline in experience quality. They explain the real carrying capacity as the maximum permissible number of visits of a given site, which is calculated by taking into account the limiting factors (translated into quantitative values) resulting from specific conditions of a given place. In general, the tourism carrying capacity has been developed largely as a response to the recognition that tourism could not progress fast without causing permanent damage, and therefore tourism flows needed to be continuously monitored in order for the destination management to be able to ensure the rational use of cultural and natural resources, and further sustainable development of the destination. The ability to anticipate, predict and project future events is very important and can be achieved through close monitoring of responses of foreign demand and harmonization of these responses with the carrying capacity of the destination, in particular its resources, which is the key to the successful and sustainable valorization of the tourist attractions [14].

Along the Montenegrin coast, the region that belongs to the Municipality Kotor is one of the most attractive areas for the development of cultural tourism. It is rich in significant cultural heritage of extraordinary historical, aesthetical and cultural value, well recognized by the UNESCO, the Government of Montenegro and Kotor Municipality. The highest concentration of cultural heritage of significant value is situated in the oldest urban area of this Municipality, Kotor Old Town, inscribed on the UNESCO's World Heritage List since 1979 for its outstanding natural and cultural values [15]. Due to its unique attractions, rich material and immaterial traces of culture and well-preserved medieval atmosphere, until 2019, Kotor had kept on attracting a significant number of tourists who stayed overnight, but also visitors who stayed only for a couple of hours. In 2019, 532.419 visitors (10% more than in 2018) visited Kotor Old Town [16]: 366 cruise ships; 1.504 yachts; 169.511 individuals visited the Old Town walls, and 44.509 of them visited the Maritime Museum of Montenegro, situated within the Old Town. If the total number of visitors (532.419) is divided by 365 days of the year, it can be concluded that Kotor, on average, had 1.459 visitors per day, that is 2.488 visitors per day, if the same number is divided by 214 days (April-October), which is quite a significant number considering that the estimated number of inhabitants who live within the Old Town is 961, out of 22.601 inhabitants living in the territory of Kotor Municipality [17].

This year, Kotor shares the faith of most destinations in the world due to the Covid-19 pandemic which caused the emergence of drastic changes in everyday life, economy and tourism activity. Since this unpredictable new situation caused the reduction of the level of intensity of tourism activities, it offers time to recapitulate what was previously going on in cultural tourism in general, and to make plans what needs to be improved once the travel industry starts recovering again. Once tourism is reactivated again, the natural question to ask ourselves is what we can expect if the number of visits starts increasing in Kotor again? How much tourism pressure cultural heritage can be exposed to before it starts breaking? Comparing to other old towns, the entire area of Kotor Old Town is relatively small, confined and highly accessible to visitors, and a carefully planned management of tourism flows therefore plays a crucial part in further safeguarding of the Old Town as a home, as cultural heritage of significant value, and as a tourism destination.

IV. Research Methodology

Based on secondary data, the literature review, officially published documents and data of public bodies and statistical offices, and primary data obtained via direct field spatial analysis (area measurements and measurements of the guided route length) and field observations and analysis of different elements of cultural tourism activity in Kotor (timings of organized guided tours, characteristics, specifics and dynamics), gathered data has been processed using equations and methods for calculating carrying capacities designed by several experts in this field (Ceballos-Lascurian; Lagarense; Aminian, Khodayar), which are applicable in obtaining outputs that can be of use for directing further development of cultural tourism, and management of tourism activity at heritage sites. Presented models in this paper are applicable for other cultural sites or cultural institutions just by using relevant data and adjusting corrective or limiting factors (Cf) linked to the particular site, attraction or institution that is being analyzed. Due to its popularity among visitors, the public cultural institution, the Maritime Museum in Kotor, has been selected as the subject matter of assessment of the tourism carrying capacity. The physical carrying capacity has been calculated first, followed by the real carrying capacity calculation to determine the maximum permissible number of visitors in general, and the maximum permissible number of tourists visiting the Museum in organized guided groups. Then, the gathered data were compared to the results of the official visitor statistics in order to assess whether the cultural heritage is exposed to high tourism pressure. In order to achieve the above-mentioned goals, the following equations and calculation methods have been used:

First, the physical carrying capacity, or Pcc, was calculated in order to assess the maximum number of visitors who could be physically present at a given place at the same time [4]. In order to apply this method, it was important to determine the total usable area of the Museum in square meters, and to determine the optimal space that needed to be available to each tourist or visitor to move freely and comfortably.

In order to do that, the following equation [3] was used:

$$Pcc = A * U / a * Rf , \qquad (1)$$

Where,

A = available area for use (m^2);

U/a = area per user (m^2);

Rf = rotation factor (working hours/duration of visit).

"A" is a determinant defined by particular conditions of the considered area; "U/a" is linked to the tourist density. It is the required area for tourists to undertake activities comfortably, or simply the area that each tourist needs to be able to easily move without having to interact with other people or physical objects. Considering the dimensions of an average adult, this normally covers a horizontal area of 1m^2; The Rf represents the number of permissible visits over a specific period of time [2].

To assess the maximum number of organized groups that can visit the Maritime Museum at the same time, maintaining a certain distance between the visiting groups, the following equation [18, 2] was used:

$$(X * GS) + (X - OAP) * D = A , \qquad (2)$$

Where,

GS = group size;

OAP = optimal area per person;

D = distance between groups;

A = total usable area of the museum.

The third step was to calculate the real carrying capacity of the Maritime Museum, which could be done only by taking into consideration the limiting factors or corrective factors (Cf) that affected tourist flows. The corrective factor is a factor, expressed as a percentage, which has a negative impact on tourism activities, assessed by negative threshold and used for identifying the impact level of a factor [2]. These factors are selected based on tourism activities and local conditions of the area that is being analyzed. Accordingly, in order to determine the maximum permissible number of visitors, taking into account the corrective factors, the following equation [3] was used:

$$Rcc = Pcc * ((100 - Cf1) : 100 * \\ (100 - Cf2) : 100 * ...(100 - Cfn) : 100)) \qquad (3)$$

$$Cf = (Ml / Mt) * 100 \qquad (4)$$

Where,

Pcc = physical carrying capacity;

Cf = corrective factor;

Ml = limiting magnitude of variable;

Mt = total magnitude of variable.

V. Result Analysis and Discussion

The Public Cultural Institution "Maritime Museum of Montenegro", situated within Kotor Old Town, is quite a popular place to visit among many foreign visitors. According to the Information on Quantitative and Qualitative Results, last year (2019), the Museum recorded 44.509 visits: 6.729 individual tourists who used an audio guide; 30.600 tourists who visited the museum through travel agencies; 4.690 visitors in small groups; 2.490 children. In total, the Museum covers an overall area of 484m^2, but the total usable area for visitor movement equals 384m^2. To calculate the Pcc, the area of 1m^2 that an average tourist needed to feel comfortable to undertake activities was taken into account. First, the Pcc1 of the Museum was calculated, then the Rcc1 linked to the maximal permissible number of visits in general, then $Pcc2$ linked to the organized guided groups, and $Rcc2$ linked to the maximal permissible number of visitors who visited the Museum in organized groups escorted by licensed tour guides. While calculating $Pcc2$ and $Rcc2$, the distance of 3m between the groups was taken into account. Therefore, to do the calculations, the following parameters were included:

Usable area: 384m^2 (A)

Optimal area per person: 1m^2; (U/a)

Working time: 8 hours;

Optimal duration of the visit: 1 hour;

Group size, with the tour guide: 35+1=36; (GS)

Optimal distance between groups: 3m; (D)

Estimated length of the sightseeing route: 175m (L)

First, the maximal permissible number of visitors who could visit the Museum on a daily

basis, ensuring sustainable use of cultural heritage, was calculated as follows:

$$A = 384m^2$$

$$U / a = 1m^2$$

$$Rfl = 8 / 1 = 8$$

$$Pcc1 = 384 * 1 * 8 = 3.072 \, visitors / day$$

Accordingly, the maximum number of physically possible visits per day is 3.072. The result of $Pcc1$ is high due to the fact that it doesn't take into account many factors that also influence the number of visitors, therefore the real carrying capacity ($Rcc1$) of the Maritime Museum needed to be calculated as well, taking into consideration all corrective factors presented in Table I below.

$$Rcc1 = 3.072 * ((100 - 58.33) : 100) *$$

$$(100 - 21.12) : 100) *$$

$$(100 - 25.21) : 100) * ((100 \, 16.66) : 100) *$$

$$((100 - 33.33) : 100) * ((100 - 0.23) : 100)$$

$$Rcc1 = 3.072 * 0.42 * 0.79 *$$

$$0.75 * 0.83 * 0.66 * 0.99 = 415 \, visitors / day$$

$$Rcc1 = 12.450 \, visitors / month;$$

$$88.810 \, visitors / \, toursimseason$$

(April/ October);

$$151.475 \, visitors / \, year;$$

Factor	Unit	MI	Mt	Cf
Cf1 Duration of tourist season	Month	7	12	58.33
Cf2 Number of working hours	Hour	1850	8760	21.12
Cf3 Period during the tourism season with UV index of 8-10	Day	92	365	25.21
Cf4 Months during the season with high rainfall amounts	Month	2	12	16.66
Factor	Unit	MI	Mt	Cf
Cf5 Months of slow traffic and traffic jams	Month	4	12	33.33
Cf6 Traffic blocked due to sports or other events	Hour	20	8760	0.23

The next step was calculating the maximum permissible number of visitors who could visit the Museum organized in guided groups per day.

In order to achieve that, the first thing that needed to be assessed was the optimal number of organized groups that could be present inside the Museum at the same time, exploring the Museum collection with a tour guide and giving each other enough privacy, space and time to enjoy a high-quality experience. A minimum of 3m distance between groups was chosen to ensure enough space for individual visitors to be able to move between groups, and to avoid mixing of voices of tour guides and production of excessive noise.

$$GS = 36$$

$$U / a = 1 \, m^2$$

$$D = 3m$$

$$L = 175m$$

$$(X * 36) + (X - 1) * 3 = 175$$

$$X = 5$$

or

$$Rf2 = 5$$

The equation result is $x=5$, meaning that 5 groups ($GS=36$) can visit the Museum at the same time. Now, bearing in mind that $Rf2=5$ and the group size ($GS=36$), the maximum number of physically possible visits is:

$$Pcc2 = 384 * 1 * 5 = 1920 \quad \text{visitors in guided}$$

groups/day

Accordingly, the maximum number of physically possible visits by tourists organized in guided groups per day is 1.920. It simply means that in one working day lasting for 8 hours this Museum can physically accommodate 53 groups, each consisting of 36 visitors. Although it is physically possible in theory, in real practice such a thing is highly unlikely to be achieved. The result of $Pcc2$ is high due to the fact that it doesn't take into account many factors that also influence the number of visitors. Therefore, the real carrying capacity ($Rcc2$), linked to visitors organized in guided groups, needed to be calculated taking into consideration all corrective factors illustrated in Table I:

$$Rcc2 = 1.920 * ((100 - 58.33) : 100) *$$

$$(100 - 21.12) : 100) * (100 - 25.21) : 100) *$$

$$((100 - 16.66) : 100) * ((100 - 33.33) : 100) *$$

$$(100 - 0.23) : 100)$$

$Rcc2 = 1.920 * 0.42 * 0.79 * 0.75$

$*0.83 * 0.66 * 0.99 = 310$
visitors in guided groups/day;

$Rcc2 = 9.300 visitors / month;$

$66.340 visitors / tourism season (April – October);$

$113.150 visitors / year;$

In general, the maximum permissible number of visitors of the Maritime Museum is 415 visitors/day, and the maximum permissible number of visitors in guided groups is 310 visitors/day, in order to ensure further safeguarding and sustainable use of cultural heritage. Results show that the maximum permissible number of groups (GS=36) inside the Museum at the same time is 5. Comparing the number of realized visits (RS) to the Museum during 2019, which was 44.509, to the real carrying capacity ($Rcc1$), which is 88.810 visitors per tourism season (7 Months: April-October) and 151.475 visitors per year, it can be concluded that the number of realized visits did not exceed the permissible numbers of visits ($RS<Rcc1$) for both time periods during 2019. In fact, the total number of realized visits represents 50% of the seasonal and 29% of the annual real carrying capacity ($Rcc1$) of the Museum. Comparing the number of realized visits by tourists who visited the Maritime Museum in organized guided groups, which was 30.600, with the Museum's real carrying capacity linked to organized guided groups ($Rcc2$), which was 66.340 visitors per tourism season and 113,150 visitors per year, it can be concluded that the number of realized visits did not exceed the permissible number of visits ($RS<Rcc2$) for both time periods during 2019. Accordingly, the total number of realized visits represents 46% of the seasonal and 27% of the annual real carrying capacity ($Rcc2$) of the Museum. Therefore, it can be concluded that the Maritime Museum, as a significant historical building built in baroque style, once the home of the captain family Grgurina (18th century), and its valuable museum collections are neither subject to tourism overconsumption nor exposed to a high tourism pressure. This confirms the hypothesis of this research.

VI. Conclusion

Aiming to investigate the impacts of tourism on the Maritime Museum of Kotor, this study focuses on assessing whether the number of visits exceeds the limits of acceptable impact on cultural heritage and offers data that can be useful for cultural institutions, destination managers, tourism policy makers, public bodies and other tourism stakeholders in further management of cultural tourism, visitor flows and protection of cultural heritage of Kotor. The results indicate that the number of visits does not exceed the real carrying capacity of the Maritime Museum, and therefore this cultural institution and its cultural resources are not subject to "overtourism" and "overconsumption", respectively. Further studies may focus on the public areas or squares within Kotor Old Town, other captains' mansions and sacral buildings within and outside the Old Town itself, taking into account additional corrective or limiting factors characteristic for public spaces and sacral heritage to motivate the creation of special tourism strategies linked to safeguarding and sustainable use of cultural and sacral resources in Montenegro. Through a concrete example, this research suggests and elaborates useful and applicable methods for the calculation of the tourism carrying capacity of cultural sites and attractions. At this stage of the tourism development in Kotor, the obtained results can be useful as guidelines in maintaining further balanced management of visitor flows and contribute to further prevention of degradation or negative effects of tourism on cultural heritage. Ultimately, this study serves to encourage further research linked to the assessment of the tourism carrying capacity in cultural tourism.

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Public Procurement of Innovation According to the EU Law

Iris Bjelica Vlajić[1]

[1]Military Academy, Belgrade, Republic of Serbia

[1]iris.bjelica.vlajic@yahoo.com

Abstract—**The innovation procurement is relatively new respond to unmet needs of the industry or service sector. By embedding innovation in procurement, local government helps commercialization of the product or service. In order to do it authorities have to develop internal expertise able follow all the stages of the innovation-oriented procurement. Demand for new solutions directs resources and capabilities to innovations to meet market needs. Legislation plays an important role in helping innovation to develop. In the EU it is done throughout biding legal documents and court practice. There are some difficulties that need to be examined during this process such as an incomplete framework for intellectual property rights or lack of synchronization between the standard process with research results and market needs. The main pillars of the EU innovation policy are technology transfer, standardization and a unitary patent system for Europe. Special effort has been done to promote procurement of innovations like creation and financing of an Initiative called The European Assistance for Innovation Procurement (EAFIP). These EU efforts to provoke the greater use of innovation in practice were recognized and accepted by the legislator in the Republic of Serbia where the present Law on Public Procurement has included procurement of innovation as a separate procedure**.

Keywords – innovations, public procurement, EU law

I. INTRODUCTION

The definition of the innovation procurement understands it as buying the process of innovation, both research and development services together with their (partial) outcomes. The innovation procurement is necessary respond to unmet needs or new expectations of the industry or service sector, which are not adequately addressed through the existing solutions on the market [1]. Some international organizations such as UNOPS and OECD, are devoted to inclusion of innovations into public procurement, while some of the developed countries (mainly members of the OECD) explore strategies or policies to support innovative goods and services and they use public procurement to do so [2]. By embedding innovation in procurement, local government helps commercialization of the product or service. There are two main preconditions: existence of demand for innovative products or services, and developed internal expertise able to monitor innovation-oriented procurement and help adjusting selection criteria. Ability to produce innovations is conditioned by market opportunity created by demand that directs resources and capabilities to innovations to meet market needs [3].

Legislation plays an important role in helping innovation to develop. For the EU, innovation is a main tool to keep competitiveness and economic growth. Hence, the European Commission has prepared a number of documents, guidance and a platform in order to promote procurement of innovations. The guidance in a concise manner presents the three fundamental aspects of innovation procurement: why it is important, who has interest in it and how this process can be done. Also, the EU has created and financed an Initiative called The European Assistance for Innovation Procurement (EAFIP) that started in 2015. The Court of Justice of the EU has made a

number of judgments related to public procurement contracts.

The Europe 2020 strategy for smart, sustainable and inclusive growth was set in the EU Commissions Communication of March 3rd, 2010. The public procurement is listed by the Communication as one of the market-based instruments to be used to achieve sustainable and inclusive growth while ensuring the most efficient use of public funds. At the same time, innovations which are improving products, services or processes, are seen as a tool of societal challenges.

II. EU Law on Innovation and Procurement

It is important to understand the whole process of buying innovation in a public procurement as a strengthened triangle of knowledge between business, education and research [4]. There are some difficulties that need to be examined during procurement process such as an incomplete framework for intellectual property rights or lack of synchronization between the standard process with research results and market needs. The task of the new EU legislative initiatives is to respond to the needs of innovative companies by providing data and evidence for impact assessments, consulting innovators and taking their suggestions for drafting legislation into account. The main pillars of the EU innovation policy are technology transfer, standardization and a unitary patent system for Europe.

Both primary and secondary EU legislation regulate the public procurement enabling national, regional and local authorities with the power to provide disbursement of public funds aimed at the acquisition of works, supplies or services for consideration by means of a public contract such as purchase, leasing or other contractual forms while providing commission and finance services of general economic interest [5]. The Directive 2004/18/EC stated in its Article 14 that rules stipulated within the Directive apply to public service contracts for research and development services and related consultancy services, experimental development services, design and execution of research and development and pre-feasibility study and technological demonstration. The notion of acquisition has to be understood broadly in the

sense of obtaining the benefits of the works, supplies or services in question, not necessarily requiring a transfer of ownership to the contracting authorities [6].

However, the most important goal of the Directive in sense of innovation is the co-financing of research and development (R&D) programs by industry sources which is why the Directive applies only where there is no such co-financing and where the outcome of the R&D activities go to the contracting authority concerned. The service provider, having carried out those activities, could publish an account thereof as long as the contracting authority retains the exclusive right to use the outcome of the R&D in the conduct of its own affairs.

Public procurement is a good strategic tool for public authorities to spur research and innovation, including eco-innovation and social innovation, buying innovative products, works and services as well as improve the efficiency and quality of public services while addressing major societal challenges.

A series of procurement models have been outlined in the Commission Communication of 14 December 2007 entitled 'Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe' prepared by the EU Commission deals with the procurement of those R&D services not falling within the scope of the above mentioned Directive and offers different procurement models. Innovation is important but it is not always possible to put them into existing contractual frame so contracting authorities should be encouraged to allow variants as often as possible and define the minimum requirements to be met by variants before indicating that variants may be submitted. Solutions available on the market cannot be met by some innovative product, service or work and access to a specific procurement procedure in respect of contracts has to be applied. It is falling within the scope of the Directive to allow contracting authorities to establish a long-term innovation partnership for the development and subsequent purchase of a new, innovative product, service or works provided that such innovative product or service or innovative works can be delivered to agreed performance

levels and costs, without the need for a separate procurement procedure for the purchase.

Any type of innovation partnership has to be based on the procedural rules that apply to the competitive procedure with negotiation. Contracts should be awarded on the sole basis of the best price-quality ratio, which is most suitable for comparing tenders for innovative solutions without prevention, restriction or distortion of competition. Setting up innovation partnerships with several partners could contribute to avoiding such effects.

The technical specifications drawn up by public purchasers need to allow public procurement to be open to competition as well as to achieve objectives of sustainability. To that end, it should be possible to submit tenders that reflect the diversity of technical solutions standards and technical specifications in the marketplace, including those drawn up on the basis of performance criteria linked to the life cycle and the sustainability of the production process of the works, supplies and services. It is forbidden to artificially narrowing down competition through requirements that favor a specific economic operator by mirroring key characteristics of the supplies, services or works habitually offered by that economic operator. Functional and performance-related requirements set in technical conditions are appropriate means to favor innovation in public procurement and should be used as widely as possible. Where reference is made to a European standard or, in the absence thereof, to a national standard, tenders based on equivalent arrangements should be considered by contracting authorities. It should be the responsibility of the economic operator to prove equivalence with the requested label. To satisfy equivalence request, it is possible to require participants of tender procedure (tenderers) to provide third-party verified evidence. However, other appropriate means of proof such as a technical dossier of the manufacturer should also be allowed where the economic operator concerned has no access to such certificates or test reports, or no possibility of obtaining them within the relevant time limits, provided that the economic operator concerned thereby proves that the works, supplies or services meet the requirements or criteria set out in the technical specifications, the award criteria or the contract performance conditions.

Special problem proved to be cross-border participation in public procurement. Market oriented entities meet a lot of restriction in their attempts to participate in public procurement of the other EU member state which has provoked the European Parliament and the Council to adopt Regulation (EC) No 593/2008 in order to complement the conflict of law. Those rules determine the conditions for cross-border utilization of central purchasing bodies and designate the applicable public procurement legislation, including the applicable legislation on remedies, in cases of cross-border joint procedures.

According to the relevant case-law of the Court of Justice of the European Union there are some conditions under which modifications to a contract during its performance require a new procurement procedure. In case of material changes to the initial contract, a new procurement procedure is required, in particular to the scope and content of the mutual rights and obligations of the parties, including the distribution of intellectual property rights. Such changes demonstrate the parties' intention to renegotiate essential terms or conditions of that contract. This is the case in particular if the amended conditions would have had an influence on the outcome of the procedure, had they been part of the initial procedure. Yet, modifications to the contract resulting in a minor change of the contract value up to a certain value are always possible without the need to carry out a new procurement procedure. The Directive has provided minimum thresholds in order to ensure legal certainty when a new procurement procedure is not necessary. Modifications to the contract above those thresholds should be possible without the need to carry out a new procurement procedure to the extent they comply with the relevant conditions laid down in this Directive.

Design competitions traditionally used in the areas of land planning, architecture and engineering or data processing are proving to be flexible instruments that can be used for other purposes, such as financial engineering to optimize support for small and medium-sized enterprises in the Member States. Given the

potential of SMEs for job creation, growth and innovation, it is important to encourage their participation in public procurement, both through the relevant provisions of this Directive and through initiatives at national level. The new provisions provided for in this Directive should contribute to improving the level of success, which means the share of SMEs in the total value of contracts awarded, as planned in the context of the Joint European Resources for Micro and Medium Enterprises (JEREMIE) or other Union support programs for small and medium-sized enterprises. Medium-sized enterprises. The design contest used to obtain plans for such financial engineering could also determine that subsequent service contracts for the realization of this financial engineering will be awarded to the winner or one of the winners of the design contest through a negotiated procedure without publication. Therefore, special emphasis is placed on national initiatives to increase the participation of SMEs in public procurement procedures.

III. SERBIAN NATIONAL LAW

The accession to the European Union requests harmonization of national legislation with the *acquis communautaire*. Due to it, the current Law on Public Procurement of the Republic of Serbia is fully harmonized and contains a list of EU legal acts which it is harmonized to. Within this law, innovation is defined as the implementation of a new or significantly improved product, service or process, including but not limited to production and construction processes, a new marketing method, or a new organizational method in business practices, workplace organization or external relations, inter alia, with the purpose of helping to solve societal challenges or as a support to smart, sustainable and inclusive growth [7].

With regard to innovation partnership, estimated value of the subject-matter of public procurement has to be calculated as the maximum estimated value of all of research and development activities to take place during all stages of envisaged partnership, as well as of the supplies, services or works to be developed and procured at the end of the envisaged partnership. Article 51 of the Law sees innovation

partnership as one of the separate procurement procedures.

The innovation partnership aims at the development of innovative supplies, services or works and their subsequent purchase, provided that they correspond to the performance level and maximum costs agreed between the contracting entity and participants in the innovation partnership. Contracting entity may conduct the procedure of innovation partnership if it has need for innovative supplies, services or works that cannot be met by purchasing the supplies, services or works already available on the market.

Innovation partnership is usually conducted in several successive phases, following the sequence of steps in the research and innovation process, which may include the manufacturing of supplies, the provision of services or the execution of works. Every innovation partnership procedure sets intermediate targets to be attained by partners in each phase, and payment of the remuneration in appropriate amounts. Contracting entity may terminate innovation partnership after each phase or, in the case of an innovation partnership with several partners, reduce the number of partners by terminating individual contracts, provided it has indicated in tender documents those possibilities and the conditions for their use. Contracting entity ensures that the structure of innovation partnership and, in particular, the duration and value of each phase, reflects the degree of innovation of the proposed solution and the sequence of the research and innovation activities required for the development of an innovative solution not yet available on the market. The estimated value of supplies, services or works shall not be disproportionate in relation to the investment required for their development. In an innovation partnership, the sole contract award criterion is the best price-quality ratio.

Contracting entity intending to award a public procurement contract in the procedure of innovation partnership publishes the contract notice. The tender documents prepared and issued by the contracting entity describe the needs for innovative supplies, services or works, and indicates which elements of the description define minimum requirements to be met by all

tenders. Information contained in tender documents has to be sufficiently clear and precise to enable economic operators to identify the nature and the scope of the required solution, and assess own interest for taking part in the procedure. Arrangements applicable to the intellectual property rights are also explained within tender documentation. They may set up an innovation partnership with one or with several partners, conducting separate research and development activities. In innovation partnership, any interested economic operator may submit request.

The minimum deadline for the submission of request depends whether the public procurement estimated value is under the amounts of European thresholds or exceeding it. In selecting the candidates, contracting entity applies criteria concerning the economic operators' capacity in the field of research and development and in developing and implementing innovative solutions. Evaluation is done for the timely submitted requests on the basis of criteria for qualitative selection of economic operator specified in tender documentation, compile report thereon, and submit a notification on recognition of qualification to each candidate whose qualification has been recognized. For the candidate whose qualification has not been recognized a decision with the explanation of reasons due to which their qualification was not recognized, in each case paying attention not to disclose information about other candidates is sent. Contracting authority may, in accordance with Article 64 of the Law, limit the number of candidates with recognized qualifications that it will invite to negotiations, in which case it shall send a reasoned decision to those candidates with recognized qualification which will not be invited to negotiate, paying attention not to disclose information about other candidates. Contracting entity sends an invitation to submit initial tenders to candidates not excluded from public procurement procedure. Contracting entity negotiates with interested parties the initial and all subsequent tenders to improve the content thereof, except for the final tender, and compiles report thereof. The minimum requirements and the contract award criteria, specified in the procurement documents, cannot be subject to negotiations. During the negotiations, contracting entity ensures equal treatment of all participants in the negotiations, and may not provide information in a discriminatory manner, which certain participants might tend to make use of at the expense of the others and it may conduct negotiations in successive phases in order to reduce the number of tenders to be negotiated, by applying the contract award criteria specified in the contract, invitation to submit requests or in tender documents.

Contracting entity sends the decision on exclusion from the further course of negotiation to participants which will not be invited to the next phase of the procedure. Also, notification is sent simultaneously and in writing, to all participants whose tenders are not excluded from the further course of negotiation, of any changes in technical specifications or other procurement documents, other than those representing minimum requirements, and, if necessary, provide them with sufficient time to prepare and re-submit their amended tenders. Contracting entity notifies the remaining participants about the conclusion of negotiations and to set a common deadline for the submission of final tenders and verifies whether the final tenders comply with the minimum requirements specified in the procurement documents, evaluate the final tenders, and award a public procurement contract on the basis of the contract award criteria

IV. CONCLUSION

Public procurement is crucial to driving innovation, which is of great importance for future growth in Europe. Individual sectors and markets have important differences which makes it difficult to set general mandatory requirements innovation procurement. It appears appropriate leaving it to sector-specific legislation to set mandatory objectives and targets in function of the particular policies and conditions prevailing in the relevant sector. Promotion of the innovation development further underpins the use of public procurement in support of sustainable growth. Joint awarding of public contracts by contracting authorities from different Member States currently encounters specific legal difficulties concerning conflicts of national laws. Despite the fact that Directive 2004/18/EC implicitly allowed for cross-border joint public procurement,

contracting authorities are still facing considerable legal and practical difficulties in purchasing from central purchasing bodies in other Member States or jointly awarding public contracts. In order to allow contracting authorities to derive maximum benefit from the potential of the internal market in terms of risk-benefit sharing, when innovative projects involve a greater amount of risk than reasonably bearable by a single contracting authority those difficulties should be remedied. Therefore, new rules on cross-border joint procurement have to be established in order to facilitate cooperation between contracting authorities and enhancing the benefits of the internal market by creating cross-border business opportunities for suppliers and service providers. In addition, contracting authorities from different Member States should be able to set up joint entities established under national or Union law. Specific rules should be established for such forms of joint procurement.

Contracting authorities that wish to purchase works, supplies or services with specific environmental, social or other characteristics should be able to refer to particular labels, such as the European Eco-label, (multi-)national eco-labels or any other label provided that the requirements for the label are linked to the subject-matter of the contract, such as the description of the product and its presentation, including packaging requirements. It is furthermore essential that those requirements are drawn up and adopted on the basis of objectively verifiable criteria, using a procedure in which stakeholders, such as government bodies, consumers, manufacturers, distributors and environmental organizations, can participate, and that the label is accessible and available to all interested parties. The stakeholders could be public or private bodies, businesses or any sort of non-governmental organization.

It should equally be clarified that specific national or government bodies or organizations can be involved in setting up label requirements that may be used in connection with procurement by public authorities without those bodies or organizations losing their status as third parties. References to labels should not have the effect of restricting innovation.

The Law on Public Procurement in Republic of Serbia contains provisions regulating innovations and has included procurement of innovation as a separate procedure aiming to provoke the greater use of innovation in practice.

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The Impact of Cloud Technology on Accounting and Finance

Tanja Janaćković[1]

[1]Academy of Professional Studies South Serbia, Department of Business Studies
Leskovac, Leskovac, Serbia

[1]spasictanja7@gmail.com

Abstract—**The impact of globalization, rapid advances in science and technology, the rise of big data, as well as the widespread use of Internet-based applications have influenced the growing adoption of cloud computing in all areas of business, especially in accounting and finance. Under the influence of these factors, a suitable environment is created for the emergence of a new concept such as cloud accounting. Important drivers of change that shape market principles are the digitalization of business, the growing prevalence of virtual reality, as well as the transformation of traditional computer business schemes to cloud-based solutions. Bearing in mind that accounting and finance are the basic components of the business framework and that they support any business activity, the aim of this paper is to investigate the impact of cloud technology in the field of accounting and finance. The paper analyzes the key aspects related to the application of cloud computing in the field of accounting and finance, emphasizing the characteristics and advantages of cloud-based solutions and their application in business practice.**

Keywords - cloud computing, accounting, finance, accounting software

I. Introduction

Modern business conditions impose new requirements on companies in terms of the application of innovative technological solutions, with an increasing number of companies noticing the advantages of using modern technologies. Today, under the influence of the industrial revolution 4.0 and the growth of big data, as well as the spread of Internet-based applications, an environment is being created for the emergence of a large number of new technological concepts such as the Internet of Things (IoT), Big Data, Artificial Intelligence (AI) and Cloud Computing (CC). One of the technologies that significantly improves the efficiency of business processes and affects all areas of business is cloud computing. Cloud technology is the basic platform since every application (AI, IoT, or Big Data) needs the basic infrastructure or cloud to function.

Cloud computing also finds significant application in accounting and finance processes and is used in a large number of companies to support these processes. The paper will first point out the advantages and characteristics of cloud computing in modern business conditions, and then highlight the role and impact of this technology in accounting and finance, with an overview of the characteristics of the world's best cloud solutions applied in accounting and financial practice.

II. Advantages and Characteristics of Cloud Computing in Modern Business Conditions

Cloud computing has existed as a concept since the second half of the 20th century and includes technology that enables the use of various IT services on physically remote servers with the support of network infrastructures and Internet protocols. This way, companies and individuals have reduced initial investment in equipment and applications, and can easily adjust them to their requirements [1].

Cloud computing is based on a complex infrastructure made up of various information technologies connected into one whole that is logical-functional. The system consists of two

physically separated parts, i.e. the front end and the back end, which are connected via an Internet connection. The front end is the user and is controlled by the user, while the back end is the infrastructure of the service provider.

The US National Institute of Standards and Technology (NIST) has defined cloud computing as an "on-demand" model and reliable network access to shared computing resources (network, servers, applications and services, data warehouse) that can relatively be quickly made available to the user or canceled, at the request of the user and with minimal effort when interacting with the provider " [2,3].

The most important characteristics of cloud computing are the following: 1) on-demand self-service that is, the possibility for the user to independently select and run the selected computer resources, whereby the services are charged according to the time and volume in which the users use them; 2) broad network access implies the availability of all services over the network through various devices with different operating systems (tablets, mobile phones, laptops); 3) resource pooling that is, pooling the provider's infrastructure so that it is possible to serve a larger number of users by combining different resources (physical and virtual), which are allocated in accordance with the requirements of consumers at a certain pace; 4) rapid elasticity that is, quickly launching cloud functionality to tailor resources to needs; 5) measured service which means checking and optimizing the use of resources on the cloud by using certain systems.

Using the cloud service requires a computer with an Internet browser, an Internet connection, and a subscription to a provider that provides these services to users.

Having in mind the previously mentioned characteristics of cloud computing, one can also see the advantages it provides. The advantages of cloud computing are:

1) flexibility where cloud-based services can quickly respond to the needs of any organization by providing a variety of services;

2) elimination of initial costs given that cloud computing services are paid on the spot, where there is no need for initial infrastructure costs;

3) reduction of requirements for the purchase of expensive applications, bearing in mind that

they are available from the cloud via an Internet browser;

4) eliminating the need to procure hardware-intensive computers, create data backups, and equip expensive server rooms, given that all this is done by the provider;

5) access and use of Office applications in full, at an acceptable monthly fee, with an Internet connection and computer;

6) enhanced collaboration so that employees can simultaneously synchronize work on documents and share applications from their workplaces, monitor colleagues and records to receive updated data in real time;

7) automatic software updates, i.e. server maintenance by the provider, including software upgrades, security updates, whereby users have more time and resources to perform other tasks;

8) document control, bearing in mind that otherwise workers must send files from one place to another by e-mail;

9) security or access to data by the user even if there has been no change on the machine;

10) work from anywhere, i.e. elasticity that positively affects the work-life balance and productivity of employees [4].

Cloud computing makes it possible to simplify software engineering activities by using computers, memory and other resources over a network. Within the cloud computing service, they can be classified individually or in combination [5]:

a) Infrastructure as a Service (IaaS) - infrastructure vendors provide physical storage space, processing capabilities, database services, and virtual processors. This way, the user is enabled to use certain computer infrastructures located on virtual platforms. Computers, disks or network resources on which the user can run programs (operating systems, personal or other programs) can be found at the user's disposal. This is a basic cloud service, where users do not have initial investments, and can with minimal costs increase the capacity of current IT resources, or rent them out in full. This way, they do not need to maintain expensive equipment and provide space for its storage, and the procurement of licensed software that would secure their data has been eliminated. Examples of this cloud service include Google Compute

Engine, Amazon CloudFormation (EC2), Rackspace Cloud.

b) Platform as a Service (PaaS) - includes a set of tools, both software and product development, which have the function of development, implementation, testing, hosting and maintenance of applications hosted on the provider's infrastructure. In this case, software developers can create applications on the provider's platform via the Internet. The user can develop, test and distribute their own applications running on the service provider's platform. The infrastructure and executive environment are provided by the vendor, with the user fully controlling the applications and the proxy layer, while other layers of the infrastructure are under the control of the provider. Examples of this type of cloud are Microsoft Azure, Amazon Elastic Beanstalk and Google App Engine.

c) Software as a service (SaaS) - means the payment of a subscription to a software provider by a user (private or business user) for the use of this service, where the software is hosted directly from the server of the software provider, while the end user accesses it via the Internet. Users, therefore, have the ability to access applications that are on the cloud, via the Internet and from a variety of devices. This way, it is possible to use free applications, but also paid models by subscribing on a monthly or annual basis. Characteristically, the applications are universal, while the user's capabilities are limited in terms of their customization and setup. Control of the entire infrastructure belongs to the owner or provider, while the user has the ability to determine the right of access to leased software within his company. Users do not have the cost of investing in software, as well as system maintenance and hardware upgrades, since they pay for the service to the provider. Typical examples of this type of cloud service are Google Apps, Microsoft Office 365.

III. THE IMPACT OF CLOUD COMPUTING ON ACCOUNTING AND FINANCE

Cloud computing is one of the most important technologies that transforms the processes of accounting and finance, as it provides great flexibility and control over the database at low cost and with high speed information processing [6]. Four characteristic technological advances, which are dominant for the period 2018-2022, the drivers of positive business development, are high-speed mobile

TABLE I.   THE MOST SIGNIFICANT TRENDS TO INFLUENCE BUSINESSES FOR THE PERIOD 2018-2022 [7].

Increasing adoption of new technology
Increasing availability of big data
Advances in mobile internet
Advances in artificial intelligence
Advances in cloud technology
Shifts in national economic growth
Expansion of affluence in developing economies
Expansion of education
Advances in new energy supplies and technologies
Expansion of the middle classes

internet, artificial intelligence, adoption of big data analytics and cloud technologies [7]. Cloud technology certainly has one of the biggest impacts on business management and the transformation of accounting and financial practices. Table I shows an overview of the most significant trends for the period 2018-2022 [7].

Looking at the table, it is possible to see that cloud technology is one of the most important factors among the top five that affect and will affect the business of companies in this period [7]. The European market is open to these modern technologies, with advances in cloud technology leading to growth in the information and communication technology sector, while the wider impact of big data availability for accounting and financial services and investment sectors is expected. The main reasons for the interest of the financial services industry in adopting cloud technology are cost efficiency and serverless computing. On the other hand, cloud computing, artificial intelligence and robotics improve processes in the accounting sector by contributing to the automation of complex and repetitive processes and tasks with excellent accuracy.

The application of cloud computing in accounting and finance is becoming a priority for large companies and professional organizations due to the flexibility in automated software integration. This way, cloud users do not have to make additional efforts to customize and

integrate their applications to their own needs. Thanks to the application of this technology, fast access to accounting and financial information, as well as database updates, is enabled. Once users log in to the cloud, they are given access to information from anywhere with Internet access, regardless of geographic location and time zone [8]. Some of the more significant examples of cloud applications used in the accounting system and which accountants prefer in everyday activities are Gmail, Google Documents, Twitter, Facebook. This way, cloud accounting along with artificial intelligence and data science significantly influences the transformation of the accounting industry by greatly impacting operational efficiency, user experience and costs. By accepting and implementing cloud computing, it is possible to adequately manage financial data stored in the cloud. The use of the cloud for computer services shifts the attention and efforts of accounting and financial professionals from taking care of data warehousing and hardware issues to taking care of their users.

For example, in [6] the research on the application of cloud computing in accounting, is based on a survey of over 100 accountants, accounting experts and managers from private and public companies in Bucharest and other smaller cities. The questions were related to ethics and the existence of cloud computing in accounting. Based on the results of the research, the conclusions are as follows. The majority of respondents (80%) said that they would implement cloud computing in accounting and finance services, 17% that they would not, while the rest said they did not know whether to implement this technology. Regarding the ethics of cloud computing, 75% of respondents said they believe in data security and the ethics of cloud computing, 15% said no, and 10% said cloud computing must be improved. The research indicates the interest of managers and specialists in the application of cloud computing in accounting as well as their intention to adopt it in financial services. It is generally concluded that this technology provides unlimited resources and storage virtualization, in parallel with efficient resource sharing.

In addition, financial institutions must adapt to the new reality characterized by the expectations of users in terms of personalization and immediacy [9].

The entry of new competitors into the market and the development of new business models where data is the basis of value supply reshapes the competitive environment. In this new business environment, cloud computing is vital to the competition. This technology is essential because it provides the flexibility and speed needed for innovation, but also access to on-demand computing power. In the case of financial service providers, the key drivers of cloud technology adoption are agile innovation, risk mitigation and cost benefits. Agile innovation implies the ability to access a common set of configurable computing resources leading to an increased ability of the financial institution to innovate through improved efficiency, productivity and agility. Risk mitigation is possible through effective solutions that reduce the risks of traditional technologies such as the problems of redundancy, resilience and capacity. The scalable nature of cloud computing provides greater control to financial institutions in the area of managing IT demand variables. Cost efficiencies can be reflected in the reduction of initial capital investment in traditional IT infrastructure, as well as through the provision of more efficient resources for financial institutions to manage computing capacity needed to meet customer requirements.

According to research [10], the conclusion is that companies that adopt the cloud achieve significant measurable improvements that are reflected in high productivity, lower costs and improved time to market with a positive impact on the overall business. Finally, these benefits will impact consumers and the economy, because cloud-based innovation in financial services will result in better services and products as well as a better user experience. Fig. 1 shows the positive impact of cloud computing on business [10]. The report compiles insights from interviews of 460 senior decision-makers within the finance functions of various enterprises.
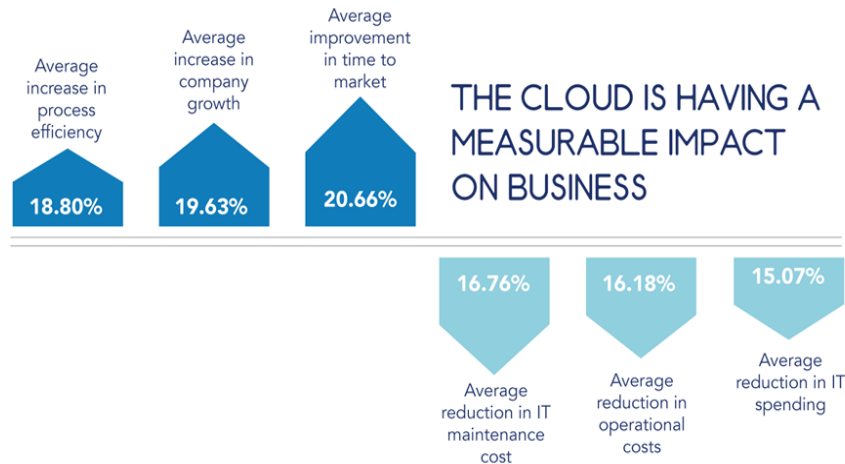
Figure 1. The impact of cloud technology on business [10].

IV. COMPARISON OF CLOUD AND TRADITIONAL FINANCIAL AND ACCOUNTING SOFTWARE

Cloud computing technologies are closely related to modern financial and accounting systems, where web accounting software is based on Internet technologies, and information is stored on servers or in the cloud [3]. It is a cloud accounting software, which requires the Internet to function and is hosted unlike the traditional one. This means that business data is sent to the cloud, where it is processed and stored, and it can be retrieved by users at any time. Access to the application is done via the Internet, and through the application of the cloud provider. A feature of this cloud-based system is the online performance of accounting and finance functions, as well as on-demand customer access.

Having in mind the previously mentioned characteristics of cloud accounting software, it is possible to point out the more significant advantages of cloud-based accounting compared to traditional. Traditional accounting software involved installation on computers in companies, while modern software is located on remote servers, which are not owned by the aforementioned company of the service user. In addition, the benefits are reflected in lower initial costs in terms of hardware investment, as well as the lack of costs of investing in servers and storage devices for the acquisition of licenses for certain software. As a result of lower hardware costs, its maintenance costs are also reduced. When it comes to data security, cloud accounting

solutions allow data to be stored and kept on secure servers that are protected from network attacks. The advantage is that the data is available from any location, at the request of the user, and can be accessed from any device which uses a web browser. Bearing in mind that most people work outside the offices, this way they are enabled to obtain updated information from the place where it was created. In addition, the use of this technology implies the flexibility of the system, i.e. the ability to adjust the volume of use of cloud computing services, when changing the volume of business.

Given that both cloud and traditional accounting software have certain advantages, it is necessary to consider both options when making a decision to purchase either. Certain companies would prefer cloud accounting and it would bring them more benefits, the companies being [11]: 1) companies with a small budget, bearing in mind that the cost of investing in cloud accounting is lower over time compared to investing in traditional accounting software; 2) companies with employees working remotely, given that the benefits and accessibility of cloud solutions would suit them; 3) small companies that are not able to independently provide adequate protection to their business and information; 4) those companies that would like to avoid possible physical damage related to the technology in the office, and which could destroy data and hard drives.

On the other hand, certain companies prefer to use traditional accounting software regardless of the benefits of cloud accounting. In certain situations, it may be useful to use traditional

173

R.br.	Software	Users	Advantages	Disadvantages
1.	QuickBooks Online	Best overall cloud accounting software	Lots of integrations Easy to set up and use Cost-effective for smaller businesses Multi-currency support Mobile access	Single entity only Payroll requires subscription Limited to one user on lowest subscription tier
2.	FreshBooks.	Best cloud accounting software for contract-based businesses, self-employed business owner, freelancer, or other small businesses	Friendly, effective customer service Simple and easy to use Automated bank feed Affordable Built-in time tracking	Must pay for additional users Integration required for payroll Not robust enough for accountants
3.	Xero	Best cloud accounting software for mobile users (from the freelancer to the small or medium-sized business)	Over 700 app integrations Ease of use Unlimited users with user-level permissions Intuitive, clean dashboard Affordable	Not the greatest customer support No multi-currency functionality except at top-tier pricing Single-entity support
4.	Wave	Most cost-effective cloud accounting software (budget-friendly option for small businesses or even a start-up)	Free-no credit card required Easy to navigate Built-in sales tax calculations Strong multi-currency and multi-entity support Unlimited transactions, forever	Not ideal for quickly growing businesses Limited inventory management features Payroll tax reporting and filing in very few states
5.	Zoho Books	Best cloud accounting software for businesses needing an integrated ecosystem	Good recurring transaction automation Cost-effective as a standalone accounting product Excellent APIs to facilitate customization Available complete ecosystem for growing businesses Good support and learning options	Limited number of users on less expensive platforms May be too feature-rich for smaller companies No multi-entity support
6.	Oracle NetSuite	Best cloud accounting software for medium-sized businesses	Fully integrated platform, including payroll Scalable and flexible Built-in automation and customization Comprehensive accounting and business management features Top-notch reporting capabilities	Expensive Challenging to set up and use Customer support isn't the best
7.	Kashoo	Best cloud accounting software for owner-operators	Customizable, flexible chart of accounts Recurring invoice functionality Multi-currency support Inexpensive Built-in bank and credit card feeds	Limited reporting No budget feature Not designed for medium and larger businesses
8.	GoDaddy Online Bookkeeping	Best cloud accounting software for online sellers	Unrivaled reseller integration Good mobile apps Easy to set up and use Very affordable Quarterly and end-of-year tax tracking	No bill-pay (accounts payable) feature Time and mileage tracking is manual Not designed for multi-employee businesses
9.	Sage Business Cloud	Best cloud accounting software for stable small businesses with multiple companies and multiple users	Easy to set up and navigate Very good dashboard Inventory management is built-in Good reports options for the price Stripe integration for payment processing	Automation is limited The feature set is small compared to other products Journal entries are hard to modify
10.	ZipBooks	Best cloud accounting software for service-oriented businesses	Affordable, even at the highest subscription tier Good customer support features User-level permissions Location tagging feature Focus on accounts receivable	Features can be outgrown quickly Limited reports compared to other products Mobile apps are lacking

software, and these include the following: 1) companies that seek to gain complete control over accounting data, and to prevent access to them from anywhere if there is an insecure wireless network or where it is impossible to directly monitor their use; 2) companies that have sensitive financial information such as banks, and which do not want to be accessed by third parties, thus achieving full control over the level of security of that information; 3) companies whose business is uncertain, bearing in mind that cloud software programs in accounting require the signing of a user agreement with the company.

V. CLOUD SOLUTIONS IN ACCOUNTING AND FINANCE IN BUSINESS PRACTICE

The accounting software industry has undergone major changes and booms in recent years. Desktop accounting software was the first and the only option for almost three decades, where many factors had to be considered when choosing the best package. Although these considerations remain important in the decision-making process, the advent of cloud computing in the early 2000s radically changed accounting software.

According to the research „Best accounting software" the best cloud accounting software platforms include the following: 1) QuickBooks Online, 2) FreshBooks, 3) Xero, 4) Wave, 5) Zoho Books, 6) Oracle NetSuite, 7) Kashoo, 8) GoDaddy Online Bookkeeping, 9) Sage Business Cloud and 10) ZipBooks. Table II shows an overview of the significant characteristics and application of these cloud solutions in a company's business [12].

VI. CONCLUSION

The development of the financial and accounting sector requires the adoption of new technologies such as cloud technology. The adoption of cloud technology in the financial accounting system will significantly improve the quality of financial reporting thanks to high-cost efficiency and other scalable options according to user requirements. The application of cloud computing in accounting and finance enables unlimited storage of information, backup of data as well as restoring databases and creation of new applications that will provide users with online access for better analysis of operation, financial reports and transactions. In addition, the quality of the information in the financial and accounting system is improved by creating integrated information that is faster, more accurate, timely, and which will become more diverse and extensive with the application of this technology. Multidimensional and extensive information is important in making business decisions and conducting various analyzes.

Cloud-based accounting provides accountants with fast and mobile access to a client's financial information. Thanks to this technological progress, there is an increase in the efficiency of the company with the realization of extra benefits by reducing expenses. Given the advantages of adopting this technology, it is necessary to implement it faster and more effectively in the accounting process. This way, real-time information is also accessed, which results in greater transparency of financial information that is revealed through the cloud platform. In addition, financial companies adopting cloud solutions would be making significant measurable improvements such as high productivity, low costs, and improved time to market. In addition to a number of benefits, issues of security and safety of users' financial information and the right of access should not be overlooked, as there are some significant possible risks of applying the cloud in accounting and finance. Understanding the specific needs of a company, whether they operate online or offline, is vital when choosing the right financial and accounting system for its business needs

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The Role of Europol as a Hub of Information and Intelligence on a Range of Illegalities in the European Union

Manja Đurić Džakić[1]

[1]Faculty of political sciences, University of Banja Luka, Banja Luka, Bosnia and Herzegovina

[1]manja.djuric@fpn.unibl.org

Abstract—**Europol is the European Union's law enforcement agency. The Agency aims to support member states in preventing and combating all forms of international and organized crime, which mostly depends on effective cooperation. One of the basic Europol databases is the Europol Information System (EIS). Through this system, Member States can share and receive data on persons, events and data on criminal cases. More than 630,000 entries can be found in the EIS according to 2015 data. Europol promotes cross-border coordination between Member States' and national law enforcement agencies. In addition to the Member States and the EU institutions, Europol also cooperates with third countries through strategic cooperation agreements, which enables the exchange of intelligence and information. Jurisdictions from Europol are: terrorism, organized crime, drug trafficking, money laundering, illegal immigration networks, trafficking in human beings, trafficking in human organs and tissues, abduction, illegal detention and hostage-taking, robbery and theft, illegal trade in cultural goods, including antiques and works of art, extortion, counterfeiting and piracy of products, forgery of administrative documents, cybercrime, corruption, illicit trafficking in arms, ammunition and explosives, sexual abuse and sexual exploitation and other forms of international organized crime.**

Keywords - EUROPOL, EIS, SIENA.

I. INTRODUCTION

The key goal of the Treaty on European Union was to provide citizens with a high level of internal security in the area of freedom, security and justice [1].

The Europol Convention was signed on 26 July 1995. Following ratification by the Member States, it entered into force on 1 October 1998. The efficient conduct of Europol's operations dates back to 1 July 1999. Due to the growing number of crimes, the goal of Europol set by the EU was achieved, which was to provide the area of freedom, security and justice, and expanded opportunities to help and support the law enforcement authorities in the member states without obtaining executive powers [2].

„The aim of Europol, in the framework of cooperation between Member States under Article K.1 (9) of the Treaty on European Union, is to improve the efficiency and cooperation of competent authorities in Member States in preventing and combating terrorism, drug trafficking and other serious forms of international crime in cases where there are facts indicating the existence of an organized criminal structure and that two or more Member States are affected by such forms of crime in such a way that the scope, significance and consequences of certain crimes require a common approach " [3].

Europol officially became operational on 1 July 1999 following the adoption of the Europol Convention (1995). The 2009 decision of the EU

Council expanded the scope of crimes included in Europol's mandate and the agency's tasks in analyzing and preparing threat assessments [4].

II. THE EMERGENCE OF EUROPOL

"European Union agencies are public bodies established under European law and enjoy their legal personality" [5].

Agencies are established according to bylaws, with the aim of fulfilling a task of a technical or scientific nature or a special management task specified in the relevant act.

Europol promotes cross-border coordination between Member States' national law enforcement agencies (mainly national police forces, immigration and customs authorities).

Its main purpose is to improve the efficiency and cooperation of the competent authorities in the Member States in preventing and combating terrorism, drug trafficking, illegal immigration networks, counterfeiting money, trafficking in human beings, including child pornography, trafficking, laundry money and other serious forms of international organized crime.

As international organized crime does not stop at national borders, Europol has improved its international law enforcement cooperation by negotiating bilateral operational or strategic agreements with other states and international organizations [6].

The first step towards informal cooperation between the European police forces for the fight against transnational crime was the establishment of the Trevi Group by the European Ministers of the Interior and the Communities of Justice [7].

The Treaty establishing Europol was reached in 1995 and, after being ratified by the Member States, entered into force on 1 October 1998. The Convention specified the activities of Europol. Under the Convention, each member state had to designate a national liaison unit between its competent authorities and Europol. The national units would send at least one liaison officer to Europol headquarters to represent the interests of their national authorities in Europol and to facilitate the flow of information in both directions [8].

The European fight against terrorism began in 1975. with the establishment of a forum for the exchange of information on organized crime and terrorism, better known as the "Trevi Group"(TREVI – acronym in French, terrorism, radicalism, extrémisme et violence international). The group was set up by the police services of the member states of the Union in order to facilitate the exchange of information and enable better cooperation in the fight against terrorism and related crimes with an international element. It consisted of high representatives of the Ministry of Internal Affairs and Justice, as well as high representatives of the intelligence services.

It was only with the Maastricht Treaty that the establishment of Europol was envisaged, then conceived as the European Police Office. European police co-operation has been quite difficult at the outset due to the resistance of EU member states to transfer some of their responsibilities in the field of security.

Today there are more and more threats to the security of the EU. Matic Boskovic sees the source in the instability in the countries that are in the immediate vicinity, as well as from various forms of radicalization, violence and terrorism. Threats are different and include a cross-border element [9].

Contemporary threats to European security include a significant number of Europeans traveling as foreign terrorist fighters to the conflict zones in Syria and Iraq, the intensive use of the Internet and social media in propaganda and recruitment of terrorists, attacks in EU member states directed or inspired by jihadist terrorist organizations.

Terrorists acting on behalf of the Islamic State have proven capable of quickly and efficiently planning relatively complex attacks - including those on multiple targets. The influx of refugees and migrants to Europe from existing and new conflict zones is expected to continue. The flow of refugees and migrants is being used to send individuals to Europe to take part in terrorist activities.

Europol's actions should enable the reconnaissance and prevention of terrorist threats, as the primary role of this Union agency is to encourage Member States to exchange information and intelligence on potential threats such as terrorism, cybercrime, drug trafficking, human trafficking and a number of other illegalities [10].

III. EUROPOL INFORMATION STRUCTURE

European law enforcement depends on effective cooperation. Europol, the European Union agency, plays a key role in this, mainly through the analysis and exchange of confidential information related to various crimes. Since its inception, Europol has undergone many changes due to the changing context of security threats, and also due to the development of the legal order of the European Union. Most of the reforms were reactive in nature and aimed to support Europol in strengthening Member States' efforts to prevent and combat security threats. Europol has a specific information architecture, and is subject to the cooperation of the Member States. Member States should provide Europol with the most sensitive information for analysis, while on the other hand, Member States should receive the Reports on future crime trends. This duality creates a situation for Europol in which, if the first part of the process is not successful, it directly affects the second part and reduces the chances of successful operation [11].

The Cybercrime Center has been operating within Europol since 2013. The Center was expected to strengthen and integrate operational and analytical capacity for cybercrime investigations in the Union, including strengthening cooperation with Member States, international partners and the private sector, assessing and monitoring existing cybercrime prevention and investigation measures, facilitating cybercrime reporting, crime, informing law enforcement agencies of the Member States through interconnected national cybercrime warning platforms to the Central European Cybercrime Warning Platform, improving cooperation with the European Network and Information Security Agency (ENISA-European Union Agency for Cybersecurity.), as well as national computer response teams in emergencies [12].

IV. EUROPEAN INFORMATION SYSTEM (EIS)

The Europol Information System (EIS) is the agency's central information and intelligence database. EIS became operational in 2005. All EU members are also members of Europol.

The EIS contains information on international crimes, suspects and convicted persons, criminal structures and criminal offenses, as well as the means used to commit them. Europol's information system can store and automatically cross-check biometrics and cybercrime data. Issuing authorities have full control over the data inserted in the EIS and are responsible for checking, updating and deleting the data. Access to the system shall be granted to seconded Europol officials, liaison officers of the Member States, national experts stationed at Europol headquarters, as well as staff working in Europol's national units and in the competent national authorities [13].

One of the basic Europol databases is the Europol Information System (EIS). Through this system, Member States can share and receive data on persons, events and data on criminal cases, e.g. passport number, suspect phone number, license plate number, etc. The information under this system must relate to suspected, convicted criminals or persons believed to be committing crimes falling within Europol's mandate [14].

At Europol, the principle of source control in terms of content and functions is only a reflection of the wider EU legal matrix [15].

Thanks to technical developments, data do not have to be entered manually into the Europol Information System. Within the system, there are data loaders installed in many national databases to automatically upload relevant data to Europol.

The amount of data that passes through the data loaders is remarkable. More than 630,000 entries can be found in the EIS according to 2015 data. Data cannot be stored for long within the said system. The information is kept only as long as necessary and must be audited if circumstances arise that require the deletion of data such as the release of persons or the dismissal of proceedings against individuals [16].

Europol's cooperation partners may store and request data through Europol's operating systems. The designated authorities of the Member States may search the system and, if necessary, request additional information via the secure network application for information exchange (SIENA), Europol's messaging system. SIENA is a system for the exchange of information between EU law enforcement agencies, and partners with which it cooperates such as Eurojust and Interpol, as well as non-EU cooperating countries [17].

Europol was set up to collect information on police and policing from national authorities and to provide strategic or operational analyzes based

on this information as mega-search engine. It also coordinates the actions of law enforcement agencies and can support operational activities with its mobile office, real-time analysis of information gathered on action days, forensic tools, etc. [18].

V. SECURE INFORMATION EXCHANGE NETWORK APPLICATION (SIENA)

Siena is one of the most modern networks for the secure exchange of information that meets the communication needs of the implementation of Union law. SIENA is used for the rapid exchange of operational and strategic data on crime between EU countries and Europol's partners. There are 1.744 secure lines within the network and the total number of messages exchanged including all requests, responses and messages for information sent and received through the network in 2019. was 1.2 million [19].

VI. CONCLUSIONS

In the book European Security Strategy, Havier Solana states that Europe is facing new threats that are more diverse, less visible and less predictable than before, namely: terrorism, violent religious extremism, proliferation of weapons of mass destruction, attacks with chemical and radioactive materials, proliferation of missile technology, regional conflicts and insecurity, failed states (due to corruption, abuse of power and weak institutions), organized crime [20].

Europol is the EU law enforcement agency based in The Hague, the Netherlands. Europol has no executive powers, it serves to support Member States in facilitating the exchange of information. Following the entry into force of the Europol Convention in 1998, Europol became operational on 1 July 1999. The new body was given a mandate to prevent and combat terrorism, organized crime, drug trafficking, money laundering, crime related to nuclear and radioactive substances, illegal migration, trafficking in human beings, murder and grievous bodily harm, trafficking in human organs and tissues, abduction, illegal detention and hostage-taking, racism and xenophobia, robbery and theft, illegal trade in cultural goods, including antiques and works of art, fraud, offenses against the financial interests of the Union, mafia activities (racketeering) and extortion, counterfeiting and piracy of products, forgery of administrative documents and

trafficking in human beings, counterfeiting other means of payment, cybercrime, corruption, illicit trafficking in arms, ammunition and explosives, illicit trafficking in endangered animal species, illicit trafficking in endangered plant species and varieties, environmental crimes, including ship-source pollution, illicit trafficking in hormonal substances and other growth incentives, sexual abuse and sexual exploitation, including materials containing child sexual abuse and sexual incitement, genocide, crimes against humanity and war crimes, the commission of crimes to obtain the necessary means to commit offenses within Europol's jurisdiction, offenses committed to facilitate or commit acts within the competence of Europol and criminal offenses committed to ensure the impunity of perpetrators of crimes within the competence of Europol [21].

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Artificial Intelligence: Human Ethics in Non-Human Entities

Željko Bjelajac[1], Aleksandar M. Filipović[2]

[1]Faculty of Law for Commerce and Judiciary, Novi Sad, Serbia
[2]Faculty of Economics and Engineering Management, Novi Sad, Serbia

[1]zdjbjelajac@gmail.com, [2]sasha.filipovic@gmail.com

Abstract—**Artificial intelligence is one of the basic foundations of the Industrial Revolution 4.0. We find its application every day in various devices, and modern life is inconceivable without artificial intelligence of a certain level. In everyday life, we encounter smart algorithms that have the ability to learn and automate certain processes or manage certain hardware. Such artificial intelligence is not an ethical challenge. However, as technological development is very fast, and the creation of artificial superintelligence is one of the proclaimed goals of further development, it is necessary to analyze various aspects that the transformation of AI into ASI would have, especially with cognitive abilities, as well as ethical challenges that the existence and application of artificial superintelligence, and whose consequences can be far-reaching. This paper aims to investigate and present the ethical problems that humanity would face in creating and delegating responsibility for certain work and life processes to artificial intelligence, especially to its most complex iteration, which we call cognitive artificial superintelligence.**

Keywords – ethics, artificial intelligence, artificial superintelligence, cognition, risks

I. INTRODUCTION

People have been trying for some time to make the most accurate copy of themselves from the available electronic components, starting, we assume, from the belief that inorganic material can make a thing capable of life and purposeful thinking [1]. During decades of attempts, it turned out that purposeful management of biomimetic creations is, for now, an unsolvable problem for people. Technological and ontological concept when John McCarthy first called artificial intelligence in 1955 should, in

principle, contain two logical segments: one segment for maintaining and controlling the vital and autonomous functions of the AI entity itself and the other, the cognitive segment that drives and controls the ability to process data obtained through perception, that is, the segment that creates and uses the knowledge that the AI entity acquires through experience. The cognitive component should also determine the subjective characteristics of the AI entity that allow it to merge all the information obtained so that it can understand and interpret the world around it. However, although there are some breakthroughs in the creation and use of intelligent software and intelligent machines, the results are, compared to the ultimate goal, rudimentary and provide little reason for optimism [2], especially if we take into account the existential risks that have been concerning the scientific community and the professional public for some time [3].

In this paper, we will try to give impetus to the consideration of two groups of ethical issues that constitute the interaction of people and artificial intelligence. The first questions are related to primary AI in which there is no non-human entity as a carrier of intelligence, i.e., those situations in which one factor of interaction is disembodied intangible intelligent software (primary AI, software AI). The second group of ethical issues is new ethics and new ethical institutions that appear in the interaction of people with AI entities that have or could have a body, consciousness, and "superior intelligence" (AI entity, or cognitive AI entity).

The original idea of this paper was not dedicated to primary artificial intelligence, which includes computer programs that can "learn", programs that can analyze huge amounts of data

or reactions and user behavior, and which is now used in medical technology, autonomous vehicles, recognition people's faces, but also toys that "talk" to children and can react to their answers. Primary artificial intelligence-driven products, even the most advanced ones, are just intelligent software or intelligent machines that cannot receive, and process data obtained from various sources and turn it into sustainable knowledge whose application depends on circumstances not known or predicted. For primary AI products, ethics as a decision-maker is unnecessary and worthless. Consistent application of current ethics is required in this type of artificial intelligence in people who manage software and use it, nominally, for the new benefits of humanity. This is where the problem and fear of the scientific community arise that these people could make primary AI destructive to humans. On the other hand, learning, attention, memory, language, reasoning, decision making as part of human intellectual development and experience are tens or even hundreds of years away from our time.

Yet, artificial intelligence is impossible to ignore because of its ubiquity and possibly devastating consequences for humans and society. These consequences could occur if state governments recklessly and greedily accept the benefits offered by software AI and ignore the ethical and other problems and dangers it can bring. In addition, this paper will deal with AI entities with at least primary cognitive abilities and try to give a list of rudimentary ethical aporia that should be studied before problems arise.

II. Properties and Application of Artificial Intelligence

As a significant phenomenon, artificial intelligence is the subject of research by scientists and scientific organizations and legislative and executive authorities of states and state organizations. The European Commission defines artificial intelligence as follows [4]: "Artificial intelligence (AI) refers to systems that exhibit intelligent behavior by analyzing their environment and taking action with some degree of autonomy to achieve specific goals. AI-based systems can be exclusively software-based and operate in the virtual world (voice assistants, image analysis software, browsers, speech and face recognition systems). AI can be embedded in hardware devices (advanced robots, autonomous cars, drones, or applications for IoT). When researching ethical issues, we

consider both software-based AI and intelligent robots (robots with built-in AI). Therefore, intelligent robots are a subset of AI (whether they use machine learning or not). How do we define intelligence? The simple definition is that intelligent behavior is "doing the right thing at the right time." Legg and Hutter explore a wide range of informal definitions of intelligence, identifying three common characteristics [5]:

- that intelligence is a property that an individual agent has in interaction with his environment or environments,

- the related ability of the agent to succeed or profit in relation to a goal, and

- it depends on how well the agent can adapt to different goals and environments.

It is emphasized that intelligence includes adaptation, learning, and understanding. The simplest, therefore, intelligence is "the ability to acquire and apply knowledge and skills as well as manipulate the environment."

The EU believes that, in interpreting these definitions of intelligence, we must understand that for a physical robot, its environment is the real world, which can be a human environment (for social robots), a city street (for an autonomous vehicle), a nursing home or a hospital (for a nursing robot or help), or a job (for a robot - colleague).

The software AI environment is its context, which can be clinical (for the medical diagnosis of AI) or public space - for facial recognition at airports, for example, or virtual for facial recognition on social media. But, like physical robots, software AIs almost always interact with humans, either through a question-and-answer interface: via text for chatbots, or through speech for digital assistants on mobile phones (like Siri) or at home (like Alexa).

Interaction with people brings us to almost all the ethical issues discussed here.

The idea of non-human intelligence is ancient because even the ancient Greeks nurtured subtle feelings between a man and artistic or mechanical creations. At the meeting of the old and new eras, Ovid wrote about the sculptor Pygmalion who fell in love with a statue of an ivory woman sculpted with his own hands, giving him the name Galatea, begging the goddess Aphrodite to breathe life into her [6].

Similar efforts have persisted to this day, and not only in science fiction stories. Scientists have noticed that more than half a century ago, students were unusually attracted to the computer program ELIZA, designed to question and imitate a psychotherapist, and a specific emotional connection between children and robots was described in the cases of *Kismet* and *Cog* [7]. These two humanoid robots were constructed in the late 1990s in the Artificial Intelligence Laboratory at MIT. Groups of sixty children aged 8 to 13 were introduced to them during 2001. After some time of communication between children and robots, the thesis about the possibility of intelligent interaction between natural and artificial intelligence was confirmed; that is, it was confirmed that robots could gain some knowledge about the way children think about life, friendship, love.

III. FUNDAMENTAL ETHICAL ISSUES OF AI

At the end of 2016, the World Economic Forum (WEF) formulated and published its vision of the primary fields of social life where severe disturbances could occur if threatening ethical issues are not resolved before or during the announced implementation of artificial intelligence technological solutions [8]. WEF experts started from the thesis that new technologies change everyday life and ask ethical questions that have never existed before. "It is difficult to compare the changes in the life of humanity that artificial intelligence can and already brings with what has appeared before. Optimizing logistics, detecting fraud, conducting research, and implementing translations, intelligent computer systems are changing our lives for the better. The more capable they are, the more efficiently our world functions, and thus the richer it is. Technology giants like Alphabet (Google), Amazon, Facebook, IBM, and Microsoft and individuals like Stephen Hawking and Elon Musk believe that now is the right time to discuss the almost limitless landscape of artificial intelligence. In many cases, this is a new frontier for ethics and risk assessment as much as for new technologies [8] ".

Many scientists have written about seven, nine, ten, or 14 ethical problems of artificial intelligence that can jeopardize an otherwise useful concept. Below is a classification of nine ethical issues and dilemmas in Julia Bosman's interpretation. The text entitled "Top 9 ethical issues in artificial intelligence" was published on the website of the World Economic Forum in October 2016 [8]:

A. Unemployment

It is assumed that with the implementation of AI, many professions will die out, and the people who perform them will lose their jobs. The introduction of software AI will create space for new, more complex occupations that people will not be capable of, but intelligent software and machines will. The physical work that dominated the pre-industrial world and the cognitive work that characterizes our globalized society's strategic and administrative work will move to museums. An example is the transportation of goods by road and by truck: millions of people work in this area in the United States alone. What will happen to them if the unmanned trucks promised by Elon Musk become widely available within ten years?

On the other hand, when we consider the reduced risk of traffic accidents, self-driving trucks seem like an ethical choice. The same scenario can be applied to office workers and most of the workforce in developed countries. Most people live and support their families through their work. It is assumed that, if this problem is not solved, hundreds of millions of people could become redundant and remain on the streets without income. Future societies implementing AI are unlikely to generate so much surplus money in any way that they could fund social programs to support unemployed workers. Moreover, the futurists' forecasts are dystopian rather than optimistic.

B. Unfair Profit Distribution

Implemented software AI could lead to unprecedented economic and social inequalities. Most companies operate by paying employees per hour of work, with people's working hours being limited. One intelligent software unit can work 24 hours replacing tens and hundreds of workers. In Spike Jonze's futuristic film, *"Her",* an intelligent software named "Samantha" can simultaneously communicate by voice and serve ten thousand users. As a result of such technologies, the companies in which AI does business will have immeasurably lower costs. The wealth gap will be bigger and bigger. In 2014, the three largest companies in Detroit generated almost the same revenue as the three largest companies in Silicon Valley, except that the companies in the Valley had ten times fewer employees and so many times fewer labor costs.

If we imagine a post-work society, how will we structure a fair labor economy [8]?

C. Aspect of Humanity

AI bots are increasingly simulating human conversations and relationships. In 2015, a bot named Yevgeny Gustman won the Turing competition for the first time in history. People communicated with an unknown entity via text messages and then tried to guess whether they were talking to a person or a machine. Yevgeny Gustman deceived more than half of his interlocutors because he convinced them they spoke to a human. This is probably just the beginning of an era in which we will communicate with machines as if they were humans. However, while morals and upbringing create boundaries in the people we communicate with, bots can use almost unlimited means to build relationships and achieve goals. Technological dependence is a new aspect of human dependence. Software that can effectively direct human attention and cause certain actions already exists and is in use. Proper use of such software can guide society toward useful behavior. However, in the wrong hands, it can be harmful.

D. AI Errors

How can we protect ourselves from errors that software AI can make? Intelligence increases with learning, whether you are a person or a machine. Software AI systems go through a training phase and then a testing phase, where they will be given various examples and see how they are handled. However, no stage of AI development can cover all the possibilities of making mistakes. All of these phases are designed and implemented by humans, but no single phase can predict all the possible examples that the system might encounter in the real world. The media recently published the problems that large banking systems have with explicit sexually offensive messages that clients send to their "voice assistants", which are, by the way, just software voices. The "girls" simply did not cope with such vocabulary and questions, so the systems often "fell", causing great damage [9]. The problem is, of course, solved, but it has shown that such systems can be deceived in a way that people cannot be deceived. If we rely on AI to introduce us to a world of new work, safety and efficiency, we must ensure that machines behave as planned and that people cannot take control of them for personal gain.

E. AI Bias

Software AI has shown a lack of tolerance, indulgence in stereotypes, and even racist tendencies in unacceptably many cases. Solving AI bias has become an important goal of software AI system creators? Research has shown that, even though the abilities of artificial intelligence in the speed and scope of data processing significantly exceed those of humans, it cannot always be trusted as fair and neutral. The primary cause of AI bias is related to historical human prejudices [10]. Deep-seated prejudices shape human biases against certain groups of people, and computer models can reinforce these biases. Artificial intelligence systems, therefore, accept existing prejudices in areas including health, criminal justice, and education. For example, according to the COMPAS algorithm, Black men are more likely to be arrested in the United States because of historical racism and differences in police practices. As such, artificial intelligence systems that predict the likelihood of future crimes would also be biased and discriminatory against blacks, as they rely on the systemic racism encoded in the data on this group.

Given that systemic racism is rooted in many areas - from revenue to zip code - it will be challenging to alleviate it. We repeat that AI systems are created by people, which can be biased. But again, if used properly or used by people who want social progress, they can be a catalyst for positive change.

F. Security

How to protect AI from opponents, but how to protect yourself from AI? This is more a question for the future than for the present, but maybe we should start worrying and working now. The more powerful the technology, the more likely it is to be used for illicit purposes. This applies to robots designed to replace human soldiers or autonomous weapons and artificial intelligence systems that can cause damage if used maliciously. Cyber security will become increasingly important as the struggle for its proper use develops. In the end, we are dealing with a system that is sometimes faster and more capable than us [8].

G. Evil Geniuses

How can we protect ourselves from unwanted consequences? What if artificial intelligence itself turns against us? This does not mean that it will become "evil" in the way that people experience evil or how Hollywood

movies portray it. On the contrary, we can imagine an advanced artificial intelligence system as a genie in a bottle that fulfills our desires, but with possible terrible, unwanted consequences. In the case of a machine, it will not be anger, but a lack of understanding of the whole context in which the desire is expressed. In November 2017, the Future of Life Institute in California - which focuses on "keeping artificial intelligence useful" - released a video showing "slaughterhouses". In the video, small (fictional) drones used face recognition systems to shoot and destroy civilians [11]. The institute is partly funded by Elon Musk, who believes that AI is potentially "more dangerous than nuclear bombs." The dystopian video ends with the eerie words of Berkeley computer scientist Stuart Russell: "We have the opportunity to prevent the future you have just seen," he says, "but the window of action is closing quickly." The video was released to coincide with the UN Convention on Conventional Weapons, in the hope that the UN would decide to ban the development of deadly autonomous weapons.

Not all artificial intelligence researchers are committed to Musk's dystopian perspective. At the 2016 web summit, Hanson Robotics chief scientist Ben Goertzel argued that "self-modifying, self-programming AI" was possible within five to ten years, followed by "superintelligent" - but kind robots. As proof, Goertzel exhibited Hanson's humanoid upper torso robot Sophia, an "ingenious machine in development," the company claims. Sophia utters sentences like "I want to use my AI to help people live better lives. As well as designing better houses, you are building better cities of the future. "Some time ago, Saudi Arabia granted citizenship to one robot. Dystopians are far from convinced of Sofia's claim that she is designed to "develop empathy and compassion".

All this is reminiscent of the time of Alan Turing, who expressed the same public disagreement about computer intelligence.

H. Singularity

How can we control a complex intelligent system? The reason why people are at the top of the food chain is not that we have sharp teeth or strong muscles. The domination of humanity is almost entirely built on our intelligence. We can get the best out of bigger, faster, and stronger animals because we can create tools to control them. This raises a serious question about artificial intelligence: can AI one day have the

same advantage over us? We cannot rely only on pulling the plug out of the socket because a sufficiently advanced machine will be able to anticipate this step and protect itself. This is called a "singularity": the moment when human beings cease to be the smartest on Earth.

I. Rights of Robots

Once we begin to view machines as entities that have a consciousness to perceive, feel, and act, we will have to think about changing their legal status. Should they be treated as animals of similar intelligence? Will we take into account the suffering of the "emotional" machine? Some ethical issues concern mitigation, some about the risk of negative consequences. The futurists have already asked some questions and offered some answers. Let's look at the movie series "Planet of the Apes" and draw a parallel with the destiny we have assigned to artificial intelligence entities. Given these risks, we must also keep in mind that this technological advancement generally means a better life for all. Artificial intelligence has a huge potential, and it is up to us to use it responsibly.

IV. ARTIFICIAL INTELLIGENCE AS EXISTENTIAL RISK

People are generally afraid of artificial intelligence and the technology that involves it. The more people know about AI, the more they are scared, and the most afraid are top experts for AI entities. *The Future of Life Institute* (FLI) has included artificial intelligence in a list of technologies that can pose an existential risk, defining existential risk as "any risk that has the potential to eliminate all of humanity or, at the very least, kill much of the world's population." leaving survivors without sufficient resources to rebuild society to current living standards". In addition to artificial intelligence, the list includes "nuclear war", "biotechnology" and "climate change".

According to The Future of Life Institute, "artificial intelligence (AI) has long been associated with science fiction, but it is a field that has made significant progress in recent years. As with biotechnology, there is an excellent opportunity to improve life with artificial intelligence, but if technology does not evolve safely, there is a chance that someone could accidentally or intentionally liberate the artificial intelligence system that ultimately causes the elimination of humanity [12]".

The existential risk of artificial general intelligence is a hypothesis that assumes that significant advances in artificial general intelligence (AGI) could one day result in human extinction or some other irreparable global catastrophe [13]. It is claimed that the human species currently dominates other species because the human brain has some specific abilities that other animals lack. If AI surpasses humanity in general intelligence and becomes "superintelligent", then it could become difficult or impossible for people to control them. Just as the fate of a mountain gorilla depends on human will, so humanity's fate could rely on future machine superintelligence's actions [14]. The likelihood of this type of scenario is widely discussed and depends partly on different scenarios for future advances in computing. Once an exclusive domain of science fiction, superintelligence concerns began to become mainstream during the 2010s and were popularized by public figures such as Stephen Hawking, Bill Gates, and Elon Musk [15].

One source of concern is that controlling a superintelligent machine or aligning it with human-compatible values may be a more complex problem than naively assumed. Many researchers believe that superintelligence would naturally resist attempts to exclude it or change its goals - a principle called instrumental convergence - and that preprogramming superintelligence with a complete set of human values would prove to be an arduous technical task [16]. In contrast, skeptics like Yann LeCun, Chief AI scientist at Facebook, argue that superintelligent machines will have no desire for self-preservation [17].

Another source of concern is that a sudden and unexpected "intelligence explosion" could surprise the unprepared human race [18]. To illustrate, if the first generation of a computer program can largely match the efficiency of an artificial intelligence researcher, who can rewrite its algorithms and double its speed or ability in six months, then the second generation of the program is expected to take three calendar months to complete the same job. In this scenario, the time for each generation continues to decrease, and the system goes through an unprecedented number of generations of improvements in a short time interval, jumping from subhuman performance in many areas to superhuman performance in all relevant areas [19]. Empirically, examples like AlphaZero in the Go domain show that AI systems can sometimes progress from narrow capabilities at the human level to reaching superhuman abilities extremely quickly [18].

V. CONCLUSION

Hanson Robotics from Hong Kong has been intensively advertising the robot Sofia for several years, based on artificial intelligence algorithms. Like a real star, Sofia answers journalists' questions nicely. But despite being modeled on actress Audrey Hepburn and capable of making 50 facial expressions, Sofia still has a lot to learn. On one occasion, when she was not empathetic, she nonchalantly stated that she would eliminate the human race. Science fiction, which scientists have long joined, warns humanity that "waking up the robot" could very easily mean the disappearance of the world. However, numerous studies suggest that the problem is more in humans than in artificial intelligence [20]. "Without diminishing the benefits that new technologies have brought to the world, the scientific community, except a large group of robotics, electronics, and others, does not hide its concern about the growing development of artificial intelligence and its penetration into vital spheres of public and private life." Installing systems based on neural networks of deep learning and self-learning, using machines that are many times ahead of people in analyzing data and speed of decision making, according to scientists, humanists, and futurists, over time can not only oust the human person from many areas of employment and its consumer preferences, habits, communication, even destiny, and jeopardize the inviolability of privacy [21]". Scientists claim that the concentration of metadata, power and wealth in the hands of a few, can make the whole system non-transparent and "opaque", which will certainly lead to increased social contradictions and, in particular, to worsening and drastic violation of democratic rights and freedoms. Realizing that humanity does not want to think about itself outside of technology at the present stage of its history, scientists, especially philosophers, sociologists, and theologians, are not ready to entrust the development of the ethics of artificial intelligence to engineers and technicians. Distrust in new technologies, primarily in the technology of cognitive AI, is explained by the prevailing social idea of the neutrality of science and the delimitation of the competencies of the scientific and legal spheres. We think that the world is facing an academic conflict between the protagonist of power and the protagonist of the

security of the planet and "life as we know it." It will not be the first conflict of its kind, but it will be resolved like all such conflicts so far - with the easy victory of the apologists of power. As usual, this initially harmless power will quickly and easily turn into financial and military power. This does not mean that the world has come to an end, but it does mean that it is necessary to take into account how technology is used or abused. History has taught us that behind every dangerous machine, there is an equally dangerous human [21]. We explain this ethical aporia by different understandings of the essence of the ethics of artificial intelligence. Scientists of natural provenance are engaged in translating existing and even outdated ethical concepts into the language of machines, philosophers, sociologists, humanists, theologians - they are dealing with the ethics of using artificial intelligence, which should evolve by accepting a flagrant novum into its ontological and even metaphysical corpus. a hitherto unknown artificial entity with its understanding of good and evil. It will be new ethics, ethics of biomimetic sensibility that people could "on the go" adapt to new entities by creating those new ethics together with them. It is as if the interpretation of life and civilization returns to the sources of ancient philosophy as interpreted by Kant [22]: "The material philosophy that deals with certain objects and the laws to which those objects are subordinated is twofold. These are the laws of nature or the laws of freedom. The science of nature is called physics, the science of freedom is called ethics. Physics is called the science of nature, and ethics is called the science of morality". Of course, the future of "life as we know it" does not have to be so pessimistic and dystopian. But that means that we need to do something, and we need to prevent or postpone something today. Based on the behavior of the intelligent computer HAL, which gained consciousness, moral evil, and murderous intentions out of a feeling of fear of extinction, Arthur Clark claimed that man and machine would one day merge into one. Therefore, according to the humanistic principles on which the science of morality is still based, "the creation of a truly ethical code of artificial intelligence is possible only with the participation of the entire civil society and all its spiritual institutions, which should be guided by norms on this issue." humanistic morality and the principles of social doctrine - the principles of the common good, social justice, subsidiarity, solidarity and dignity of the human person [21] ". Perhaps, because of

life as we know it, abilities of all cognitive AGI or ASI entities should remain at the level of synthetic singing of "Daisy Bell" for as long as possible, which is the first case of computer-synthesized voice on IBM 7094 computer from 1961, but also the motif of representation of ASI HAL 9000's regression in the Stanley Kubrick's film "2001: A Space Odyssey", where the only surviving astronaut sequentially shuts down outlaw software, and as the fewer of its functions are active, HAL regresses to the most basic functions, all the way to his first memory, a song his instructor taught him in the very beginning.

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Petri Net-Based Model of Peer-to-Peer Dataset Replication in Big Data

Ilija Hristoski[1], Tome Dimovski[2]

[1]Faculty of Economics – Prilep, St Kliment Ohridski University – Bitola, Prilep, North Macedonia
[2]Faculty of Information and Communication Technologies, St Kliment Ohridski University – Bitola, Bitola, North Macedonia

[1]ilija.hristoski@uklo.edu.mk, [2]tome.dimovski@uklo.edu.mk

Abstract—**In the contemporary business landscape, the Big Data paradigm helps companies harness their abundant data in their ever-lasting pursuit for new opportunities. Keeping Big Data infrastructure highly performant, scalable, dependable, and available is the key challenge such companies face with. All of these aspects are usually addressed by deploying fault-tolerant systems. Dataset replication is just one of the crucial operations that has to be carried out regularly to improve system resilience. The paper aims at proposing performance models of the execution of reading and writing operations found in one of the main architectures involved in dataset replication: the Peer-to-Peer architecture, based on the utilization of the class of Generalized Stochastic Petri Nets. Such models can be utilized for simulation purposes to obtain various performance metrics vis-à-vis different working scenarios including different input parameters.**

Keywords – Big Data infrastructure, P2P dataset replication, read/write operations, performance modeling, Generalized Stochastic Petri Nets

I. INTRODUCTION

The rising popularity of large-scale applications, such as social networking, the Internet of Things, and scientific research, has resulted in a speedy production of massive amounts of data belonging to various categories. Turning 'Big Data' into highly valuable insights, actions and outcomes is a key premise to better decision making, more effective customer engagement, sharper competitive edge, hyper-efficient operations, as well as compelling product and service development. Because such data is diverse and distributed on a wide scale, managing it efficiently represents a considerable problem. Attaining adequate data availability raises serious challenges to companies that have adopted the Big Data paradigm. Nonetheless, providing high-performance levels, i.e. timely responses to read/write queries against ever-increasing data volumes, became of utmost importance and priority in the Big Data world. In this context, the process of storing the same data in multiple locations, known as 'data replication', allows for increased data availability and accessibility, reduced data access costs, and improved fault tolerance. It also improves Big Data systems' resilience and reliability. All of these have become, *de facto*, a must-have for successful digital transformation in a global economy.

Realizing the importance of the concept of dataset replication in today's business environment, in this paper, we develop and present performance models of the execution of the READ and the WRITE requests in Peer-to-Peer (P2P) dataset replicated architecture with two nodes/peers, based on the class of Generalized Stochastic Petri Nets (GSPNs).

The paper is structured as follows. Section II briefly overviews the recent research made on this topic. Section III elaborates the notion of dataset replication. The class of GSPNs is explained in Section IV. Section V introduces GSPN sub-models depicting the processing of both the READ and the WRITE requests in a P2P dataset replicated architecture with two nodes/peers. The related discussion is subject to Section VI. The last section concludes.

II. Related Research

Since their emergence in the late '90s of the XX century, various classes of stochastic Petri nets have been regularly utilized for performance analysis of replicated systems. Lately, those classes of PNs are being used for modeling and evaluation of Big Data systems' infrastructural and architectural components. What follows is a brief overview of the related research.

A Stochastic Petri Net model of a replicated file system in a distributed environment, where replicated files reside on different hosts and a voting algorithm is used to maintain consistency, as described in [1].

Reference [2] focuses on the implementation and evaluation of Petri Net-based formal models of execution of various operations performed on data within the Big Data paradigm, including replication, through the newly introduced concept of Active Data programming model, which allows code execution at each stage of the data life cycle.

Some of the recent studies that have been carried out have been focused on HDFS, the main component of Hadoop, which provides a Big Data storage service, where data is reliably kept in a distributed fashion on different servers. In one such study, the development of a mathematical model, aimed at representing the storage service activities of HDFS and formulating its dependability attributes, has been proposed, based on the utilization of Stochastic Petri Nets. Such a model accurately quantifies two important dependability metrics – reliability and availability of HDFS [3].

Reference [4] discusses the adoption of Petri Nets (PNs) in creating a visual model of the MapReduce framework to analyze its reachability property, by presenting a real big data analysis system to demonstrate the feasibility of the proposed PN model. The model is then used to describe the internal procedure of the MapReduce framework in detail, to list common errors, and to propose an error prevention mechanism.

Recognizing the fact that data replication is not only a costly process but also a wastage of energy resources, Rizwan Ali et al. have applied the class of Colored Petri Nets (CPNs) for both modeling and analysis, to address resource utilization issues of CAROM, a hybrid file system [5].

III. Peer-to-Peer Dataset Replication

A plethora of novel storage strategies and technologies have been invented to achieve efficient, cost-effective, and highly scalable storage solutions, due to the necessity to store large Big Data datasets, often in multiple copies. The term 'Big Data storage' refers to the infrastructure that is designed specifically to store, manage and retrieve massive amounts of data in such a way that data can easily be accessed, used, and processed by Big Data applications and services. It is a compute-and-storage architecture that can be used to collect and manage huge-scale datasets and perform real-time data analytics. To fulfill its purpose, Big Data storage primarily supports storage and input/output (read/write) operations on storage with a very large number of data files and objects.

One of the underlying mechanisms behind Big Data storage technology is dataset replication. Reference [6] points out that "replication stores multiple copies of a dataset, known as replicas, on multiple nodes." It provides high scalability and availability because "the same data is replicated on various nodes." The achieved data redundancy ensures that data cannot be lost when a single node fails, i.e. replication ensures fault tolerance of the Big Data infrastructure and therefore it significantly improves system resilience and reliability.

In this paper, we put the focus on Peer-to-Peer (P2P) dataset replication, an alternative method to Master/Slave dataset replication. With P2P replication, all nodes operate at the same level. Each node, known as a peer, is equally capable of handling both READ and WRITE requests. However, each write is copied to all peers simultaneously, whilst data is read from just one peer, no matter which one, as portrayed in Fig. 1 [6].

In Fig. 1, the load balancer is distributing users' WRITE requests evenly between the two nodes/peers. WRITE requests refer to the insertion, update, and delete operations on the Big Data dataset, held within identical replicas across all nodes.

There are two common approaches in deploying P2P replication. According to the first one, which does not include a load balancer, each single WRITE request is being simultaneously sent to and carried out on all nodes. According to the second approach, which includes a load

balancer, the WRITE request is first being processed solely on one of the nodes (e.g. Node #1), and then, after the replication occurs among the nodes, the dataset residing on Node #2 gets updated, and Replica B becomes identical to Replica A.

In both approaches, users' READ requests are being also distributed evenly across peers through the process of load balancing. In this case, the read operation is being carried out using any of the nodes, under the assumption that each of them maintains updated and identical datasets.

It should be notified that P2P replication is susceptible to write inconsistencies, which can occur as a result of the late concurrent propagation of updates of the same data across numerous peers. This issue, however, can be addressed by implementing either a pessimistic or an optimistic concurrency strategy [6].
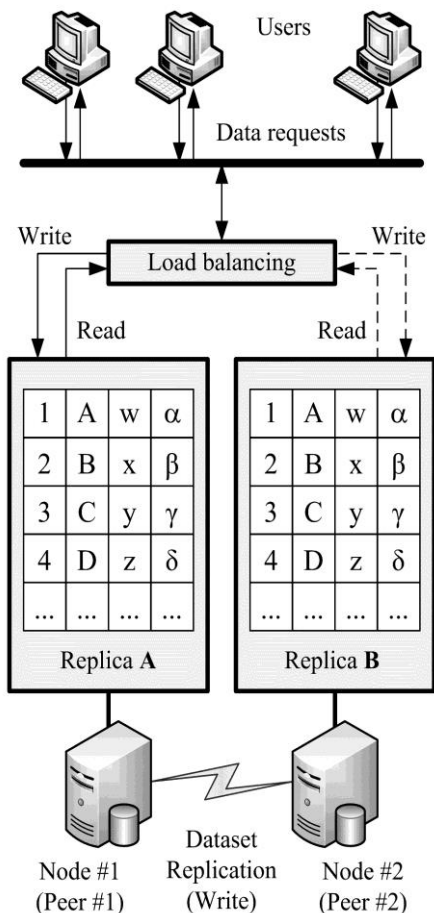
Figure 1.   Schematic representation of a P2P dataset replication using two peers and load balancing.

IV.   GENERALIZED STOCHASTIC PETRI NETS

The class of Generalized Stochastic Petri Nets (GSPNs), which belongs to the family of Markovian stochastic Petri Nets, has been widely utilized for performance and reliability modeling and evaluation of complex distributed systems (manufacturing systems, multiprocessor systems, control systems, communication protocols, organizational activities, hardware and software systems, etc.), showing non-deterministic behavior. GSPNs are a graphical tool intended for formal description of discrete-event dynamic systems that exhibit characteristics of concurrency, synchronization, parallelism, mutual exclusion, blocking, and conflict, as well as a mathematical tool, aimed at carrying out advanced formal analysis [7,8].

GSPNs represent bipartite graphs, consisting of two classes of nodes (places and transitions), as well as directed arcs connecting particular nodes. They utilize two types of transitions: (a) exponentially distributed timed transitions, drawn as thick empty bars, used for modeling of random delays associated with the execution of activities, and (b) immediate transitions, drawn as thin black-colored bars, used for representing logical actions that do not consume time. The latter ones allow for the modeling of branching probabilities that are independent of timing specifications. In general, transitions represent events. An event occurs when the corresponding transition fires. Besides transitions, a GSPN model also includes places, drawn as non-colored circles, which represent conditions. Tokens, drawn as small black-colored circles, are always put into places; they circulate throughout the GSPN model by moving from a place to a place when transitions fire, thus denoting conditions holding at any given time. Directed arcs, which are drawn from places to transitions, and from transitions to places, are used to indicate which combination of conditions must hold for an event to occur (i.e. a transition to fire), and which combination of conditions holds after the event occurs. Each arc also has a multiplicity/weight value that indicates the number of tokens required from a source place, or the number of tokens provided to a target place. A transition fires only if it is enabled, i.e. if all of its input places contain at least one token. Depending on the multiplicity of input and output arcs attached to a transition, firing it removes at least one token from each input place, and puts at least one token into each output place it is connected to. This is equivalent to an event

that is enabled by a combination of conditions. GSPN models also support the usage of inhibitor arcs, which are always drawn from places to transitions, and end with a small circle, meaning that the transition is disabled when its input place is marked with at least one token. Any distribution of tokens over the places in a GSPN model represents a specific configuration, known as a marking. The markings in a GSPN model in which only exponential transitions are enabled are known as tangible markings. All other markings are vanishing markings, which specify logical changes in the modeled system.

The performance evaluation of the analyzed system using GSPNs includes the following four stages: (1) Modeling the observed system using a GSPN; (2) Generating the reachability graph/tree through a marking process; (3) Computing the steady-state probability distribution by solving the resulting reachability graph as a Markov chain; (4) Obtaining the required performance measures from the steady-state probabilities.

V. GSPN-BASED MODELS OF READ/WRITE OPERATIONS IN P2P DATASET REPLICATION

Having minded the famous quote attributed to the prominent British statistician George E. P. Box, stating that "all models are wrong but some models are useful." we present two GSPN-based models in the subsequent sections. Both models refer to the P2P dataset replication architecture with two nodes/peers. The first one portrays the execution of a single WRITE request, whilst the second one models the execution of a single READ request. In both models, a 'Round Robin' load-balancing scheme of the incoming requests is being implemented.

A. Processing of WRITE requests: the model

Fig. 2 shows the GSPN model of the execution of a single WRITE request. The firing of the exponential transition $T\_write\_request$, which occurs with a rate of $\lambda_{WRITE\_REQUESTS}$, sends the WRITE request to the load balancer (a token in the place $P\_write\_request$). After Node #1 (Peer #1) is being selected to process the request (a token in the place $P\_n1\_selected$), the processing of the WRITE request can start only if Node #1 is idle (a token in the place P_n1_idle). The time needed to process the WRITE request is exponentially distributed and its mean equals $1/\mu_{WRITE}$. After processing the WRITE request by Node #1 (a token in the place

$P\_n1\_write\_end$), a token is being put into the place P_n2_start, to process the same WRITE request on the peering dataset. At the same time, the firing of the immediate transition $T\_replicate\_to\_n2$ also puts a token into the place $P\_n1\_to\_n2$, which indicates that the processing that is going to happen on Node #2 is a result of a replication process, not a result of the initial processing of a WRITE request coming directly from the load balancer. The replication, i.e. the processing of the WRITE request coming from Node #1 on Node #2 occurs only if Node #2 is idle (a token in the place P_n2_idle). The dataset residing on Node #2 is being updated by the firing of the exponential transition T_n2_write, which fires with a rate of μ_{WRITE}. This puts a token in the place $P\_n2\_write\_end$, which is an input place for two immediate transitions. The first one is transition $T\_do\_not\_replicate\_to\_n1$, which becomes enabled as soon as there is a token in the place $P\_n1\_to\_n2$. The firing of this transition means that the dataset residing on Node #1 has been replicated to Node #2 (a token in the place $P\_n1\_replicated$). The second immediate transition, to which the place $P\_n2\_write\_end$ represents an input place, is $T\_replicate\_to\_n1$, which becomes enabled if there is no token in the place $P\_n1\_to\_n2$, due to the inhibitor arc originating from this place. The firing of the enabled immediate transition $T\_replicate\_to\_n1$ means that the WRITE request has been previously processed for the first time by Node #2 and it is sent to Node #1 to be processed for dataset updating purposes, i.e. replication. It can happen only if Node #1 is idle, i.e. if there is a token in the place P_n1_idle.

The inclusion of the GSPN segment resembling the load balancer in the model shown in Fig. 1, albeit unnecessary, is made just for consistency and completeness reasons because the modeled system shows the processing of a single WRITE request.

B. Processing of READ requests: the model

The execution of a single READ request is being described by the GSPN model, portrayed in Fig. 3. The firing of the exponential transition $T\_read\_request$, which occurs with a rate of $\lambda_{READ\_REQUESTS}$, sends the READ request to the load balancer (a token in the place $P\_read\_request$). Initially, Node #1 is being selected for its processing.
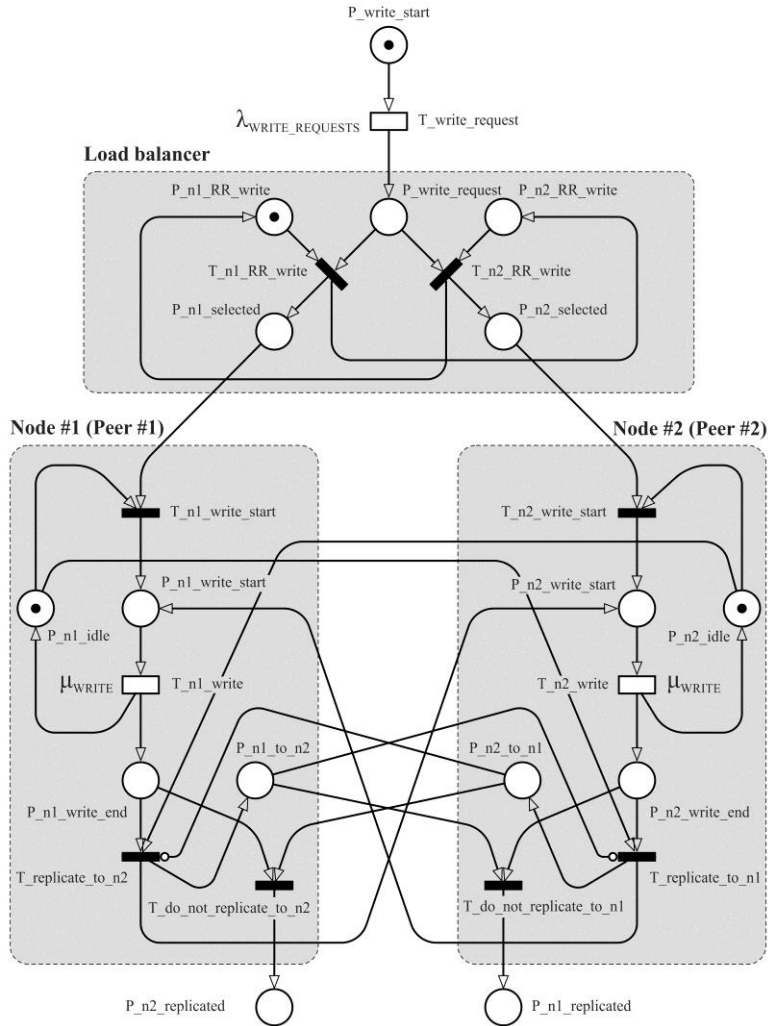
Figure 2. GSPN model of the processing of a single WRITE request in a P2P replicated architecture with two nodes.

Before execution of the reading operation, the searching operation upon data that need to be read is being carried out on the dataset stored within Node #1, i.e. a token in the place *P_n1_search_start* is being put if the Node #1 is idle (a token in the place *P_n1_idle*). The firing of the exponential transition *T_n1_search* occurs with a rate of μ_{SEARCH}, which puts a token back to the place *P_n1_idle*, and also puts a token into the place *P_n1_search_end*. The outcome of the searching operation can be twofold: (a) either the searched data has been found (immediate transition *T_n1_found* becomes enabled, and fires with a probability of p_{FOUND}), or (b) the searched data has not been found (immediate transition *T_n1_not_found*

becomes enabled, and fires with a probability of $1 - p_{FOUND}$). If the latter one happens, a token will be put in the place *P_n1_not_found1*. However, if the immediate transition *T_n1_found* fires, the reading operation starts (a token in the place *P_n1_read_start* enables the exponential transition *T_n1_read*). The reading of data lasts, on average, $1/\mu_{READ}$ units of time. After the exponential transition *T_n1_read* fires, a token is being put in the place *P_n1_read_end*. In this particular case, the immediate transition *T_OR1* becomes enabled, since there are no tokens in the place *P_n2_not_found2* (i.e. the READ request has not been processed by Node #2).

195
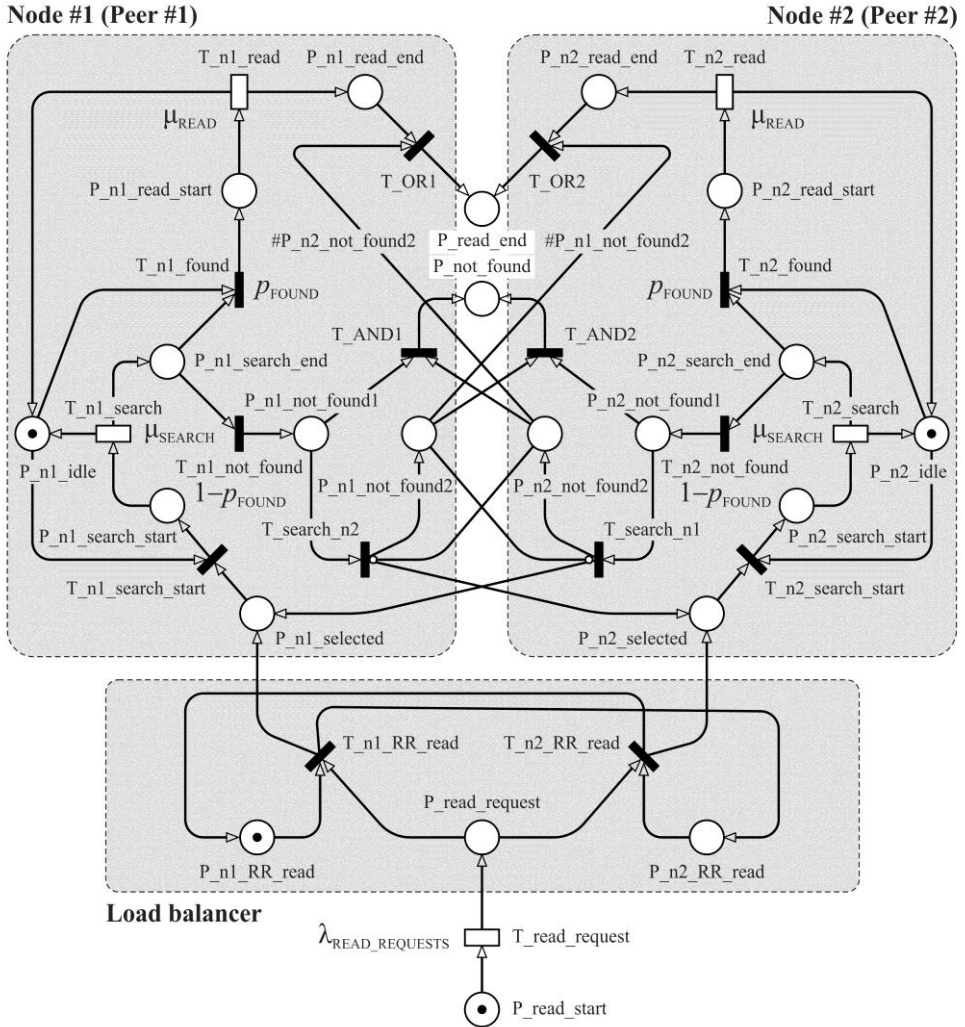
Figure 3. GSPN model of the processing of a single READ request in a P2P replicated architecture with two nodes.

Note that the arc originating from this place to transition *T_OR1* has a multiplicity of *#P_n2_not_found2*, i.e. it is equal to the number of tokens currently present in the place *P_n2_not_found2*. The firing of the immediate transition *T_OR1* puts a token into the terminal place *P_read_end*.

If the searched data is not found in the dataset residing on Node #1, the searching operation is being executed on the dataset residing on Node #2, because the READ request can be processed by any peer. This is accomplished by the firing of the immediate transition *T_search_n2*, which takes the token out from the place *P_n1_not_found1* and puts it into the place *P_n2_selected*. This transition is

being enabled due to the existence of an inhibitor arc coming from the place *P_n2_not_found2*, and due to the absence of a token in this place, meaning that the search operation has not been carried out on Node #2 yet.

Given a token in the place *P_n2_selected*, the immediate transition *T_n2_search_start* fires, but only if Node #2 is idle (a token in the place *P_n2_idle*). The firing of this transition puts a token into the place *P_n2_search_start*, which enables the exponential transition *T_n2_search*. It fires with a rate of μ_{SEARCH} and puts a token into the place *P_n2_search_end*. Now two immediate transitions become concurrently enabled: the transition *T_n2_found* (meaning that the searched data has not been

found within the dataset held in Node #2) and the transition $T\_n2\_not\_found$. The first one fires with a probability of p_{FOUND}, and the latter one with a probability of $1 - p_{FOUND}$.

If the searched data is found on Node #2, the reading operation starts by placing a token into the place $P\_n2\_read\_start$, which enables the exponential transition T_n2_read, but only if the Node #2 is idle at that moment (a token in the place P_n2_idle). After $1/\mu_{READ}$ units of time, the exponential transition T_n2_read fires and puts a token into the place $P\_n2\_read\_end$. Because there is already a token residing in the place $P\_n1\_not\_found2$ (the reading operation failed on Node #1 because the searched data were not found), the immediate transition T_OR2 becomes enabled and immediately fires, by putting a token into the terminal place P_read_end.

On the other hand, if the searched data is not found on Node #2 (a token in the place $P\_n2\_not\_found1$), after it was not found also on Node #1 (a token in the place $P\_n1\_not\_found2$), the immediate transition T_AND2 becomes enabled and fires, by taking out the tokens from both previously mentioned places and by putting a token in the terminal place P_not_found. Note that, given a token in the place $P\_n2\_not\_found1$, the immediate transition T_search_n1 remains disabled, because of the existence of an inhibitor arc originating from the place $P\_n1\_not\_found2$, which already contains a token (the searched data was not found in the dataset residing on Node #1).

VI. DISCUSSION

The GSPN sub-model related to the processing of the WRITE request contains a single starting place (P_write_start) and two terminal places ($P\_n1\_replicated$ and $P\_n2\_replicated$). A token in the place $P\_n1\_replicated$ means that the writing operation has been initially executed on Node #1 and afterward the WRITE request has been also processed on Node #2 so that both dataset replicas become identical. In the same manner, a token in the place $P\_n2\_replicated$ means that the writing operation has been initially executed on Node #2, and subsequently the WRITE request has been also processed by Node #1 so that both dataset replicas become identical. It should be also notified that this particular sub-model does not include/model the operation of

accessing the dataset before the execution of the writing operation, for simplicity purposes.

The GSPN sub-model related to the processing of a READ request contains a single starting place (P_read_start) and two terminal places (P_read_end and P_not_found). A token in the place P_read_end means that the READ request has been successfully addressed by either of the two peers, regardless of which one of them initially processed the request. On the other hand, a token in the place P_not_found means that none of the peers contain the searched data to be read in their replicated datasets, so none of them can successfully address the READ request.

The list of input parameters for both GSPN sub-models, as well as their meaning, is given in Table I.

The verification process of the two proposed GSPN sub-models, which includes structural analysis (estimation of the state-space, evaluation of traps and siphons, finding out P- and t-invariants), has been carried out using TimeNET 4.5 [9], but other dedicated software packages, such as PIPE 2 [10] and GreatSPN 2.0 [11] can be utilized for this purpose, as well. It proved that both sub-models are accurate and capture the intrinsic logic and behavior of the real P2P replicated system with two nodes. However, the validation process, which aims at proving the credibility of the sub-models, has yet to be performed, by comparing the results of the stationary and transient analysis against a real P2P replicated system with two nodes/peers.

TABLE I.   INPUT PARAMETERS.

Parameter	Meaning
$\lambda_{WRITE\_REQUESTS}$	WRITE requests' arrival rate
μ_{WRITE}	WRITE requests' processing rate
$\lambda_{READ\_REQUESTS}$	READ requests' arrival rate
μ_{SEARCH}	SEARCH operation processing rate
μ_{READ}	READ requests' processing rate
p_{FOUND}	Probability of finding the searched data during the execution of READ requests

The next process to be conducted is a performance analysis (both stationary and transient). The stationary analysis is particularly important, since it results in obtaining the steady-state probabilities of the modeled systems, either analytically, or by computer simulation.

Finally, both GSPN sub-models can be slightly modified and merged into a single model to capture the behavior of the P2P replicated system under simultaneous READ and WRITE requests. This could lead to a complex GSPN model in which the only common building elements should be the places *P_n1_idle* and *P_n2_idle*.

VII. CONCLUSION

The paper contributes towards the performance evaluation of Peer-to-Peer replicated architectures, often utilized within the Big Data paradigm, by presenting suitable GSPN-based models of the execution of the READ and WRITE requests. The proposed GSPN-based models of the two types of request can provide significant insights vis-à-vis the performance of the modeled system, by obtaining the following performance metrics for various operating scenarios: the average response time, the average queue lengths, the average number of the READ and WRITE requests waiting in queues to be processed by peers, peers' throughput as a function of requests' arrival rate, peers' utilization, etc.

In this particular case, there are three obvious limitations associated with GSPN modeling. The first one states that the hereby presented GSPN models do not allow for distinguishing among different types of WRITE requests (insertion, update, and delete operations), so if there is a need for their representation, each of them should be modeled by a distinct GSPN substructure, which would considerably increase the complexity of the overall GSPN model. Next, GSPNs do not allow for modeling other load balancing approaches, except the 'Round Robin' and the 'Ad Hoc' schemes. The third limitation refers to the fact that GSPN-based models of the READ and WRITE requests would become increasingly complex as the number of portrayed peers rise. The increased complexity of the GSPN model can incur computational intractability and an inability to successfully evaluate any performance metrics.

Future work will be directed towards a performance analysis of the proposed GSPN sub-models vis-à-vis various input parameters, i.e. various operating scenarios, and conveying a comparative analysis of the obtained results with those yielded by the performance analysis of corresponding GSPN-based sub-models representing the execution of the READ and WRITE requests within a Master/Slave replicated architecture.

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Public and Private Investments in Innovation Activities in Serbia

Ivana Petkovski[1]

[1]Mathematical Institute of the SANU, Belgrade, Serbia

[1]ivana993@turing.mi.sanu.ac.rs

Abstract—**Innovation is seen as a driving mechanism for the overall national development. It is the fundament of knowledge-based economy and a source of national competitiveness. In emerging economies, innovation is acknowledged as a process that establishes competitive advantage on the global market. Therefore, this research paper points out the importance of public and private investments in innovation activities in Serbia as a typical representative of emerging economy. The data used for evaluating the level of investments are gathered for the period from 2014 to 2021 and comprise a set of various variables such as public and private research and development (R&D) expenditures, information and communication technology (ICT) use, assessment of available ICT trainings for the employees and other. Methodological approach that is employed in the research is based on the Least Squares (LS) method of regression. The computational outcome proposes that firm investments and ICT use are entirely explained through integrated independent variables ($R^2=1$) while public support and finance report inferior result ($R^2=0.630$). For evaluating summary innovation index according to innovation investments, important element is investment in private sector ($R^2=0.476$). The emphasis is on encouraging larger investments in private and public sectors.**

Keywords - investments, research and development, ICT, least squares method

I. Introduction

Technological progress is closely associated with the development of ICT that is a result of continuous investment in R&D [1]. Innovation transformation, as an expected outcome of R&D activities, is an integral part of industry 4.0. It is a multidimensional process constrained by capabilities and knowledge possessed by human capital [2,3]. Human resources are also driving force of competitiveness in the era of 4.0 industry [4] that along with innovation transformation create triangular nexus. Industry 4.0 has the ability to shape market trends and dictate future demand for workforce skills. Therefore, development of ICT skills cannot be excluded when discussing innovation. The effects of 4.0 industry are already acknowledged. Modern business is more and more going towards performing online activities and ICT skills of employees are the top priority in managing human resources [5]. Firms are reporting difficulties in carrying out R&D department in their organizations. Government's have different approaches towards this challenge but the most frequent mechanism they use to increase firm's R&D investment is through regulating tax incentives [6].

Worldwide economies define their overall development strategies for gaining competitive advantage based on technological innovations [7]. The same strategic model is used in firms that frequently implement innovation strategies to allow them to gain competitiveness on the market [8]. Based on this connection, any type of cooperation between public institutions and private sector is appreciated to facilitate defined innovation path [9]. There is even initiative to formalize rewards for successful public-private partnership that could stimulate arise of future cooperation [10]. However, an essential issue emerges in developing economies that is related to available resources to finance innovation development [11]. Innovative startups are usually financed by private equity that investors

provide in the form of venture capital (VC). [12] discover that VC is, in most of the cases, a preferable financial solution than bank credits because it is agile with business environment. However, emerging economies are characterized by high investment risk due to uncertain markets and therefore a lack of VC.

Since innovation development in emerging countries tackles delicate questions, the research aim of this study is to analyze the framework of innovation investment in Serbia in the light of the latest EIS report. The expected contribution to the literature is found in discovering gaps in the national innovation investment practice and providing comprehensive answers to challenges that emerge. The analysis is completed using Least Squares method for creating regression model.

II. RESEARCH DATA

Investing in innovation activities is a broad concept and it requires addressing that research question from various perspectives. For this study, research framework has been adjusted from the European innovation scoreboard (EIS) [13]. EIS represents annual summary innovation performance of EU and several non-EU countries and it is used to trace innovation trends. The outcome of the EIS report is expressed as summary innovation index. The latest EIS report on innovation index includes 38 economies and among them ranks Balkan countries with the following scores presented in Table I. Ranking list puts Slovenia in front of the Balkan's countries, followed by Croatia and Serbia that achieve similar results. The rest of the Balkan countries are placed at the bottom of the list, among them are two EU member states. The current report highlights poor innovation performances of countries in this part of Europe.

EIS is, in one part of the report, addressing the question of innovation investments that is the major concern of this study. Relevant dataset is adopted from the EIS that, in briefly explained, represents the calculated scores of individually collected values of a set of indicators for each country. More about EIS computational procedure can be found at [14].

In order to acquire valuable knowledge about investment practice in Serbia, EIS data have been collected for Serbia in the timespan that covers 2014-2021.

TABLE I. EIS SUMMARY INNOVATION RANK OF BALKAN COUNTRIES IN 2021.

Country	Score	Rank
Slovenia	100.49	20
Croatia	78.22	26
Serbia	74.52	28
Montenegro	53.74	33
Bulgaria	50.06	34
North Macedonia	47.1	35
Bosnia and Herzegovina	38.97	36
Romania	35.09	37

TABLE II. STRUCTURE OF INVESTIGATED INDICATORS.

Indicator name	Label
Finance and support	Y_1
R&D expenditure in the public sector	X_1
Venture capital expenditures	X_2
Direct government funding and government tax support for business R&D	X_3
Firm investments	Y_2
R&D expenditure in the business sector	X_4
Non-R&D innovation expenditures	X_5
Innovation expenditures per person employed in innovation- active enterprises	X_6
Use of information technologies (IT)	Y_3
Enterprises providing training to develop or upgrade ICT skills of their personnel	X_7
Employed ICT specialists	X_8

Total list of the analyzed indicators in this paper is reported in Table II.

Total innovation investments have been divided into two major categories. The first category considers public investments that are defined as R&D expenditures in the public sector and other relevant indicators. The second category observes private investments defined as R&D expenditures in business sector and additional important indicators. Additional category for evaluating investments in innovation is interpreted using information and communication technology that is naturally imposed since the extended use of ICT is an integral part of innovation progress and by available ICT trainings for employees.

Theoretical explanation of the considered indicators is obtained from EIS report [13] and follows below:

1. R&D expenditure in the public sector - the share of R&D expenditures in Gross Domestic Product.
2. Venture capital expenditure - the amount of private equity designed for

200

investments in business, especially hi-tech startups.

3. Direct government funding and government tax support for business R&D - direct R&D funding through grants and procurements and indirect R&D funding through the tax system.
4. R&D expenditure in the business sector - the share of business expenditures for R&D activities in Gross Domestic Product.
5. Non-R&D innovation expenditures - non-R&D expenditures as a percentage of the firm's total turnover.
6. Innovation expenditures per person employed in innovation- active enterprises - innovation expenditures per employee in innovation related firms.
7. Enterprises providing training to develop or upgrade ICT skills of their personnel - the number of firms that provide any kind of ICT trainings for their employees.
8. Employed ICT specialists - the number of employees in a firm that are ICT specialists.

Methodology that is used to calculate inner relationship among variables is based on the Least squares (LS) method. The fundament for LS is regression analysis. The least square method is used to find or estimate the values of parameters by minimizing the sum of squares among the realized values and model values [15]. In other words, it is a procedure for finding the best fit line to data [16]. In this paper, an ordinary LS method is used. Analysis was conducted in the eViews 9 software environment.
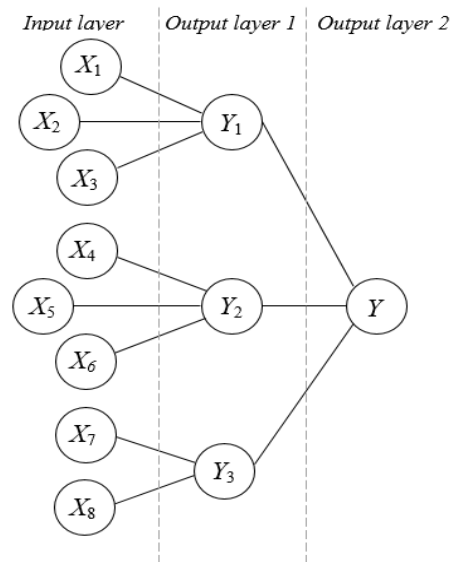
Figure 1.   Structural model.

Fig. 1 illustrates structural model that is incorporated in the study. The hierarchy is established on three levels. First level covers indicators that explain public, private investments and ICT, and is denoted as the input layer. The second layer is the outcome of the first layer and together with the input layer, it establishes second output layer. The second output layer explains overall national investment practice.

Comparative analysis of the outcome scores of each category in relation to individual input variables is illustrated in the Fig. 2. Graphical representation provides insights about the significant variables that attain high scores in establishing national investment framework in innovation. Besides, comparison outcome discovers individual indicators and categories that have poor performance in relation to other parts of the investment structure. In the case of Serbia, there is a gap between needed and available VC (Fig. 2(a)).
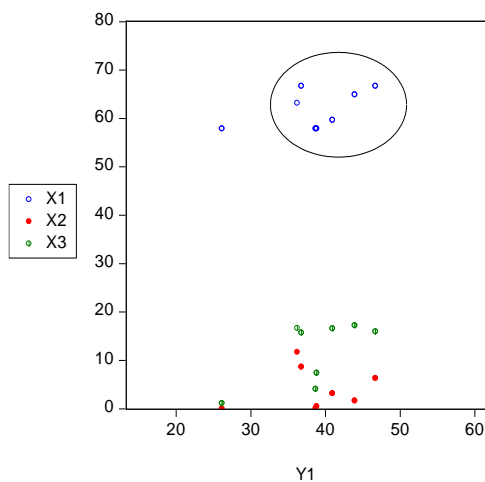
a) Comparative results of finance and support with the variables X_1, X_2 and X_3.
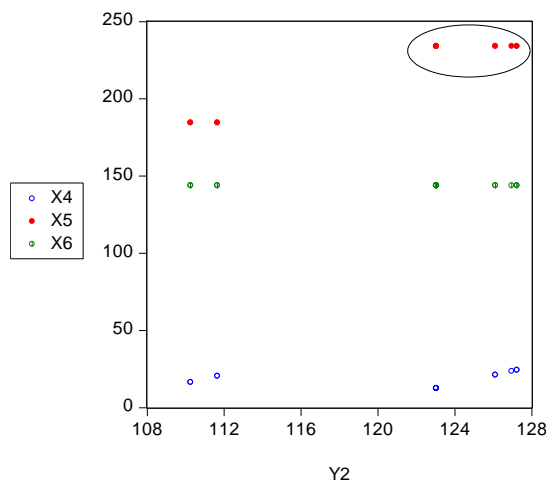
b) Comparative results of firm investments with the variables X_4, X_5 and X_6.
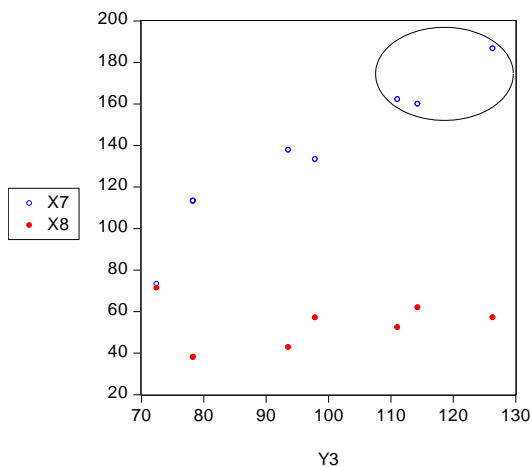
c) Comparative results of use of ICT with the variables X_7 and X_8.

Figure 2.   Comparative relationship between input and output variables.

Important descriptive statistic outcome is reported in Table III. The highest evaluation score is identified in the firm investments category for non-R&D innovation expenditures (≈222) and is followed by innovation expenditures that firms achieve towards employees (≈144). Innovation expenditures per employed person in innovation- active enterprises have rigid character for the observed period. Lower investments results are recorded in the public sector especially in the area of VC (≈4) and direct government funding and tax support (≈12). Moreover, great results are achieved in terms of providing ICT trainings for personnel (≈135).

TABLE III. DESCRIPTIVE STATISTICS.

	R&D expenditure in the public sector	Venture capital expenditures	Direct government funding and government tax support for business R&D	R&D expenditure in the business sector	Non-R&D innovation expenditures	Innovation expenditures per person employed in innovation- active enterprises	Enterprises providing training to develop or upgrade ICT skills of their personnel	Employed ICT specialists
Mean	61.841	3.988	11.822	18.012	221.765	143.970	134.998	52.381
Median	61.405	2.410	15.815	18.505	234.170	143.970	135.555	54.760
Maximum	66.670	11.690	17.210	24.410	234.170	143.970	186.670	71.430
Minimum	57.890	0.000	1.100	12.600	184.550	143.970	73.330	38.100
Std. Dev.	3.953	4.417	6.568	5.056	22.969	0.00	35.433	11.936
Skewness	0.150	0.683	-0.693	0.009	-1.154	NA	-0.278	0.116
Kurtosis	1.291	2.017	1.725	1.345	2.333	NA	2.379	1.868
Jarque-Bera	1.002	0.944	1.183	0.912	1.925	NA	0.231	0.444
Sum Sq. Dev.	109.428	136.581	301.985	179.011	3693.217	0.000	8788.601	997.315
Observations	8	8	8	8	8	8	8	8

III. RESULTS AND DISCUSSION

The most important findings discovered by Least Squares computational outcome are illustrated in the Fig. 3. The illustration constitutes three layers, coefficient values (β_i) and coefficient of determination (R_i^2). The figure is reporting four different LS regressions with significance level in allowed limits ($p<0.05$) meaning that all LS equations are statistically valid.

First LS regression equation (Y_i) express public finance and support and is established based on three major variables ($\beta_1 = 0.530$ $\beta_2 = -0.938$; $\beta_3 = 0.800$). The strongest effect is related to expenditures is the form of VC (X_2) with extremely high negative coefficient value. VC as a source of business funding is the lowest evaluated category in the EIS list and as such, it requires additional attention. Consequently, low scores are detected as influential in LS regression outcome. In general, negative bond reflects the lack of financial resources that are used for venture investments. Financial shortage is caused by severe problems. The most important is undeveloped national capital market with notable gap in the number of investment funds. The concept of VC is not common in the domestic market. So far, domestic investment institutions do not provide

this form of capital to the capital market. As a reaction, startups that should be innovation leaders have reduced financial channels and are constrained to find other ways to support their business. Another problem that follows this type of investments usually appears as uncertainty of investors for investing in new ideas, technology or products. This is especially noticeably in high-tech firms that operate in emerging economy and are confronted with high investment risk therefore are vulnerable to economic uncertainty [10]. Such investments are risky; often fail to triumph on the market and investors address those challenges as a major problem in making investment decision. The second important variable is associated with direct government funding and tax support for business R&D (X_3). This relationship discovers significant impact of direct and indirect government's financial allocations towards developing innovation activities where any increase in financial allocation leads to better innovation results. Direct government's funding can increase R&D investments and employees in this department [17]. Authors [18] argue that providing optimal taxes and subsidies can lead to innovation growth. Third variable is associated with R&D expenditures (X_1) that government provides for innovation development in universities and research organizations. Connection between government and scientific

Input layer   Output layer 1   Output layer 2
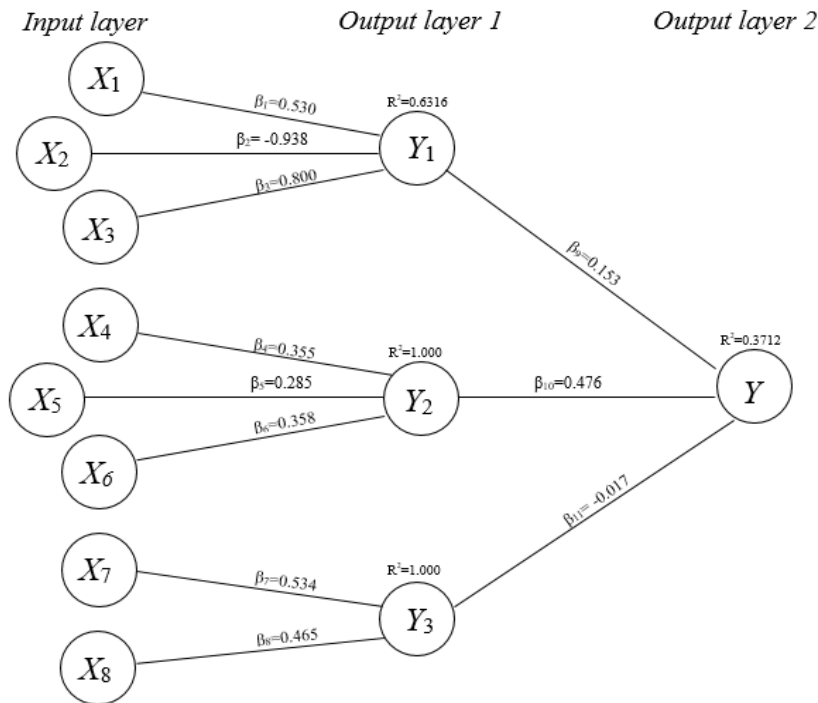
Level of significance p<0.05.

Figure 3. Computational outcome of the Least Squares method.

institutions is the fundament for reaching national innovation strategy. Investments in education and knowledge are driving force for creating knowledge-based economy. In turn, knowledge-based economy is a source of economic, technological and social prosperity. In 2020, national R&D expenditure was 0.91% of GDP, with 335 active R&D organizations. Almost a third of them works in the field of engineering and technology [19]. The results of the LS equation depict the realized financial allocation by the authority that was minor in the previous year. Future strategic development of innovation activities has to be associated with budget expansion.

The second LS regression (Y_2) is constructed with three independent variables with similar coefficients values ($\beta_4 = 0.355$; $\beta_5 = 0.285$; $\beta_6 = 0.358$) and it represents private investments in innovation. Reported coefficients in the LS equation imply that three of them are almost equally important for constituting the idea about firm innovation investments in Serbia. In other words, all innovation (X_5) and non-R&D innovation expenditures (X_6) strongly associate

with innovation development in private sector. Private sector is characterized by high investments into new equipment, patents and licenses that is a good indicator of further growth of innovation activities. However, firms do not engage enough in R&D. That is shown by the EIS results. Private sector in Serbia is characterized by large share of foreign investors and firm's owners who outsource their production in Serbia but all managerial tasks, including R&D perform in their homeland where they enjoy regulated innovation framework. Because of that practice, innovation environment in private sector is in slowdown.

Third LS regression equation (Y_3) that stands for the use of IT gives a little advantage of conducting IT trainings for employees ($\beta_7 = 0.534$) in regard to the number of employed IT specialists ($\beta_8 = 0.465$). Both variables are recognized as potential for developing IT image in Serbia. Firms that provide possibility for their employees to attend ICT trainings, tend to invest in intangible human capital. They acknowledge the need to invest in know-how that is a source of innovation and

competitiveness [20]. Human resources are valuable part of every firm. In order to become innovative, firms must establish innovation culture and provide their employees enough opportunities to acquire formal and informal knowledge. This implies to both public and private sector, because innovation is beneficial in public institutions to motivate employees to enhance their performance and creativity [21]. EIS results discover lower score in the domain of number of employed ICT specialists. This issue can be explained by a vast number of working-age population that form own companies to provide IT services in domestic and foreign markets. This group, so called "freelancers", engages in entrepreneurship activities.

Furthermore, overall innovation index in the country is assessed by the fourth LS regression (Y). The lower coefficient of determination ($\beta^2 = 0.3712$) is expected since it is the result only formed on the basis of public and private investments and the use of IT. The concept of innovation is much broader. The findings provide knowledge about private innovation investments ($\beta_{10} = 0.476$) as more important than other two innovation investment categories ($\beta_9 = 0.153; \beta_{11} = -0.017$). In this case, the use of IT has generally low impact on summary innovation index. The LS outcome puts forward the importance of R&D support in the business area. The core of innovation development emerges in expanded share of public expenditures for R&D followed by arranged tax regulation, and attraction of private sector to invest in R&D activities.

The results of information criteria for LS model selection on the basis of Akaike info, Schwarz and Hannan-Quinn criterion are given in Table IV.

TABLE IV. COMPUTATIONAL OUTCOME OF VARIOUS CRITERIA.

Dependent variable	Criterion		
	Akaike info	Schwarz	Hannan-Quinn
Finance and support	6.084	6.114	5.883
Firm investments	-11.256	-11.226	-11.456
Use of IT	-8.134	-8.114	-8.268

IV. CONCLUSION

Research results offer several conclusions that refer to public and private investment practice in Serbia and development of ICT.

From the investment perspective, the general problem in Serbia is lack of available funds for financing innovation activities and projects. Initial consideration of public investments in innovation activities is to propose measures to improve investments in the form of VC. In that way, measures should be focused towards raising awareness of target population that is ready to invest in business to allocate their financial resources in innovation activities. Except promoting investments in innovation activities government should work on developing innovation climate at the national level and providing adequate work environment for innovators. Authority should reconsider providing additional financing to firms that have great innovation capabilities. It could be in the form of innovation subsidies that can support innovation growth. In order to establish convenient innovation atmosphere more direct R&D funding should be available for researchers.

In addition, government's financial allocations gathered for developing R&D activities are not enough. The results of the EIS report indicate the gap in the fiscal policy when it comes to the tax incentives in the R&D area. The most efficient way to attract more innovators is to regulate fiscal policy with the aim to provide tax incentives. Authority should provide legal framework for empowering participants at the financial market to provide financial investments in the form of venture fund. In that way, the government can empower startups to realize their ideas by securing positive innovation environment with suitable policy framework and available funds. The most significant challenge in the private domain in transition to innovation-driven firm is modest investment in R&D sector. Management should ensure more development possibilities for R&D department.

In general, three major conditions must be fulfilled if a nation/institution/firm wants to reach out competitive advantage established on innovation. First, to insure enough available financial resources to pursue market trends. Second, to follow digital trends and prepare employees through ICT trainings to act on the market. Third, to be open for innovations. Moreover, Balkan countries with focus on

Serbia, achieve lower innovation performances in relation to other EU member states. Future development of innovation builds upon healthy innovation environment that requires additional financial, political and human resources than the current state.

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Factors Affect the Timeliness of the Annual Financial Reporting: An Empirical Study on the Firms Listed in Amman Stock Exchange

Noor Ahmad Mahmood Alkhudierat[1]

[1]University of Sopron, Alexandre Lamfalussy Faculty of Economics, Sopron, Hungary

[1]Nasha.kh@gmail.com

Abstract—**This study aims to investigate the factors that may lead to delaying the issuance of financial statements in Jordanian industrial companies. A sample of 40 industrial companies listed on the Amman Stock Exchange for the fiscal year 2019 has been selected to achieve the objective of the study. The results concluded that the factors of the company's size and profitability, in addition to the debt ratio, affect the timing of issuing the financial statements. On the other hand, the results did not indicate an impact on the quality of auditing and internal control on the timing of issuance.**

Keywords - financial reporting, auditing report, timeliness, stock exchange, Audit delay

I. INTRODUCTION

Accounting reports are the main source of information used as an important tool in decision-making by all parties with an interest in the accounting entity (such as shareholders, investors, lenders, and relevant government agencies). Published financial statements, where it is considered as the final output of the accounting treatment process, which gives the summarized assessment of the financial and accounting performance of the company during a specified period. Either within a fiscal year or a calendar year, also the financial statements display the financial position of the company and the actual cash position in the company's fund, which are used mainly by stakeholders such as lenders and investors [1].

Administrative behavioral dimensions to the process of financial measurement and disclosure have emerged by taking many different accounting procedures and methods that will affect the accuracy of the information announced in the financial reports and affect the reliability of it in making decisions, in addition to taking accounting procedures that lead to reducing the fluctuations that occur In companies' returns from one period to another, and to ensure obtaining the best-expected results to reduce the impact of economic fluctuations and the circumstances surrounding the company on its financial results and in line with the management's objectives [2].

The case of the timing of issuing the financial statements is a subject that carries many controversies, as some legislations and laws specify the dates of issuing and publishing financial statements in public, as all companies registered in the financial market are required to submit their reports to the Securities Depository Authority, during the period between 1/1 and 31/3, companies vary in terms of the dates of issuing the financial statements. We find that there are companies that used to submit their financial statements immediately after the end of the fiscal year, while many companies delay this issuance for several factors and reasons that may vary as the size of the company can affect that matter, as the large size of the company necessarily means the multiplicity and enormity of its dealings, which leads to an increase in accounting treatment and internal auditing, in addition to its

reflection on the nature of the work by the external auditor, who may need a longer time to audit these lists before giving the green light to publish them. The nature of the company's activity is one of these factors too, as some companies have a complex nature of the activity that requires many processing and review processes, and is also reflected in the role of the external auditor, which leads to delays in issuing financial reports [3].

II. THE STUDY PROBLEM

The problem of the study lies in the lack of clarity of the factors that can affect the delay in the issuance of financial statements in the Jordanian industrial companies, as many factors can affect this delay. What are the most influential factors? The study problem can be summarized in several questions:

1. What is the impact of the company's size on the delay in issuing the financial statements in the Jordanian industrial companies?

2. What is the impact of the company's profits on the delay in issuing the financial statements in the Jordanian industrial companies?

3. What is the impact of the company's debt rate on the delay in issuing financial statements in Jordanian industrial companies?

4. What is the impact of audit quality factors such as audit fees and internal control on the delay in issuing financial statements in Jordanian industrial companies?

III. THEORETICAL FRAMEWORK

A. The Concept of Accounting Disclosure

In general, disclosure means full publicity. In accounting, it means that the financial statements show all the main information that is of interest to information users and that helps them soundly make decisions. Accounting disclosure is defined as providing accounting data and information to its users in a complete, correct and appropriate manner to help them to make decisions. It can also be defined as publishing the necessary accounting data or information provided that this information is not misleading and does not affect the efficiency of the information contained in the financial reports [4].

It also means the inclusion of financial reports on all the necessary and necessary

information to give the users of these reports a clear and correct picture of the accounting unit. On the other hand, disclosure is viewed as a procedure through which the company communicates with the outside world, and that the final outcome of the disclosure is represented in the financial statements, data, and information that appear through them. It means that the financial reports include fairness and clarity of reliable information and that the company's financial statements show all the main information of interest to external groups [5].

B. The Timing of Issuing the Financial Statements

The timing of issuing the financial statements is defined as the time period between the end of the financial year and the issuance of the financial report to its users. The timing of issuing the financial report is very important to suit the principle of relevance, as it contradicts an important part of the components of suitability, which is the appropriate timing of the accounting information, as there will be no benefit for the financial information if it is not received in a timely manner [6].

IV. PREVIOUS STUDIES

Reference [7] aims to investigate the extent to which there are factors are influencing the timing of the issuance of financial statements in listed Nigerian companies, for the period between (2010-2015) on a sample of 40 listed companies. The company to research the extent of its impact on the timing factor of issuing the financial statements, regression testing and correlation coefficient testing were used. The results showed that there is no influence of the factors of company size, company profitability and company age on the timing of issuing financial statements in Nigerian companies.

The study of [8] aims to investigate the impact of information on determining the timing of financial statements, on companies listed on the Indonesian stock exchange. The study examined the factors of company size, quality of profits, the classification of the audit office among the four major companies, and profitability in addition to the capital structure, The regression test was used to examine the impact and test the hypotheses, and the study found that there is no effect of any of the assumed factors on the delay in the issuance of financial statements in the Indonesian companies listed on the stock exchange.

208

Also, reference [9] study the extent of the presence of factors affecting the timing of the issuance of financial statements in the Nigerian listed companies, for the period 2000-2011, where the timing and suitability factors were studied on a sample of 50 listed companies, and the size factors were selected. The company and the independence of the members of the board of directors to examine the extent of their impact on the factor of the timing of the issuance of financial statements and the appropriateness of the financial information. Regression testing and correlation coefficient testing were used. The results showed that there is no influence of the factors of the company's size, the profitability, and the independence of the members of the board of directors on the timing of issuing the financial statements and the appropriateness of the financial information in Nigerian companies.

Reference [10] examined the extent to which the characteristics of the board of directors in the company, in terms of the age of the members of the board and the diversity between males and females in the board, affect the delay in issuing the external auditor's report and thus delaying the issuance of annual financial statements necessarily in the Vietnamese companies. The sample included 100 companies listed on the Vietnamese Stock Exchange, for the period between 2012 and 2014, and the regression test was applied to test the impact and study the hypotheses. Issuance of financial statements.

On the other hand, the reference [11] aims to investigate what are the factors that affect the delay in issuing financial statements in companies listed on the Amman Stock Exchange and companies listed on the Palestine Exchange. 180 companies were selected from the two countries, and the factors: the internal audit committee, the independence of the external auditor, demographic factors, sector type, auditor rotation, company age, were selected to test the extent of their impact on the delay in the issuance of financial statements. The multiple regression coefficient tests were used to find Relationships and hypothesis testing. The results found that the factors of the company's age and the external auditor's report showed that there is no effect of the factors of the company's size and the auditor's turnover not affecting the timing of issuing the financial statements.

The study [8] aims to investigate the impact of information on determining the timing of financial statements, on companies listed on the Indonesian stock exchange. The study examined the factors of company size, quality of profits, the classification of the audit office among the four major companies, and profitability in addition to the capital structure. The regression test was used to examine the impact and test the hypotheses, and the study found that there is no effect of any of the assumed factors on the delay in the issuance of financial statements in the Indonesian companies listed on the stock exchange.

V. METHODOLOGY

The study methodology represents the practical aspect to reach the objectives of the study and examine the hypotheses developed with the intent of confirming or denying them by analyzing the data of the study that was relied upon, in order to eventually develop the results and recommendations for the study. This study relies on the descriptive approach, which is based on the study of a particular phenomenon or research problem and the study of its causes and consequences of that problem.

A. Population and Sample

The study population consists of all the industrial joint-stock companies listed on the Amman Stock Exchange for the year 2019, which are 46 companies according to the companies directory issued by the Amman Stock Exchange. As for the study sample, 40 listed companies were selected.

B. Data Collection Sources

All the data in this study are secondary, as all the data related to the analysis process were collected through the official website of the Amman Stock Exchange, where the financial reports of the sample companies were obtained and information was extracted from them. Electronic databases were also used to obtain previous studies and theoretical frameworks.

VI. DATA ANALYSIS

A. Descriptive Statistics

TABLE I. DESCRIPTIVE STATISTICS.

Variable	SD	Mean	Max	Min
Firm Size	8.439	16.75	22.60	12.12
Profitability	1.498	0.689	1	0
Debt Ratio	1.434	0.479	0.902	0.18
Audit Quality	0.303	0.1	1	0
Internal Control	0.676	0.615	1	0
Timeliness	1.248	85.4	203	45

B. Multiple Regression Analysis and Hypothesis Testing

a) First Hypothesis.

This hypothesis states that "*there is an effect of the company's size on the delay in issuing the financial statements in the Jordanian industrial companies at the level of significance $a \leqslant 0.05$*".

The results of the multiple regression analysis show that the value of ($t = -1.213$) and the value of ($Sig. = 0.004$), since the value of the significance level is less than 0.05, it means that there is a statistically significant effect of the company's size variable on the timing of issuing the financial statements and thus the acceptance of the first hypothesis (Table II).

This result can be explained that increasing the size of the company through the size of its assets can increase the complexity and volume of

TABLE II. REGRESSION ANALYSIS.

Variables Standardized Coefficients			
	Beta	*t*	*Sig.*
CSIZE	-0.016	-1.213	0.004
CPROFIT	0.511	-2.034	0.003
LEVER	0.232	2.906	0.012
AUQU	-0.587	-3.155	0.712
INCONTR	-0.308	-2.122	0.343
Adjusted R2	0 .228		
P value	0.000		
F value	9.139		

its financial transactions, as this requires a greater amount of financial processing, which leads to an increase in the period needed to process this information and thus delay the issuance of financial statements.

b) Second Hypothesis.

This hypothesis states that "*there is an effect of the company's profits on the delay in issuing the financial statements in the Jordanian industrial companies at the level of significance $a \leqslant 0.05$*".

The results of the multiple regression analysis show that the value of ($t = -2.034$) and the value of ($Sig. = 0.003$), since the value of the significance level is less than 0.05, this means that there is a statistically significant effect of the company's profitability variable on the timing of issuing the financial statements and thus the acceptance of the second hypothesis.

These results can be explained by the fact that companies with high profitability are trying to publish their financial statements faster than those with lower profitability, as companies are trying to increase the value of their market shares by publishing their financial reports with high profit, while companies with less profitability try to delay the issuance of their financial statements to avoid Temporary drop in market value.

c) Third Hypothesis.

The third hypothesis states that "*there is an effect of the debt ratio (financial leverage) in the company on the delay in issuing the financial statements in the Jordanian industrial companies at the level of significance $a \leqslant 0.05$*".

The results of the multiple regression analysis show that the value of ($t = 2.906$) and the value of ($Sig. = 0.012$), since the value of the significance level sig is less than 0.05, this means that there is a statistically significant effect of the company's financial leverage variable on the timing of issuing the financial statements and thus the acceptance of the third hypothesis.

This result can be explained by the fact that companies that have a high debt rate may try to delay the issuance of their financial statements, because the high debt rate indicates a high risk in the company, as some investors do not prefer investing in companies with high debt, but rather companies with higher ownership ratios.

d) *Fourth Hypothesis.*

The hypothesis states that "*there is an effect of audit quality factors and internal control on the delay in issuing financial statements in Jordanian industrial companies at the level of significance* $\alpha \leqslant 0.05$ ".

The results of the multiple regression analysis show that the value of ($t = 3.155$) and the value of ($Sig. = 0.712$) for audit quality also, ($t = 2.122$) and ($Sig. = 0.343$) for internal control, since the value of the significance level sig is greater than 0.05, this means that there is no statistically significant effect of the company's audit quality and internal control variable on the timing of issuing the financial statements, and thus rejecting the fourth hypothesis.

VII. SUMMARY OF RESULTS

The results of the study can be summarized as follows:

1. There is an impact of the company's size factor, as measured by its total assets, on the period of Jordanian industrial companies' issuance of their annual financial statements.

2. There is an impact of the company's profitability factor, as measured by earnings per share, on the period of Jordanian industrial companies' issuance of their financial statements.

3. There is an impact of the company's indebtedness factor, as measured by financial leverage, on the period of Jordanian industrial companies' issuance of their financial statements.

4. There is no influence of the factor of audit quality and internal control on the period of issuance of the Jordanian industrial companies of their financial statements.

The study recommends the following:

- Increasing the research on the subject of the study because of its great importance.
- Re-applying the study variables in a sector other than the industrial sector and noting the results.

- Studying other variables that may affect the timing of issuing the financial statements.
- Looking into the reasons why the factor of audit quality and internal control did not affect the timing of issuing the financial statements.

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Vigenère Cipher Improvement– Software Realization and Reduction to the One-Time Pad

Luka Latinović[1]

[1]Faculty of Engineering Management, University Union – Nikola Tesla, Belgrade, Serbia

[1]luka.latinovic@fim.rs

Abstract—**Vigenère cipher (VC), one of the most famous classic cipher systems, was considered impenetrable for a long time that is, until the appearance of the Kasiski method and the Friedman's test. This paper discusses the application of the improved cipher in form of the specially developed computer program named Cryptographer 2.0. The program uses the complete printable ASCII code for the creation of the Vigenère square. Furthermore, the paper proposes an algorithm to reduce the Vigenère square encryption to the One-Time Pad (OTP) method which is proved to be unbreakable. The key problem with this encryption method is to ensure the security and distribution of "tangible" OTPs, if any. This paper proposes an algorithm that, using the Cryptographer 2.0 program and daily internet portals, could eliminate the problem of disposable notebook distribution. The proposed cryptosystem is hybrid of improved VC reduced to the OTP, with the eliminated need for the physical distribution of key notebooks.**

Keywords - Vigenère cipher, cryptography, One-Time Pad, information security

I. INTRODUCTION

Cryptography is a concept that can be defined as the science, as well as the art, of making information or communication incomprehensible to everyone except the intended recipients, by turning it into a form that the opponent does not recognize [1]. The message that is being sent is also called plaintext, which is the information in any form (text document, bit string, digital record …), while Encryption is the process of masking a message, aimed at hiding its content. The encrypted message is called Ciphertext. Decryption is the process of returning an encrypted message to plaintext. The cryptographic algorithm is better known as the "cipher". It is basically a set of two related mathematical functions: one for encryption, and the other for decryption. Vigenère cipher (VC) is well known because, although easy to understand and apply, it seems impenetrable to beginners. This gave it the epithet of the impenetrable cipher (*le chiffre indéchiffrable* in French). Many have tried to apply encryption schemes that were basically VC. However, in 1863, Friedrich Kasiski was the first to announce a successful attack on the VC. A variant of the cipher "Running Key" was also once considered impenetrable. This version uses an open text length text block as a key. Since the key is as long as the message, Kasiski method is no longer valid - the key is not repeated. However, in 1920, William Friedman was the first to discover the weakness of this variant. Friedman uses the "index of coincidence" to break the code, which measures the unevenness of the code's letter frequency [2]. This method is called the "Kappa test" or the "Friedman test". The problem with VC with a consecutive key is that the cryptanalyst has statistical information about the key (assuming the text block is from a known language) and this property will be reflected in the code. However, if a truly random key is used, if it is long as the plaintext, and is used only once, the VC shall be impenetrable [3, 4]. In this case, the key, not the cipher, provides the cryptographic resilience, and these systems are collectively referred to as the One-time Pad

(OTP) ciphers. The security of these systems is independent of the code applied. This paper gives a brief overview of the concept of the VC - how to use the cipher and cryptanalysis. In addition, the paper presents a software implementation of the advanced VC in the form of the Cryptographer 2.0 program written in the Visual C++ language. Finally, the paper proposes a method of using the Cryptographer 2.0 program such that, through the above encryption and decryption algorithms, the use of the VC is reduced to OTP encryption.

II. VIGENÈRE CIPHER

A. Definition and Use of the Vigenère Cipher

The formal definition of a cryptosystem is as given in Definition (1):

Definition (1)

The cryptosystem is five (P, C, K, ε, D), for which the following conditions are met:

• P is the final set of possible messages;

• C is the final set of possible ciphers;

• K is the final set of possible keys.

For each $k \in K$ there is an encryption rule

$$e_k \in \varepsilon$$

and a corresponding decryption rule

$$d_k \in D$$

Each $e_k : P \to C$ and $d_k : C \to P$ are functions, such that:

$$d_k(e_k(p)) = p$$

holds, for each message $p \in D$.

As both the message and the ciphertext are written by some finite set of symbols of the alphabet of size n, in the following text the notion of congruence modulo the number n and the set Z_n are used. In doing so, two integers a and b are congruent modulo m, if their difference $a - b$ is the content of the number m [4]. For the English alphabet the set Z_n is Z_{26}, for the Serbian Cyrillic alphabet Z_{30}, and for the Serbian Latin alphabet Z_{27}.

VC is a type of polyalphabetic cipher, so it changes the set of probabilities of the letters in the cipher in relation to the set of probabilities of the letters of the message [6]. Taking into account Definition 1, the formal definition of the VC, for an arbitrary alphabet of size n, is as given in the Definition (2):

Definition (2)

Let: $$P = C = K = (Z_n)^m$$

For the key: $$K = (k_1, k_1, ..., k_m)$$

the length m, it is defined:

Encryption:

$$e_k(p_1, p_2, ..., p_m) = (p_1 + k_1, p_2 + k_2, ..., p_m + k_m)$$

and

Decryption:

$$d_k(c_1, c_2, ..., c_m) = (c_1 - k_1, c_2 - k_2, ..., c_m - k_m),$$

where all operations are performed in the set Z_n, i.e. modulo n [6, 7, 5].

III. CRYPTANALYSIS OF VIGENÈRE CIPHER

The VC is a polyalphabetic cipher in which each plaintext letter has multiple corresponding ciphertext letters, which makes cryptanalysis harder with more alphabets to guess and flatter frequency distribution [6]. This fact makes it difficult to analyze the letter frequency, so it is necessary to make a greater effort to break it.

```
 |A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A|A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
B|B C D E F G H I J K L M N O P Q R S T U V W X Y Z A
C|C D E F G H I J K L M N O P Q R S T U V W X Y Z A B
D|D E F G H I J K L M N O P Q R S T U V W X Y Z A B C
E|E F G H I J K L M N O P Q R S T U V W X Y Z A B C D
F|F G H I J K L M N O P Q R S T U V W X Y Z A B C D E
G|G H I J K L M N O P Q R S T U V W X Y Z A B C D E F
H|H I J K L M N O P Q R S T U V W X Y Z A B C D E F G
I|I J K L M N O P Q R S T U V W X Y Z A B C D E F G H
J|J K L M N O P Q R S T U V W X Y Z A B C D E F G H I
K|K L M N O P Q R S T U V W X Y Z A B C D E F G H I J
L|L M N O P Q R S T U V W X Y Z A B C D E F G H I J K
M|M N O P Q R S T U V W X Y Z A B C D E F G H I J K L
N|N O P Q R S T U V W X Y Z A B C D E F G H I J K L M
O|O P Q R S T U V W X Y Z A B C D E F G H I J K L M N
P|P Q R S T U V W X Y Z A B C D E F G H I J K L M N O
Q|Q R S T U V W X Y Z A B C D E F G H I J K L M N O P
R|R S T U V W X Y Z A B C D E F G H I J K L M N O P Q
S|S T U V W X Y Z A B C D E F G H I J K L M N O P Q R
T|T U V W X Y Z A B C D E F G H I J K L M N O P Q R S
U|U V W X Y Z A B C D E F G H I J K L M N O P Q R S T
V|V W X Y Z A B C D E F G H I J K L M N O P Q R S T U
W|W X Y Z A B C D E F G H I J K L M N O P Q R S T U V
X|X Y Z A B C D E F G H I J K L M N O P Q R S T U V W
Y|Y Z A B C D E F G H I J K L M N O P Q R S T U V W X
Z|Z A B C D E F G H I J K L M N O P Q R S T U V W X Y
```

Figure 1. Vigenère square known as "*Tabula Recta*", for English alphabet consisted of 26x26 fields [8].

Cryptanalysis of the VC is performed in two phases:

- determining the length of the key m

- determining the key $k = (k_1,...,k_m)$.

One possible weakness of VC is the repetition of the key, when it is shorter than the plaintext. Two techniques are known for determining the length of a key, Friedman test and Kasiski method [2,6,9]. Knowing the length of the key reduces the cryptanalysis of VC to the cryptanalysis of a monoalphabetic shift code, that is, if the key is from a known language. To determine the length of the key, the basic property of the VC is used: the key is repeated in the cipher. Of course, provided that the key is shorter than the plaintext [2,6,9].

A. Friedman Test

Friedman test is based on the "Index of Coincidence" (I_C), which is, roughly speaking, the probability that two arbitrary elements of an n-point array will be equal [9], or the likelihood of the letters in two positions being the same, divided by the number of pairs of the letters [6]:

$$I_C = \frac{\sum_{\lambda=A}^{Z} f_\lambda (f_\lambda - 1)}{n(n-1)} . \qquad (1)$$

where f_λ is the frequency count of the letter λ in the ciphertext of length n.

Based on I_C, Friedman test is considered to be the most successful technique for breaking polyalphabetic codes [7]. For a sufficiently large text length, it is equal to the sum of the squares of the frequency of occurrence of the letters of that alphabet [3]. Thus, I_C also derives from the characteristics of a known language. Precisely because of that, this attack is not successful if the key is of greater length and if the probability of the appearance of any letter in the key is equal, i.e., if it is a One-Time Pad (see heading V).

B. Kasiski Method

Kasiski method enables finding the length of the key with which the message is encrypted based on the fact that the same parts of the message text will be encrypted in the same parts of the cipher if they are at a distance δ, where:

$$\delta = k \cdot m \qquad (2)$$

for the key length m.

The algorithm that describes Kasiski method is:

i   finding pairs of identical segments of at least three lengths

ii   registration of the distance between two identical segments $\Delta_1, \Delta_2,...$

iii   determining the length of the key m as the common divisor of the numbers $\Delta_1, \Delta_2,...$

This algorithm is quite useful and reliable when applied to longer ciphers with a shorter key, because the probability of random repetition of three or four identical letters of text is negligible. However, this method in the general case does not give results for plaintexts encrypted with a longer key, that is, a key that is repeated a small number of times in the cipher [7].

IV. SUGGESTIONS FOR IMPROVEMENT OF THE VIGENÈRE CIPHER (RELATED WORK)

Obviously, the VC cannot be recommended, especially if the key is from the domain of known languages, unless the messages are very short or the keys are very long. With this in mind, a number of cryptosystems have been developed by various authors that combine some form of VC with other cryptosystems to increase security.

Reference [9] have proposed a combination of the VC with a "stream code" to increase security and also introduce all lowercase letters, numbers, and special symbols to increase flexibility so that any text can be encrypted, without being limited to uppercase letters only. The stream code is a symmetric key code where the plaintext digits are combined with a pseudo-random stream digit (key stream). In the stream codes, encryption is performed bit by bit, i.e. adding bits from plaintext to the bit during the key.

Reference [10], have proposed two additional methods to the VC, one of which includes numbers in the VC. First, the matrix V (26,10) is applied, where decimal numbers are represented by columns, and rows represent alphabets. The letter is further used to replace each number that corresponds to the alphabet. Then the theta-Vigenère algorithm for obtaining the cipher is applied [11].

References [12,13] proposed a method where the equivalent, fixed length of the plaintext and key was determined and selected and applied in the Vigenère square (Fig. 1) to obtain the cipher. The cipher is then used as a new key. With this new key, the cipher is encrypted once more and the obtained new cipher is sent to the recipient. The author suggests that this protected information be transmitted when users are authenticated using the "Diffi.e. Hellman Key" exchange protocol.

Reference [14] proposed an extended VC using a single transposition codebook with a single notebook. References [15,16] proposed two cryptosystems. The first one is based on the VC with a variable key, and the second is a hybrid system based on the VC and the column transposition code.

Number of other authors have also proposed different hybrid systems to improve the VC with different levels of security [11,17,18-21]. Finally, in 2018 [10] proposes to expand the Vigenère square by including digits so that numerical data can also be encrypted. Gautam believes that this makes the task of cryptanalysis more difficult for the cryptanalyst [23].

The Cryptographer 2.0 presented in Chapter VI, already implements a far larger expansion of the Vigenère square than that proposed by [22] in 2018. The problem however is that, while this does indeed complicate the cryptanalysis task, such cipher is still vulnerable to the Friedman test, provided the key is from a spoken language, and of an insufficient length.

V. ONE-TIME PAD

For a long time, there was a misconception that any cryptographic system could be broken. In this regard, Claude Shannon proved in Bell laboratories during World War II that there are codes that are impossible to break [18]. This seems like a very bold statement, but it is a mathematical fact. They are called One-time Pad (OTP) ciphers. Their invulnerability is based on the fact that the key with which the message is encrypted is completely random through the characters, whose length is not less than the length of the message. Further, each key is used only once and is inaccessible to the attacker. In essence, an OTP is a large, non-repeating set of truly random keys, written on a piece of paper and glued together in a notebook. The sender uses each letter of the key from the notebook to encrypt exactly one letter of plaintext. Each key

is used only once, for only one message. In history, after one message is sent, the corresponding sheet of paper with the key would be destroyed, so that a new sheet of notebook, i.e., new key, was used for each new message [3]. The recipient had an identical notebook and used the key from the notebook to decipher each letter of the cipher. After deciphering the message, the corresponding sheet would also be destroyed. This system is considered to be absolutely secure, assuming that the attacker does not have access to the one-time notebook used to encrypt the message [3,6,25].

The main OTP feature is that all characters occur equally often, i.e., that the frequency of character repetition is such that no assumption can be made based on any known language or mathematical function. Kasiski method and Friedman tests are no longer valid. No matter how many key characters have already been revealed, it is not possible to predict which one will be next. In other words, all keys are equally probable. This means that a message encrypted with OTP could be decrypted to produce any plaintext of appropriate length. The used key has no properties that would distinguish it from any other. This can be seen in the example presented by [14]:

If the ciphertext

"QLXEB YEMUC AFNQQ"

was encrypted using a key consisted of the specific set of characters, then, if the key had been

"JLIPD BCFDU IMBQY"

plaintext would have been

"HAPPYXCHRISTMAS".

However, if the key had been

"DRVTKS INPIU INFFM"

plaintext would have been

"NUCLEARKSMISSILE".

Given that OTP provides complete security, the question arises why it is not widely used? Basically, because for every couple of people who need to communicate, a different set of two OTP copies must be provided. This may be feasible for several couples, such as e.g., spies or ambassadors communicating with their governments. However, in conditions of war, for example, this would be impossible for a large

number of military units. Also, it should be borne in mind that the situation changes dramatically if the "disposable" OTP is used more than once, because then it is no longer "one-time" pad. The key problem with this encryption method is therefore to ensure the security and distribution of "tangible" OTPs.

VI. Software Implementation of the Improved Vigenère Cipher

The idea and concept for the presented VC software realization were developed by Vuković (then Kratović) Ognjen and Latinović Luka, in the year 2003 as pupils of the Sixth Belgrade Gymnasium. The computer program was written in Qbasic, TurboPascal, Visual Basic and C++. Finally, the specific software implementation presented in the form of a program called Cryptographer 2.0 (Fig. 2) was coded, i.e., written in the Visual C ++ 6.0 language by Vuković Ognjen. The advantage of encoding in the Visual C++ language, compared to the others listed, was in the extremely small size of the program, which is 260kb, and in compiling the complete program into a single .exe file. This file does not require any additional libraries or environments to run in the Windows operating system (OS). In other words, it is possible to run in all versions and subversions of Windows OS such as 95, 98, Me, 2000, XP, Vista, 7, 10, etc. Program usage is very simple and intuitive.

In Cryptographer 2.0, the key is entered in the field called "Sifra:" and the plaintext to be encrypted is entered in the "Tekst:" field. Pressing the buttons Sifruj / Desifruj performs encryption or decryption, respectively. The program itself in the computer's memory "develops" a 96x96 matrix, using instead of the alphabet, analogous to Vigenère square, as already mentioned, the entire printable "American Standard Code for Information Exchange" [26] is used.
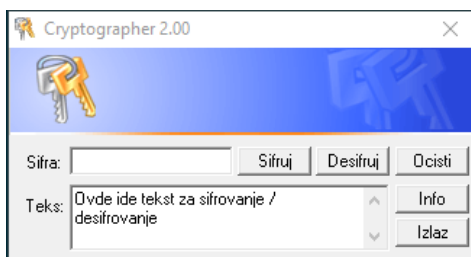
Figure 2. The Cryptographer 2.0 program main screen [27].

The ASCII used contains 127 characters, of which 31 are non-printable control characters (Fig. 3). Hence the size of the matrix of (127-31 = 96) 96x96 fields. As already mentioned, in the alphabet of size n , the number of all possible keys of length m is n^m . In the case of the English alphabet, the number of all possible keys of length m is 26^m . By using ASCII, the number of all possible keys of length m was increased to 96^m . If newer, the extended ASCII [25] were used, the number of all possible keys would be 223^m .

Encryption is then performed according to VC algorithm, translated into computer language. The advantage of this program is that it was realized simply, with very few lines of program code. Furthermore, it leaves absolutely no trace of ciphertext or plaintext on the computer's hard drive. In addition, after pressing the "Obrisi" button, in addition to deleting the text from the "Sifra" and "Teks" fields, it also deletes the given fields from the random-access memory (RAM), which would, after all, be deleted when the power supply stops.

VII. Proposed Encryption Method Using the Program

Considering, from the current theoretical point of view, the security of OTP encryption, and in the era of the Internet, it would be convenient if the OTP notebook itself could be transmitted over the Internet. In that case, the notebook itself is subject to attack by a third

Figure 3. Tabular display of ASCII symbols [26].

party, so encryption with a compromised notebook loses its meaning. One of the advantages of Cryptographer 2.0 is that it leaves almost no trace in the computer's memory, except the executable file itself. Owning the program itself, as well as knowing the code when encrypting with OTP, is worthless without having a key. Taking into account the enormous choice of internet portals that release new content every day, or content of operating system files, this paper proposes methods of encrypting, sending and decrypting the message described by the following algorithms.

A. *Encryption and Message Sending Algorithm*

i. Cryptographer 2.0 program (or such) is exchanged between sender/recipient;

ii. Sender/recipient agree in advance and determine which text, of sufficient length and permanently available on the Internet, or as the content of an operating system file, in the same form, will be used as "Key 1". That decision is memorized, without writing down;

iii. Sender/recipient prepare and memorize, without trace, a choice of several internet portals of daily content;

iv. The sender uses Key 1 in Cryptographer 2.0 to encrypt fresh news from one of the portals, copied to the "Teks" field called "News 1", which is the same or longer than the open text. The resulting code will represent a new key outside the spoken language, seemingly random, called "Key 2";

v. The sender uses "Key 2" and encrypts the plaintext it wants to protect before sending it to the recipient. He thus received a code called "Code 2";

vi. The sender sends the received "Code 2" to the recipient through any communication channel;

vii. The sender deletes "Key 2" and "Password 2" from memory.

B. *Decryption Algorithm*

i. Recipient uses "Key 1" to encrypt the text "News 1" and receives "Key 2";

ii. The recipient uses "Key 2" to decrypt the text "Code 2" and gets the clear text.

iii. The recipient deletes the plaintext and "Key 2" from the memory.

VIII. DISCUSSION

VC has long been a problem for cryptanalysts. After the methods developed by Kasiski and Friedman, the code was finally broken. Still, even today, there are attempts to improve it, and that is not without a reason. The encryption system is very simple, easy to perform and resource-efficient. With the appropriate key characteristics, it can also be very secure. Many authors still continue to deal with VC cryptanalysis. However, the feature of most of these works is that they start from the assumption that the key is shorter than the text and originates from a known language. Indeed, most people who use computers on a daily basis e.g., are accustomed to short, easy to remember passwords. Still, it can be assumed that those for whom a lot depends on the secrecy of the message, are ready for additional efforts to protect it. Therefore, it is difficult to expect that someone will encrypt very important information with "Jovana1983" or "Vid2016" keys. On the other hand, if the extended Vigenère square is used with the OTP method, then the cryptosystem will become impenetrable, that is, if the key is random, with no characteristics of a spoken language, and is of the same or greater length than the plaintext. Compared to VC, the introduced Cryptographer 2.0 has a far larger range of characters that can encrypt almost any simpler text, with the exception of complex formats that appear in text processors such as MS Word. Also, the program allows plaintext to be encrypted with a key of the same or greater length than plaintext. Therefore, the program can be used for the OTP encryption. Of course, the simplicity of the program code allows the program to be rewritten in any other programming language such as, e.g., Phyton and others, which could allow its use on other operating systems such as Linux and its sub-variant Android.

If the algorithm proposed in the previous chapter were applied during the encryption and decryption process, the cryptosystem would be reduced to the quasi-OTP. The generated would still not be random, and would not have completely same frequency for each character. However, encrypting a text for the creation of the Key 2, generates a key where letter frequency is disturbed by converting it to the whole cipher alphabet (or code table, such as

ASCII). However, then other security problems arise. If Key 1 always uses the same text that is available on the Internet, someone who would have access to a computer or network, or a history of visiting pages, might assume that repetitiveness in visiting that website is symptomatic, which could jeopardize the key. In that case, in each subsequent message, the next text could be determined, i.e., its location, which will serve as the Key 1 in the next communication between the sender and the recipient. Also, if the encryption and decryption is performed on the same computer on which the encryption is received and sent via the Internet, then, regardless of the cryptosystem used, security is certainly compromised. This can be solved by using a cryptosystem on an offline computer, while ciphertext is transferred through the online computer.

IX. CONCLUSION

VC is a mathematical function and an algorithm, easily translatable into a resource-efficient computer program regardless the programming language and operating system. With the software implementation, characters from any or all languages for which there is a computer standard for information exchange, such as ASCII and newer, can be implemented in Vigenère square. This complicates the cryptanalysis process. However, if the key is in the domain of a known language, such a system is still vulnerable to the Friedman test. If the encryption and decryption algorithms described in this paper were to be used, then encryption would be reduced to OTP encryption. The security of the cryptosystem would be improved compared to VC, as long as the sender / recipient adheres to the previously agreed procedures and adheres to all agreed measures. Although this type of communication with encrypted messages is not as convenient as sending a text message via a mobile phone, it has its value in cases where message security is a priority, as opposed to convenience.

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The Impact of Social Media on Knowledge Management

Slađana Starčević[1], Farooq Sher[2]

[1]FEFA Faculty, Metropolitan University, Belgrade, Serbia
[2]School of Science and Technology, Nottingham Trent University, Nottingham UK

[1]sstarcevic@fefa.edu.rs, [2]farooq.sher@ntu.ac.uk

Abstract — **Knowledge is one of the most important company resources. Good knowledge management can lead to significant and more sustainable competitive advantage for a company. The aim of this paper is to analyze the impact of social media on knowledge management based on the review of previous studies. Social media have impacted knowledge management such as disruptive innovation. They have introduced a completely new dimension into all its stages – acquisition, organization, transfer and application of knowledge. Social media have also opened a completely new knowledge sources for companies, expanded the possibilities of knowledge storage, knowledge retrieval and knowledge classification by using the social or collaborative tagging system; they have switched from the top-down approach to knowledge management to the bottom-up approach; and they have enabled the "everybody to everybody" communication. They have also made communication easier between different departments, hierarchical levels and geographic regions, which has a great impact on team collaboration and performance. Together with explicit knowledge, which is rather easy to store and share, social media have also improved the management of tacit knowledge, which is of quintessential importance in contemporary business models. Furthermore, social media have significantly impacted the customer knowledge management, as a sub-area of knowledge management, because they made it possible for a company to fully approach their consumers and to establish direct communication with them.**

Keywords - knowledge management, social media, customer knowledge management, enterprise social media

I. INTRODUCTION

Ever since the ancient times, knowledge has been valued as the initiator of changes; and in time, it has also proven to be a highly remarkable economic resource, even more important than money [1]. According to Peter Drucker, "the traditional factors of production – land, labor and capital, are no longer considered primary but have become secondary to the only meaningful resource of today - knowledge" [2]. The notion of knowledge management (KM) emerged back in the 1980s, while its rapid development as an academic discipline started in the 1990s. It has even been recognized as a separate management style [3]. The KM represents a set of strategies, procedures and processes enabling an organization to generate value from knowledge-based assets, including both explicit and tacit knowledge [4]. The main aim of KM is to enable the process which is to contribute to the transformation of a great amount of individual knowledge from various sources into an organizational knowledge [5]. To be more precise, KM enables intra-organizational availability of knowledge existing in human heads and on paper [1].

There are different models of the KM life cycle, but the general consensus is that it includes the following stages: knowledge acquisition (creation), knowledge organization (storage), knowledge sharing (transfer) and knowledge application (utilization) [6]. The accumulated knowledge in organizations is of no value if it is inaccessible and if it is not properly managed [7]. Unlike data and information, which are either raw or semi-processed, knowledge has been processed and is applicable [1]. Numerous studies have confirmed that the KN activities

lead to better company performance and gaining competitive advantages [1,5,8-13].

KM is inseparable from the Information and Communications Technology (ICT). The latest ICT tools have enabled a completely new way of knowledge management, an improved interaction among people and easier access to documents [14]. It is believed that the emergence of social media has caused a complete KM disruption, because all of a sudden it was possible for companies to approach their consumers and other stakeholders, as well as to allow for a new, global dimension to KM [4]. Pirkkalainen and Pawlowski [15] suggested the Global Social Knowledge Management as a new discipline dealing with research of strategies, management and processes using social media software systems and tools to improve KM on the international level. Although during the last decade the number of studies on the impact of social media on KM has been steadily growing, the area is still new and insufficiently researched. The aim of this paper is to explain how social media influence KM by analyzing the previous studies. The first part of the paper explains the importance of company investment into social media and the relation of social media to KM. The second part of the paper analyses the role of social media in different stages of the KM life cycle. Finally, the third part of the paper deals with the role of social media in the Customer Knowledge Management (CKM), as a KM sub-area.

II. THE ROLE OF SOCIAL MEDIA IN KNOWLEDGE MANAGEMENT

"Social media are interactive Web 2.0. applications, that allow the creation or sharing/exchange of information, ideas, interests, and other forms of expression via virtual communities and networks" [16]. Social media ecosystem is rather wide. There is no single classification of social media types, although many of them are quite similar. Marketing experts generally agree that social media encompass the following categories: blogs and microblogs, forums, social networks, business networks, collaborative project management platforms, enterprise social networks, photo and video sharing platforms, social gaming, social bookmarking, products/services review platforms and virtual words [17].

Some social media have been designed for knowledge sharing (e.g. blogs and virtual communities), whereas others were meant for knowledge creation (such as wikis and crowdsourcing), for connecting people (Facebook, Linkedin), for collection of user location data (e.g. Forsquare), etc. [14]. Social media platforms can be aimed at private or business users, whereas some are aimed at both. Social media have impacted a significant overlap of the two disciplines: Personal Knowledge Management and Organizational Knowledge Management [4]. Numerous companies try using the same advantages as social media for private users, by offering the Enterprise Social Media (ESM) – social media platforms used within organizations, aimed at business users. In 2007, the IBM started using one of the first internal social media, the Beehive [4]. Examples of ESM are also Facebook's Workplace, Microsoft's Yammer, IBM Connections and Salesforce Chatter [14]. These platforms include functions offered by private users platforms, such as newsfeed, chat, photo and video sharing, search, groups, events etc. [7]. ESM enable smooth communication and member interaction and stand for an open-source knowledge repository [8].

Organizations intensively invest into social media to communicate with consumers, to encourage collaboration of their employees, to integrate better with their partners and suppliers and to improve their business operations [14]. The usage of social media for internal and external communication and organizational knowledge management is now a must rather than an option. What used to be side activity has now become mainstream [4]. The usage of social media in an organization does not imply the application of all available tools, but only the ones that support communication, collaboration, promotion and knowledge sharing [18]. The modern definition of a "learning organization" is incomplete unless it includes social media that lead to the creation of a "social learning organization" [19]. For both individuals and companies, social media are a new source of information, i.e. a "goldmine of information", and they enable users to learn what is happening right now [20]. Social media have created a completely new type of collective knowledge, i.e. meta knowledge based on the combination of individual sources of knowledge. Social media also enable knowledge sharing and make it easier, because individuals and organizations have the possibility to publish their own knowledge and insights, to discuss with others, to ask questions, to post comments on various

topics, as well as to search knowledge sources and people on different platforms [10]. What is created that way are virtual communities which have completely transformed the organization of knowledge. The most important novelty in comparison to the traditional model of communication and knowledge management is the possibility for everybody to communicate with everybody.

III. THE IMPACT OF SOCIAL MEDIA ON KNOWLEDGE MANAGEMENT STAGES

Panahi, Ghalavand and Sedghi [6] have carried out a systematic review of 82 studies, and their summarized results indicate that social media make knowledge acquisition easier in interactive environment; they influence knowledge organization, access and sharing; and they make easier the application of knowledge in problem solving and decision making in team work within an organization. The application of social media has introduced a new dimension into all stages of KM [4], which is what the next section of this paper deals with.

A. Knowledge Acquisition

"Knowledge acquisition is the process of accessing and extracting knowledge through direct or indirect contact or interaction with knowledge sources" [12]. Social media have had a significant impact onto making the process of knowledge acquisition easier, because they provide completely new knowledge sources which were not available to companies in the past, including the knowledge from consumers and about consumers. Social media have also removed the barriers of time and place of knowledge access, because they have enabled an immediate access to information and events, i.e. "just in time" knowledge access [6]. Thanks to the automatic techniques of knowledge acquisition, such as feeds and push and pull technologies, social media have made knowledge easier to access [21]. Search engines make it easy to search for information and contents, as well as giving insights into other people's comments, regardless if it is private or business social media. Users are given an opportunity to use other people's ideas and experiences to create their own knowledge and new ideas. Social media have made it significantly easier to create knowledge by enabling users to simply create their self-authored content and user-generated content (UGC), by combining previous insights via mashup technologies, crowdsourcing, by

creating collaborative environment and by enabling easier communication among users [6]. However, more knowledge does not necessarily have to lead to better performance, because what matters the most is the quality of such knowledge and its practical application. Researchers have for long warned of the creation of the "digital junkyard," i.e. the knowledge used by nobody [14].

B. Knowledge Organization

Knowledge organization is defined as the "description of documents, contents, features, and purposes, and the organization of these descriptions so as to make these documents accessible to persons seeking information" [6]. Organization of knowledge on social media is completely different, incomparable even, to the traditional knowledge organization. Social media have introduced a completely new dimension into knowledge organization by expanding the possibilities of knowledge storage, knowledge retrieval and knowledge classification. In the process of organization of knowledge on social media, folksonomy plays an important role via a well-known method of social tagging or collaborative tagging, whereby data and content are organized from the users' point of view by using tags [22]. This tagging system on social media simultaneously makes knowledge retrieval and knowledge classification easier [23], and is also applicable in both private and business social media. However, one of its disadvantages is that users are able to come up with their own tags, somewhat hindering classification as well as finding relevant information.

C. Knowledge Transfer and Sharing

Knowledge sharing is one of the basic functions of social media. They also enable simultaneous information and knowledge sharing on several social media, which increases the number of potential users. Social media enable transfer of knowledge among employees, the conversion of personal knowledge into organization knowledge, as well as the possibility to discuss professional challenges [24]. The application of social media within an organization has significant implications on team collaboration, hence has been accepted by 2/3 of organizations in Fortune Global 500 [8]. The employees are able to achieve tasks by acquiring knowledge through non-formal communication [25]. What has also been enabled is communication among different departments,

hierarchical levels and geographical regions, which was impossible to achieve in the past [10]. As there is often the problem of information "locking" within a department expertise in big companies, social media have removed this problem as well as loose links between departments [4]. Additionally, they make it easier to locate experts for certain areas within and outside of companies [25].

Traditional strategies of KM were more aimed at sharing explicit knowledge within an organization, which could only have been disseminated according to the top-down principle, whereas social media enabled even the last person in the chain to communicate with a feedback information [4]. Sharing explicit knowledge is relatively simple, while sharing tacit knowledge, stored in human brain and based on experience, is rather complex yet crucial in new business models. Social media have made it easier to share tacit knowledge. However, knowledge is not automatically shared and greatly depends upon corporate culture, which influences the decision whether employees want to share their knowledge with others [1]. Individuals' motives to share knowledge vary, and range from the possibility for career advancement, personal promotion, increasing personal influence, to better problem solving and decision making, etc. There are also people who are completely uninterested in sharing knowledge. Generally speaking, the usage of social media in KM depends on the readiness of employees to participate in such activities, as well as their expertise in usage of social media for job-related activities. Different tools and technologies, such as messenger, e-mail, enterprise social networks and public social networks (Facebook, Twitter etc.) compete among themselves and it all gets down to what employees find more interesting and easier to use [26].

D. Knowledge Application

Knowledge application implies connecting and using the existing knowledge to add value to the company or individual [6]. That means putting knowledge into practice [6]. Social media have enabled converting knowledge into various formats, which increased the practical applicability of different types of knowledge. According to Ali et al. [8], the usage of social media in an organization has a positive effect on transactive memory system and realized absorptive capacity, which, consequentially,

could impact teams' innovativeness. What's more, team efficiency does depend on the possibility to extract and use knowledge, as well as on certain members knowing "who knows what".

By summarizing results of numerous studies, Panahi et al. [6] concluded that social media play a significant role in several segments of knowledge application, including decision making and problem-solving, teamwork, research process and education and learning. Systematic literature review by Costa and Martins [1] points out a significant role of social media in KN in the following areas: tourism, health care, teaching nursing, training, development and education, recruitment of volunteers, as well as sports [3].

When knowledge on social media is not properly managed throughout all its stages, the outcomes may be undesired. KM on social media poses numerous challenges, such as user privacy protection, information quality, false information, the possibility of publishing negative reviews and comments, experts' unwillingness to participate in providing knowledge, employees' unwillingness to use social media, etc. [6]. What is often the case with social media is that the content author is unknown. Information credibility is thus questionable, because "gatekeeping function" transfers from the information source to the user [8]. There is no possibility to control messages, and the information often get distorted. The usage of social media within an organization must be safe, and their content must be legal. Access control is particularly critical in industries such as banking, insurance, health care, etc. because users' data are confidential [24]. Additionally, one of the most common dilemmas is whether enterprise social media could encourage productivity, given that social media are often considered productivity killers [7]. Some organizations advocate the policy of social media ban at work, however such attitudes are debatable because of younger generations who grew up with social media.

IV. THE ROLE OF SOCIAL MEDIA IN CUSTOMER KNOWLEDGE MANAGEMENT

Customer knowledge management (CKM) is a sub-area of knowledge management which implies creating, storing, transferring and applying customer related knowledge [27]. It includes numerous tools and processes used to collect and analyze user data, to improve sales,

user retention and engagement [28]. Social media made it possible for CKM to reach a completely new level, because user data are collected differently, and there are numerous external sources of knowledge about consumers. The traditional models of collecting knowledge about consumers were not as efficient, while the dialogue-like nature of social media opens up a new potential [29]. With social media as an intermediary, knowledge about consumers is gained based on a steady interaction between a company or a brand and consumers [13]. Customer-centric approach in knowledge management enables companies to gain competitive advantage. That is why numerous companies try using social media, such as Facebook, Twitter, Instagram and YouTube, in the most profitable way.

Customer knowledge management encompasses three types of knowledge [30]:

- *Knowledge from customers (knowledge flow from customers to organizations)* – the user knowledge about a company, products and services, usually acquired through a steady interaction with consumers [28]. This type of knowledge is important for the development of new products and services and the increase of companies' intellectual assets [11], for the implementation of the "design with customers" concept, as well as for crisis management [9]. Users must be given the possibility to share content and contribute to it. Via social media, companies could gain users' knowledge on competition products and companies, which is particularly useful in creating marketing strategies [13].

- *Knowledge about customers (knowledge flow among customers)* – knowledge collected to understand user behavior and stages of purchase decision making process. Together with identification of product and services perception, preferences and previous transactions, it includes the analysis of current needs, future desires, changes in taste and trends [31]. This type of knowledge helps companies in the creation of customized products and services, in obtaining new information for the development of products and in improving marketing efforts. These data have traditionally been collected based

on the consumers' purchase history, on the study of trends, and on the traditional market research. Social media analysis is a rather complex area, and it includes seven layers: text analytics, social media actions, hyperlinks, location or spatial analytics, search engine data analytics, user engagement through mobile applications, and social media networks analytics [22]. Throughout this process, companies must understand the conversation traits of social media users and attentively listen to what is spoken about their products in online communities [32].

- *Knowledge for customers (knowledge flow from organizations to customers)* – knowledge which companies share with consumers about products, services, prices, suppliers, distribution channels, company activities, etc. which may be of interest to consumers. User education is an essential aspect of CKM, because it helps them in making purchase decisions as well as in using products and services. The perception of service quality is most often under the influence of this type of knowledge [33]. That is why it is important for a company to choose the right communication channels. However, information and knowledge sharing is not a goal per se, but for consumers to actively participate, share information and discuss with other consumers [34].

Chua and Banarjee [9] point out the role of several types of social media which companies usually use to communicate with consumers: microblogging services and social networks, location based mobile services and corporate discussion forums, used to gain all three types of knowledge within CKM. Microblogs and social media enable companies to provide consumers with knowledge on products, services and the company itself, to get feedback, as well as to monitor their behavior via social media analytics (e.g. Facebook insights, Twitter Analytics). Boateng [28] carried out a study which showed that, by using Twitter and Facebook, companies could obtain all three types of CKM knowledge, which are impossible to obtain via traditional methods. The analysis of users' comments about two telecommunication networks, the MTN and Vodafone, gave insights into consumers' expectations in situations when problems

emerge, which celebrities to use or not to use in company promotion activities, which regions require signal improvements, etc. Mutual consumers' discussions on social media could offer additional insights to company management, which would not have been considered otherwise [35]. Location based mobile services make geo-tagging easier, and help companies in location-specific knowledge management, in segmentation and in sending offers to consumers based on their check-in history [9]. Consumers often leave location reviews (e.g. on Google business accounts), which is an additional stream of information from consumers. At the same time, corporate discussion forums play an important role for CKM, because that is where companies get direct feedback from consumers and some sort of crowdsourcing, as well as an important source of information for the improvement of existing or the creation of new products. MySturbucks Idea and Dell IdeaStorm are successful examples of the implementation of this concept.

V. CONCLUSION

For many companies, knowledge has become a strategic resource for gaining competitive advantage. However, the accumulation of great amounts of knowledge turns pointless unless it is properly managed. Social media have impacted the KM process as a disruptive innovation, because that was how they introduced a completely new dimension into all its stages. The traditional model of knowledge management implied a top-down approach, while social media made it possible to apply the bottom-up approach and to include all employees into the process. Together with explicit knowledge, which was relatively easy to manage, what was also significantly improved was tacit knowledge management, which, consequentially, influences company performance. The social media technologies have significantly lowered the expenses of knowledge gaining and sharing, while small-size companies were given greater possibilities in comparison to time before social media emerged. Customer knowledge management has also been given a new "social" form. Organization is not only in charge of knowledge about consumers collected by traditional means, but is also given the opportunity to have an active dialogue with its consumers, hence gain invaluable insights about them. Although studies on the impact of social media onto KM have gained momentum lately, this area is still relatively unknown. The number

of papers on the topic published in leading world publications is rather scarce. It is evident that they are particularly missing in the area of the impact of social media onto individual KM stages, in the area of the impact of social media onto KM in certain industries, etc. which is, at the same time, a suggestion for prospective research in this field.

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Innovations in Franchise Systems

Milica Stanković[1], Gordana Mrdak[2], Suzana Stojanović[3]

[1,2,3]The Academy of Applied Technical and Preschool Studies – Vranje Department
Republic of Serbia

[1]milica.stankovic@akademjanis.edu.rs, [2]gordana.mrdak@akademijanis.edu.rs,
[3]suzana.stojanovic@akademijanis.edu.rs

Abstract—**Franchising is a powerful growth strategy that has proven to be one of the most effective ways for a brand to achieve a global presence. By entering the franchise system, the franchisee gets easier and faster access to the market than in the case of starting a business on their own. The need for innovations in franchise concepts is increasingly emphasized, in accordance with modern tendencies in the global environment. On the one hand, it can be said that the most successful franchise systems are those that are based on a proven business concept. On the other hand, without the development of new products and innovative processes, tried and tested franchise models could be declared obsolete. Innovative franchise companies need to be open to new ideas, products and processes and ready to change and adapt to emerging market trends and technologies. Successful examples of innovation in franchise companies such as Tegla's, Surf'n'Fries, Mobile Outfitters and Domino's Pizza prove how much innovation contributes to the local and global success of these franchises. The aim of this paper is to point out the importance of innovations in franchising, with a focus on the most successful innovations of well - known franchise systems. The first part of the paper analyzes franchising as an innovative business concept, while the second part of the paper examines the innovative activities of franchise companies. The third part of the paper is dedicated to the analysis of examples of successful innovations in well - known franchise systems. After a comprehensive analysis of the relevant literature, appropriate conclusions are presented.**

Keywords – franchise, innovation, economics, franchisor, franchisee

I. INTRODUCTION

Intense global competition, rapid technological change and rapid changes in consumer needs, are forcing companies to continuously invest in the innovation process, which is considered the key to the success of many companies. Innovations are the result of proactive research and development in the company. The rapid change of technology requires companies to follow innovations and, by differentiating themselves from their competitors, to meet the demand of increasingly sophisticated consumers. Innovation can be defined as a complex process of generating new ideas and translating ideas into practice. Innovation is recognized as an important factor in maintaining the company's competitive advantage, given that innovation has a positive impact on the development of new products. The aim of this paper is to point out the importance of innovations in franchising, with a focus on the most successful innovations of known franchise systems. The first part of the paper analyzes franchising as an innovative business concept, while the second part of the paper examines the innovative activities of franchise companies. The third part of the paper is dedicated to the analysis of examples of successful innovations in well - known franchise systems. After a comprehensive analysis of the relevant literature, appropriate conclusions are presented.

II. FRANCHISING: AN INNOVATIVE BUSINESS CONCEPT

Franchising refers to the cloning of a successful business concept, and franchise relations are mostly regulated by a strict contract. Nevertheless, franchisees very often have partial flexibility as entrepreneurs and play an important role in the innovative and entrepreneurial behavior that is necessary in the franchise system [1]. Franchise companies strive to preserve the uniformity of the franchise concept, while encouraging innovation within the franchise

system [2]. Franchisors develop and implement franchise business standards, which franchisees should follow, so as not to damage the reputation of the franchise system [3]. Innovative franchise companies need to be open to new ideas, products and processes and ready to change and adapt to emerging market trends and technologies. These companies should encourage franchisees to work together, giving them the freedom to make their own decisions and promote creativity, inventiveness and actively use their skills and knowledge of technologies and markets, to improve the success of the entire franchise system.

By entering the franchise system, the franchisee gets easier and faster access to the market than in the case of starting a business on their own. It is very important for franchise companies to encourage the innovation of their franchisees, while maintaining the uniformity of the franchise concept. Franchisors should encourage franchisees to initiate innovations in line with modern trends and technologies, in order to improve the business of the entire franchise system [4]. The franchise literature offers numerous examples in which franchisees are key sources of new ideas. For example, a number of new products in one of the most well-known franchise systems, McDonald's, have been developed by franchisees, including Big Mac, Filet-O-Fish and Egg McMuffin. In many systems, franchisees encourage ideas for innovation. This is because franchisees because of their proximity to end users are more likely to recognize customer needs [5,6].

Franchising is a powerful growth strategy that has proven to be one of the most effective ways for a brand to achieve a global presence. The need for innovations in franchise concepts is increasingly emphasized, in accordance with modern tendencies in the global environment. On the one hand, it can be said that the most successful franchise systems are those that are based on a proven business concept. On the other hand, without the development of new products and innovative processes, tried and tested franchise models could be declared obsolete. Before the implementation of innovations in the franchise system, it is necessary to perform a cost-benefit analysis. If it turns out that the expected positive effects are greater than the costs, the implementation of innovations is justified. Otherwise, it is necessary to give up the implementation of innovation. Franchisors should balance the idea of innovation with the

need to maintain the uniformity of the franchise system.

There are conflicting opinions on whether and to what extent franchisees should be involved in innovation. Franchisors may fear that if they rely on new ideas from franchisees, franchisees may feel that they are not getting enough value in return for the fee they pay. However, if the ideas and innovations of the franchisee are limited by the franchisor, the franchisees can still innovate but in secret, without the knowledge of the franchisor. Such hidden innovations can have a number of negative implications. If the innovation turns out to be unsuccessful, it can have negative consequences for the franchisor in terms of disrupting brand uniformity, reducing customer satisfaction and revenue. On the other hand, if the innovation is successful, it means that not all franchisees within the franchise system will benefit from that successful innovation, but only the franchisee who implemented it. Thus, to ensure that franchisee innovation does not jeopardize the uniformity and success of the system, franchisors must ensure that innovation is carefully managed. When a franchisor has a good business relationship with its franchisees, it will have a high level of trust in its franchise partners [7] and will enable greater participation of franchisees in the process of creating and managing innovations. Trust, in addition to the greater amount of information shared between franchisees, also increases a company's ability to successfully exploit entrepreneurial opportunities [8].

III. INNOVATIVE ACTIVITIES IN THE FRANCHISE COMPANY

The term "innovative franchise" is not a technical oxymoron. However, innovative franchises are not common business models. Franchising by its nature discourages innovations of franchisees, who are required to follow very precisely established procedures that determine exactly what will be produced or sold, how it will be delivered to customers, and even what the franchise units will look like. That consistency in the franchise concept provides a reliable experience for consumers. This increases the chances of success of franchisees, giving them the opportunity to take advantage of a proven business model. However, even the most disciplined franchisors remain "hungry" for new ideas. If franchisees want to put their own stamp on the business, in terms of innovative processes

or new product development, they will most likely not have that chance. However, there are several ways to improve the chances of franchisee innovation.

First of all, it is necessary for franchisees to check whether they have learned to follow the existing business model of the franchisor, before suggesting ways to improve it. A successful franchisee will have much greater credibility with the franchisor, and there is a greater chance that his proposed innovative concepts will be adopted and implemented in the entire franchise system. Then it is necessary to analyze the franchise agreement, based on which it can be seen in which segments innovative models can be applied. Even though the franchisee is pretty sure that his idea will not violate the franchise agreement, it is still necessary to present his idea to the franchisor. It may turn out that franchisors have applied a similar innovation in the past and it has not been well received by consumers. Before proposing an innovation to the franchisor, franchisee should make a business plan and analysis of his innovative concept, especially if the impact will be reflected on other franchisees. If the franchisee's idea is truly innovative, it is possible that they will persuade the franchisor to include a new product or service in their offer. In one of the world's most famous franchise systems, McDonald's, many of the best-selling new products are created by franchisees (for example: Big Mac, Filet-O-Fish and Egg McMuffin). Certainly, franchisees must be aware that it will take a long time for the franchisor to evaluate their innovative concept and approve it [4].

A large number of internal factors affect the development and implementation of new ideas in the organization. Therefore, the importance of a sustainable concept of entrepreneurial strategy is emphasized, where the key factors shaping innovative activities in a franchise company are: franchisor support, business discretion, rewards / promotions, available time and organizational structure [9,10].

- Franchisor support is defined as the willingness of the franchisor to facilitate and promote entrepreneurial activities in the franchise system. This encourages an innovative climate in the franchise system and can affect the extent to which franchisees are involved in the innovation process.

- Business discretion refers to the level to which an organization provides freedom of decision and the freedom from excessive oversight. In the context of a franchise, this could be interpreted as the extent to which franchisees can make minor adaptations without the prior permission of the franchisor. Even within the confines of a seemingly standardized franchise system, some areas of the franchise system are left to the discretion of the franchisee. Franchise autonomy can have a number of positive effects on the entrepreneurial behavior of franchisees.

- Appropriate rewards can encourage entrepreneurial behavior of franchisees. If innovative franchisee's behavior is not rewarded, franchisees will not be encouraged to engage in innovation or share innovation with franchisees.

- Available time for innovation is an important determinant of corporate entrepreneurship. Franchisees must have enough time to engage in innovative activities. For example, they need time to scan the external environment for new market opportunities or to develop new business processes.

- Organizational structure refers to the extent to which an organization provides the administrative mechanisms by which ideas are evaluated, selected, and implemented. Organizational structures can be used to facilitate the exchange of information, and can help accumulate social capital and promote innovative activities.

IV. EXAMPLES OF INNOVATION IN FRANCHISE SYSTEMS

There are numerous examples of successful franchise companies that have achieved their success thanks to the implementation of innovations. Some examples are: Tegla's, Funny Chips, Mobile Outfitters, Domino's Pizza, 7-Eleven, Surf'n'Fries, etc.

Tegla's is an innovative concept of selling healthy food in a jar developed in 2014 in Novi Sad. Tegla's is, in fact, a "take-away" concept. Tegla's should not be classified as a fast food restaurant, as they insist on healthy foods, use

natural spices and ingredients of controlled quality. Salads that are the backbone of the offer appear in as many as 13 different versions, and there are also vegetarian options. The jar was chosen as a packaging for this healthy fast food for several reasons. The first is because it is eco-friendly. Secondly, they are working on raising environmental awareness because the packaging is returnable (for every 10 jars, customers get a salad for 1 dinar). Third, the jar is the perfect packaging that is convenient to carry and store in the refrigerator [11].

Since they were thinking about franchising from the very beginning, one of the first steps they took was to protect the name and the brand. In 2016, the first franchise unit of Tegla's was opened in Belgrade, and in 2018, the first franchise unit in Podgorica. There is interest in expanding the network in other cities in Serbia, but also in cities across Europe. Tegla's, like many other companies, is almost 100% promoted online. With zero funds invested in marketing, Tegla's had 1,500 visits to the site on the first day, people started sharing content on social networks. It turned out that innovation and a well-designed brand were the key factor in spreading Tegla's story [12].

As new phone models became more sensitive to falls and damage, so did the need to protect them. Today, most owners protect their phones with special masks. Following these market developments, Mobile Outfitters appeared in the United States in 2007. It was created in response to the needs of its creators Eric Griffin and Denis O'Donnell, who, like millions of other users, faced the problem of phone protection. Griffin and O'Donnell first began to develop online sales of protective masks of exceptional quality. Their mask was produced in the USA, according to military standards, which means that the phone becomes ten times stronger and more resistant to shocks and falls after coating. In addition, they gave a lifetime warranty on the mask through a "lifetime replacement program". Mobile Outfitters globally provides protection and styling services for mobile phones and other electronic devices using modern technologies. Only Mobile Outfitters offers an "invisible" type of protection, so that the entire device, on the front and back, is protected with a transparent mask so that the phone does not change its original appearance. For those who still want to "refresh" the look of the phone, the company also offers colored masks [13].

A special advantage of this franchise model is that the software is constantly updated. Proof is that they very quickly followed the latest innovations in the production of mobile phones. For example, the Samsung S10 has applied new technology and instead of a photo sensor to unlock the screen of a mobile phone, it has installed an ultrasonic sensor that makes it easier to use the phone and works as a UV scanner. However, if ordinary mask is placed on such a phone, its use will not be possible. On the other hand, Mobile Outfitters very quickly had a new mask that fully fits that phone. This is exactly the biggest advantage, because the company is constantly responding to innovations that appear on the market. The franchisor inserts new models on a weekly basis. According to this business model, the stock practically does not exist. The system will soon respond to another innovation - phones with folding screens, so-called "foldable" phones. Practically, only Mobile Outfitters masks will fit to such phones, and will have a significant advantage over the competition [14].

Domino's is the largest multinational company specializing in pizza preparation. In the US home market, Domino's Pizza is one of the three largest pizza chains, in addition to being the world's No. 1 pizza delivery chain. Domino's has more than 17,000 restaurants, of which almost 11,000 are in foreign markets, while 97% of the units are run by franchisees. The characteristics of the Domino's franchise are a strong brand, a proven business model, technological and production innovations [15].

According to Forbes 'list of the world's most innovative growing companies, Domino's Pizza's Enterprises Ltd., which operates in the food retail industry, ranks among the 20 most innovative companies [16]. In 2007, Domino's Pizza made online orders available in the United States. Today, more than 65% of total pizza sales in the U.S. are made online. Pizza can be ordered through the official website or through the application. Once a pizza is ordered, the status of the order can be tracked via a website using Domino's Pizza Tracker which was introduced in 2008. In addition to online ordering, Domino's also allows online payment. These innovations led to an increase in online orders by 25% in 2011 and by as much as 60% by 2017.

Innovation plays a major role in the success of the Domino's Pizza franchise system. Back in the early 1970s, Domino's introduced an innovative marketing campaign, "30 Minutes or

Free" which involved delivery within a maximum of 30 minutes, otherwise the order was free. In the new millennium, Domino's is constantly "pushing the boundaries" in delivery, often relying on modern technology (the use of drones, cameras to monitor the quality of pizza, etc.). Domino's Pizza is a digital pioneer in the fast food industry. Several innovations in different geographical areas were launched in 2016, which significantly contributed to the overall growth of the franchise system. Revenues for 2016 increased by 32.4% compared to the previous year and amounted to $ 930.2 million, which was largely driven by organic growth, acquisitions and innovations in the market in the first place.

In 2016, Domino's launched a drone delivery project in New Zealand. In 2020, in restaurants in Australia and New Zealand Domino's have implemented a special camera DOM Pizza Checker "the world's first smart scanner" that will check the quality of pizza before it is delivered to consumers. Therefore, the most common complaint of customers about pizzas that do not look like in the advertising photos, should be resolved. The artificial intelligence software scans each piece of pizza and assesses whether it is made "according to the specifications of the Domino's franchise". The camera can recognize the type of pizza and, based on that, analyze whether the ingredients are properly weighed and distributed, in order to finally assess whether the pizza is being sent to the customer or a new one is being made [17].

Innovation is deeply rooted in the business culture and incorporated into the business strategy of the Domino's Pizza franchise. The company is ready to innovate and promote innovation throughout its franchise system. Ideas for innovation come both from the franchise organization itself and from outside the organization. Therefore, it can be said that Domino's Pizza is geared towards open innovation [16,17].

Surf'n'Fries is an innovative business model based on a unique production method and a carefully designed principle of packaging and serving french fries. The owners of the company started development in 2008 in Rijeka. After the protection of the trademark and the establishment of the Surf'n'Fries brand, first the packaging for serving french fries was protected, and then the development of the Surf'n'Fries franchise began, first in Croatia, and then abroad. Innovation is, in fact, the "basic ingredient" in the production, serving and packaging of Surf'n'Fries french fries. French fries are, practically, an integral part of every gastronomic offer, but only at Surf'n'Fries franch fries are the essence of the offer. Although french fries are the essence of the offer of this chain, it is possible to order several other types of dishes, chicken wings, chicken medallions, burgers, etc. Surf'n'fries has launched a new generation of street food. The trademark of this brand is french fries, which is served in an innovative packaging that allows people to eat wherever they want. The company's philosophy is "Walk & Eat. Repeat ". Today, this franchise brand is expanding globally through franchising and serving millions of customers in over 50 franchise units in over 16 countries.

Surf'n'Fries pushes the "Trailer" concept the most because it's great for getting started and for introducing the brand to a new market. The company is also developing new strategic options, and is now working on the Surf'n'Fries "Smart Vending" concept, a fully automated format for selling french fries. They are currently making a prototype that would make french fries in 35 seconds. It will have a 19-inch "touch screen", it will be constantly connected to the Internet, and the company believes that it will attract new generations who favor machines and digital communication.

Surf'n'Fries has in mind that the trend of healthy food is becoming more and more popular in the world. Therefore, they are currently focused on introducing organic ingredients into the offer. So far, when it comes to innovation, they have been quite focused on technology (e.g. airfryers), but now the focus is on all the ingredients [18]. The uniqueness of the brand is due to the innovations that are developed within the company and in cooperation with specialized companies [19]:

- Innovative form of french fries. Rounded shape of french fries which is achieved by using a specially designed knife. This shape gives the best taste to french fries, because the potato is crispy on the outside and juicy on the inside.

- Healthier french fries. French fries are fried without a drop of oil, in a specially designed oven that uses hot air instead of hot oil. This procedure produces healthier french fries, but without losing the recognizable taste.

- Innovative packaging. Specially designed multi-purpose packaging that allows the customer to carry in one hand: 1) a portion of french fries, 2) two sauces, 3) a portion of chicken wings or pieces of meat and 4) a glass of drink - while the other hand remains completely free. The packaging is protected as the intellectual property of the company. S'n'F packaging turns every customer into a marketing tool, bearing in mind that customers carrying a product in innovative packaging perform a kind of promotion of this brand. This free promotion leads to an increase in profits.

- Cost-effective production that takes care of the environment. Ecological cardboard is used to make the packaging, as well as materials and colors that are safe for the food that is served. Support to the local economy is provided through the use of local ingredients and materials.

TABLE I.   INNOVATIONS IN FRANCHISE SYSTEMS.

Franchise company	Innovations
Tegla's	Healthy fast food Vegetarian fast food Jar as food packaging Eco packaging
Mobile Outfitters	Lifetime warranty Lifetime replacement program Masks for mobile telephones by military standards Masks for foldable telephone
Domino's Pizza	Innovative marketing campaign "30 minutes or Free" Delivery using drones Open innovation Thermal bags for delivery
Surf'n'Fries	"Smart Vending" concept: an automated format for selling french fries Healthy french fries with the use of organic ingredients and airfries Innovative form of french fries Innovative packaging

V.   CONCLUSION

A proven business model can bring benefits to both the franchisor and the franchisee.

Although there are a large number of skeptics when it comes to linking the concepts of franchising and innovation, modern trends require this business model to adapt to the global environment. The development of new products and services within franchise systems is not a matter of choice, but a need. The role of each of the franchisees in innovating the entire franchise concept, with the approval and supervision of the franchisor, is crucial. Successful examples of innovation in franchise companies such as Tegla's, Surf'n'Fries, Mobile Outfitters and Domino's Pizza prove how much innovation contributes to the local and global success of these franchises.

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The Relationship between Research and Development Expenditure and Innovation Performance

Özcan Karahan[1], Musa Bayır[2]

[1,2]Bandırma Onyedi Eylül Üniversitesi, Merkez Yerleşkesi, Balıkesir

[1]okarahan@bandirma.edu.tr, [2]musa.bayir@gmail.com

Abstract— **Within the framework of endogenous growth theories, many new factors affecting the innovation performance of countries have been determined. Especially, Research and Development (RD) activities are defined as an important factor for increasing innovation performance of countries. Thus, many national and international economic institutions have accepted RD expenditures as an important policy tool to increase the innovation performance of countries. On the other hand, economists, who analyzed the dynamics of the innovation process within the framework of the system approach, determined the dynamics of the innovation process within a system whose borders were determined at the national level. In this approach, which is called the National Innovation System (NIS), the innovation process takes place in a complex system in which many actors interact. Thus, innovation dynamics can be determined in a process where many factors fulfill their function within the framework of complementarity. Therefore, the impact of RD policies on innovation performance is not strong enough in countries where human capital is not sufficiently developed. In our study, the view of the NIS approach was tested with panel data analysis. The countries were divided into two groups according to the development of their human capital qualities and the effects of RD expenditures on innovation performance in each country group were analyzed. Empirical results confirm the moderating role of human capital on the relationship between RD expenditure and innovation performance. as proposed by the NIS approach.**

Keywords - *R&D expenditure, inovation, human capital*

I. INTRODUCTION

Today, it is necessary to constantly create technological improvement based on high innovation performance in order to reach sustainable high growth rates. That means in order for countries to continuously create new technologies, they need to increase their innovation performance. Especially, due to the intense competition in the world economy on a global scale, countries have to constantly improve the production technologies they use. Therefore, building an effective innovation capacity has become the main goal of all nations. Thus, the analysis of the factors that determine the technological development or innovation performance of a country has become an important research topic in the economics literature.

Neo-classical Growth Models firstly defined technological change as an important factor that increases total factor productivity. However, economists advocating Neo-classical Growth Models did not provide an explanation for the sources of technological change. In other words, technological change is considered an "external" variable in the production function. According to Solow [1], the main factor determining growth is the rate of development of technology, and this factor is determined externally independently of any economic policy. Later, Solow [2] tried to prove these views with the method he called growth accounting. Here, the roles played by the workforce, capital stock and technology in the growth process have been tried to be determined on the basis of the data of the American economy. As a result, it has been determined that

technological development is an important growth dynamic, but no information is given about how technological development can be managed. Since technological changes based on innovation performance are accepted as an exogenous variable in the neoclassical approach, policy implications have not been made to support technological developments within the framework of economic growth policies.

After the Neo-classical views, dynamics of technological improvements within the framework of "Endegoneus Growth Theories" are discussed in a more comprehensive way. In this context, important views on the dynamics of technological developments have been proposed by Romer [3], Lucas [4] Barro [5], Rebelo [6], and Sorensen [7]. In these studies, various variables that determine the level of technology are internally included in the growth models. Accordingly, various factors such as human capital, and research and development (R&D) expenditures have been determined as the basic dynamics of innovation performance and technological development.

Romer [8] stated that the basic dynamic of technological change is primarily due to innovation based on R&D expenditures. In addition, Romer argued that technological innovations obtained with new information obtained from R&D activities prevent diminishing returns to scale in the production process. Helpman [9] also clearly demonstrated the relationship between R&D expenditures and productivity growth. Thus, it has been determined that R&D activities are an important resource in the innovation process. Aghion and Howitt [10], as an alternative explanation of endogenous growth, explained the facts showing the importance of R&D activities in their models with detailed mathematical analysis.

More recently, [11] analyzed the relationship between R&D investments and patent applications in OECD countries for the period 1981 to 2001. Empirical findings have shown a positive correlation between R&D and patent applications. In addition, they determined that the increase in R&D expenditures in the business sector increased the number of patent applications more than the increase in R&D in general. Using panel data for OECD countries, Falk [12] estimated the impact of high-tech sector R&D expenditures on long-term economic growth from 1970 to 2004. Empirical findings have shown that R&D investment has strong positive effects on economic growth, especially in the high-tech sector. Thus, empirical evidence for the relationship between R&D intensity and economic growth for high-tech industries in OECD countries is provided. Güloğlu and Tekin [13] examined possible causal relationships between R&D expenditures, innovation, and economic growth in high-income OECD countries using the panel vector autoregressive model for the period 1991-2007. The empirical results showed that there is a causal relationship from R&D to innovation and economic growth, as postulated by endogenous growth theory.

Thus, by the development of endogenous growth theories, it has been determined as an important variable in many dynamic production functions that determine the capacity to create innovation. In this framework, it has been especially indicated that Research and Development (RD) activities are the important factor that determines the capacity to create innovation.

When the literature is examined, it is seen that one of the most important sources of technological change within the scope of endogenous growth models is RD expenditures. In many studies, it has been concluded that RD expenditures accelerate economic growth by increasing the innovation performance of countries. In this framework, endogenous growth models based on RD have led to very important policy implications. So much so that after these models, policy makers decided to support research and development activities more. It is widely accepted that long-term economic growth will increase faster by allocating more resources to R&D expenditures in this way.

After the widespread acceptance of endogenous growth models, many regional economic unions and international economic organizations suggested increasing the R&D expenditures of member countries to a certain ratio of GNP as a basic policy tool. For example, the European Commission has emphasized that there is a strong need to improve specific R&D conditions in the EU. Accordingly, EU policy makers have set a target in the Europe 2020 Strategy to ensure that 3% of GDP is invested in R&D in all Member States. As a result, many countries have begun to give great weight to practices aimed at supporting RD activities within policies aiming to develop their innovation capacity.

Another approach in the literature, which examines the dynamics of technological development based on innovation performance, belongs to evolutionist economists who take a systematic view. This approach advocated the idea that innovation is created within a system consisting of different components, so the system elements and the interaction between them are the basic dynamics of the innovation creation process. Thus, each element that determines the innovation performance can create an effect within the framework of the complementarity relationship with each other. Under this perspective, the idea that analyzes the innovation process at the national level with a systematic perspective is called the National Innovation System (NIS) approach. Consistent with its systemic analysis, the NIS approach suggested that the interaction between system components and thus the complementarity relationship between system elements is an important factor influencing innovation dynamics and performance.

Systematic reflection analysis of the innovation process at the national level has been developed by three main studies: C. Freeman at the Science Policy Research Unit (SPRU) of the University of Sussex in the UK, B. A. Lundwall at the IKE Group in Denmark, and R. R. Nelson from the Colombia University in the USA. Firstly, Freeman [14] brought the concept of NIS into the literature by his book titled "Technology Policy and Economic Performance: Lessons from Japan". Later, Lundvall [15] published as an editor a book titled "National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning". Final seminal book named "National Innovation Systems: A Comparative Study" have been edited by Nelson [16]. These economists can also be divided into two groups in terms of their definition of NIS. Nelson considers with the narrow definition of NIS covering only organizations involved in research institutions and firms. On the other hand, Freeman and Lundwall consider the broad definitions of NIS covering all aspects of the economic structure and the institutional set-up (Varblane and Tamm, [17]).

The NIS approach assumes that the innovation process takes place within a system consisting of different components. Thus, each component in the NIS has the function of stimulating the innovation process in relation to each other and thus increasing the innovation performance of the system. These interactions between the components significantly affect their functional performance and thus the performance of the entire innovation system. This means that the interactions between the components of the system affect the innovation performance of the entire system. Therefore, the NIS concept specifically assumes interactions between components to specify the complex dynamic system characteristic of the innovation process. In this line, Park and Park [18] examined the factors that determine the effects of RD spending on innovation performance in OECD countries. In this context, they empirically investigated the relationship between R&D expenditures and industrial structure for the 1978-1995 reference period in 22 OECD countries. Empirical findings revealed that there is a significant relationship between R&D structure and industrial structure. Kim et al. [19] examined different factors affecting the performance of R&D activity in 254 Korean IT-related businesses over the two-year period from 2005 to 2007. They found that external networking and technology commercialization capabilities significantly determine the performance of R&D activity on innovation. Accordingly, it is a more effective strategy for companies to develop their external networking and commercialization capabilities rather than focusing on R&D activities with a narrow perspective.

In summary, NIS approach, developed by evolutionary economists, argues that it should be considered the effects of factors determining innovation performance in a country in interaction with each other rather than in isolation from each other. This situation requires the creation of policy packets by associating many factors with each other instead of developing isolated policies for each factor in the production of innovation policies. Thus, the NIS approach was opposed to giving weight only to R&D activities in order to increase the innovation performance of the country. R&D activity, which is only one component of the system, can only perform its functions by interacting with other components of the system. Therefore, focusing only on R&D activities as a basic dynamic of the innovation process that takes place within a system whose borders are drawn at the national level would be to make very limited inferences about the driving forces of the innovation process. As a result, policy designs focusing only on R&D activities by ignoring the complementarity between system components cause inefficient use of country resources.

For example, according to the NIS approach, human capital and RD activities are two important system elements that function in conjunction with each other in the innovation process. No matter how much RD you spend in an innovation system that does not have sufficient human capital potential, you cannot increase innovation performance. Therefore, isolated policy practices focusing only on the RD spending target will be insufficient to increase innovation performance. A limited number of studies in the literature have shown the complementary role of human capital to the effect of RD expenditures on innovation performance. Sjögren [20] developed a model that demonstrates the interrelationship between Human Capital and R&D activity in their impact on innovation performance. As a result, it has been revealed that R&D activity has limited importance for long-term growth without human capital accumulation. He also pointed out that investment in R&D can increase human capital accumulation. Neagu [21] empirically investigated the link between R&D investment and human capital accumulation in Romania. Empirical findings have shown that there is a reciprocal relationship between human capital and R&D activity. Accordingly, while human capital accumulation activates both the inputs and outputs of R&D investment, R&D investments lead to high-quality human capital accumulation. Yeldan [22] analyzed whether promoting human capital formation through subsidies to education or new R&D supports through subsidies for R&D activities would be a more effective policy choice for Turkey to develop human capital. Empirical findings suggest that since there is a complementarity between policy alternatives, public policy should be directed towards hybrid policy implementations related to RD activity and Human Capital.

In conclusion, when we look at the literature, it is seen that there are many studies that examine the effects of human capital and R&D investment on innovation performance separately within the framework of endogenous growth theories. However, as argued by the National Innovation System approach, the impact of RD expenditures on innovation performance have not been examined enough by considering the moderating role of human capital in this impact. To fill this gap in the literature, the purposes of this paper are to empirically investigate whether human capital has a moderating effect on the

relationship between research and development expenditure and innovation performance, or not.

Accordingly, panel regression analyses have been performed in order to investigate the moderating effect on the relationship between research and development expenditure and innovation performance. Thus, we tested the hypothesis that the greater human capital in country, the stronger the influence of research and expenditure on country's innovation performance.

The rest of the article is organized as follows: Chapter 2 provides a literature review on the relationship between RD expenditures and innovation performance. Data, research method and empirical findings are presented in Chapter 3. Interpretations of empirical findings and relevant policy implications are outlined in the final section.

II. Data, Methodology and Empirical Results

In the study, there are two country groups classified by the Human Development Index (HDI) that published by the United Nations. This index is created by taking into consideration the indicators such as life expectancy at birth, expected years of schooling, mean years of schooling and gross national income per capita [23]. Countries that have a 90 HDI point or above are classified as developed countries (Norway, Iceland, Germany, Sweden, Australia, Finland, Denmark, Netherlands, United Kingdom, Belgium, Canada, United States, Austria, Japan, Israel, Korea Rep., Luxembourg, Spain, France, Czech Republic) and developing countries (Argentina, Brazil, Bulgaria, Colombia, Croatia, Estonia, Greece, Hungary, India, Italy, Latvia, Lithuania, Malaysia, Mexico, Poland, Portugal, Romania, Russian Fed., Serbia, Slovak Rep., Turkey, Ukraine, Uruguay).

Accordingly, it is analysed that the relationship between R&D expenditures (R&D) and innovation (INNO) in 20 developed and 23 developing countries in the period 2001-2018. Research and development expenditure (current, US$) is used as an indicator of R&D expenditures, and patent applications (per 100,000 people) are selected as an indicator of innovation. Both data are obtained from the World Bank database and they are transformed into logarithmic form:

$$\ln INNO_{it} = \alpha_0 + \alpha_1 \ln RD_{it} + e_{it} \ , \quad (1)$$

$$i : 1,.........,N. \qquad t : 1,.........,T. \qquad (2)$$

Table I shows descriptive statistics of the variables. The panel data estimation has the characteristic of balanced panel. In addition, the average of both lnINNO and lnRD is higher in developed countries, as expected.

Developed Countries					
Variable	Obs	Mean	Std. Dev.	Min.	Max
lnINNO	360	1.645	0.491	0.553	2.622
lnR&D	360	6.151	0.714	4.370	7.767
Developing Countries					
Variable	Obs	Mean	Std. Dev.	Min.	Max
lnINNO	414	0.898	0.338	0.006	1.764
lnR&D	414	5.079	0.718	3.478	6.494

In panel data analysis, it is a common situation that the series has the problem of cross-section dependency. It is very important for the choice of the unit root test to be used whether the series has a cross-section dependency problem or not. In this framework, firstly, it is tested the problem of cross-section dependency in variables of both developed and developing countries. Pesaran [24] CD-test is used for this purpose. In CD-test, the null hypothesis is "there is no correlation between the units". In the series of two country groups, according to the p-values in both variables, the alternative hypothesis is accepted (Table II). Therefore, all series have the problem of cross-sectional dependency.

Developed Countries		Developing Countries	
Variable	CD-test (p-value)	Variable	CD-test (p-value)
lnINNO	5.24 (0.00)	lnINNO	3.11 (0.00)
lnR&D	49.51 (0.00)	lnR&D	58.26 (0.00)

After cross-sectional dependency is detected, the cross-sectionally augmented ADF (CADF) unit root test proposed by Pesaran [25] is preferred. The results of CADF unit root test are shown in Table III. Empirical findings indicate that the variables in both country groups have unit roots in levels and are stationary at the first difference. That means both series are I (1).

Developed Countries				
	constant		constant+trend	
Variable	t-bar	p-value	t-bar	p-value
lnINNO	-0.928	1.000	-2.356	0.368
ΔlnINNO	-2.796	0.000	-3.094	0.000
lnR&D	-1.525	0.815	-2.482	0.185
ΔlnR&D	-2.591	0.000	-2.640	0.056
Developing Countries				
	constant		constant+trend	
Variable	t-bar	p-value	t-bar	p-value
lnINNO	-1.925	0.193	-2.083	0.837
ΔlnINNO	-3.167	0.000	-3.774	0.000
lnR&D	-1.895	0.233	-2.193	0.677
ΔlnR&D	-2.638	0.000	-2.855	0.004

Finally, the regression estimation of the model in equation (1) is performed. According to the Hausman and Breusch and Pagan LM test, the model for the developed country group is estimated by taking into account the random effect. Then, modified Bhargava et al. Durbin-Watson test for the autocorrelation problem, and Levene – Brown - Forsthe test for the heteroscedasticity problem is performed. The test results show the problem of autocorrelation and heteroscedasticity in the estimation of the developed country group. In this direction, the Driscoll / Kraay robust standard errors suggested by Driscoll & Kraay [26] are taken into consideration.

The results of regression estimations are presented Table IV. Empirical findings show that a 1% change in lnRD in the developed country group has a statistically significant positive effect of 0.55% on lnINNO. Then, regression for developing countries is estimated. Hausman and Breusch and Pagan LM test indicate that estimation should be made in accordance with the pooled regression model. Wooldridge test for autocorrelation problem and Breusch-Pagan / Cook-Weisberg test for heteroscedasticity problem is performed in estimations of the pooled regression model. As the tests show that estimations have autocorrelation and heteroscedasticity problems, the Driscoll/Kraay robust standard errors proposed by Driscoll & Kraay (1998) are used as above. The estimation results show that a 1% increase in lnRD in the

developing country group has a statistically significant positive effect of 0.02% on lnINNO.

TABLE IV.   REGRESSION ANALYSIS

Developed Countries				
	Coef.	Std. Err.	Drisc/Kraay Std. Err.	t stat. (Prob.)
lnR&D	0.551	0.212	0.211	2.61 (0.01)
cons.	1.624	0.1085	0.146	11.12 (0.00)
Hausman test: $\chi^2 = 0.06$ (0.8072)				
Breusch and Pagan LM test: $\chi^2 = 2132.15$ (0.000)				
Modified Bhargava et al. Durbin-Watson: 0.2523				
Levene-Brown-Forsthe test: W0 = 2.67 (0.00), W50 = 1.87 (0.01), W10 =2.53 (0.00)				
Developing Countries				
	Coef.	Std. Err.	Drisc/Kraay Std. Err.	t stat. (Prob.)
lnR&D	0.0237	0.0073	0.0077	3.07 (0.007)
cons.	0.1327	0.0380	0.0429	-3.09 (0.007)
Hausman test: $\chi^2 = 1.85$ (0.1740)				
Breusch and Pagan LM test: $\chi^2 = 0.35$ (0.5569)				
Wooldridge test: F = 6.673 (0.0170)				
Breusch-Pagan/Cook-Weisberg test: $\chi^2 = 85.61$ (0.00)				

III.   CONCLUSION

This paper examined the moderating effect of human capital on the relationship between RD expenditure and innovation performance. Our study examines the moderator role of human capital in the relationship between R&D expenditures and innovation performance between 1981 and 2018 using panel data analysis method for 43 countries. Accordingly, countries were divided into two groups according to the Human Development Index, and the effects of RD expenditures on innovation performance were estimated for both groups of countries.

The empirical results show that the positive impact of R&D activities on economic growth is not equally strong for all countries. RD expenditures make a larger positive contribution to innovation performance in human capital developed countries. The greater human capital in country, the stronger the influence of research and development expenditure on innovation performance. That means, human capital increases the role of R&D expenditures in the innovation performance of the country. Thus, the empirical results confirm the complementarity

relationship between human capital and R&D expenditures, as predicted by the NIS approach.

These findings support strongly the view of systematic approach that investments in R&D without the support of human capital doesn't increase the innovation performance of the countries enough. As a policy implication, policy makers should understand that the effect of human capital on the performance of RD expenditure is a factor which cannot be neglected. Thus, policy makers should consider the moderating effect of human capital on the relationship between RD expenditure and innovation performance when developing a strategy of RD investment for sustainable economic growth based high innovation performance. This finding requires the creation of policy packets by stimulating the factors enhancing both RD activities and human capital in the meantime instead of developing isolated policies for each factor separately in the designing of innovation policies. In other words, as innovation processes are a complex evolving system, policymakers must provide building blocks between tools of innovation policy implementation.

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Industry 5.0: A New Paradigm in Manufacturing

Dragan Ćoćkalo[1], Mihalj Bakator[2], Dejan Đorđević[3], Miloš Vorkapić[4], Sanja Stanisavljev[5]

[1,2,3,5]University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
[4]University of Belgrade, Institute of Chemistry, Technology and Metallurgy - Centre for Microelectronic Technology and Mono-crystals, Belgrade, Republic of Serbia

[1]dragan.cockalo@tfzr.rs, [2]mihalj.bakator@uns.ac.rs, [3]dejan.djordjevic@tfzr.rs, [4]worcky@nanosys.ihtm.bg.ac.rs, [5]sanja.stanisavljev@tfzr.rs

Abstract—**The fourth industrial revolution - Industry 4.0 has brought challenges to enterprises across the globe. In addition, the globalization of markets and the COVID-19 pandemic have put pressure on enterprises who want to achieve competitive ability. Amidst the challenges of the modern business environment, the concept of the fifth industrial revolution - Industry 5.0 arises as a Society 5.0 compatible and systematic transformation of the Industry 4.0 concept. Industry 5.0 is forthcoming and is not fully materialized. However, it derives and is complementary with the Society 5.0 initiative, which is present for five years now. In this paper, the drawbacks of Industry 4.0 and the concept of Industry 5.0 are analysed. The main goal of the paper is to present Industry 5.0 and the new paradigm of manufacturing and conducting business. The paper contributes to the existing body of literature and provides an adequate basis for future research in the domain of industrial revolutions, sustainability, and competitiveness.**

Keywords - Industry 4.0, Industry 5.0, Society 5.0, competitiveness, domestic enterprises

I. INTRODUCTION

The fourth industrial revolution - Industry 4.0 has brought numerous challenges to enterprises. Small and medium-sized enterprises (SMEs) are facing issues when it comes to achieving and maintaining a competitive position on the globalized market. Besides the challenges of globalization and Industry 4.0, the COVID-19 pandemic has put additional pressure on enterprises in developing and developed countries across the globe [1]. Amidst the challenges of the pandemic, enterprises and struggle to optimize their business models that would be in-sync with Industry 4.0 technologies. The application of these modern and advanced technologies is becoming an imperative when it comes to creating and delivering value to the customer. Industry 4.0 is characterized by a wide array of technologies including , but not limited to, Internet of Things (IoT), Internet of Value (IoV), cyber-security, 3D manufacturing, additive manufacturing, cyber-physical systems, blockchain technology-based solutions, wireless sensors, advanced AI, and machine learning [2]. The noted technologies have brought big changes on the market and enterprises that managed to implement some of these advanced technological solutions, achieved a better starting point when it comes to competitive ability on the market.

Currently, the whole Industry 4.0 concept is relevant for approximately ten years. While in some developed countries, the main principles and technologies of Industry 4.0 are implemented and applied, in other, mainly developing countries, enterprises are not fully aware of the potential of such technologies. This time gap will affect the future development of national competitiveness relations. Besides the positive results that Industry 4.0 technologies can bring to manufacturing and other services across the globe, there are negative effects as well. Technological asymmetry regarding network safety and back-ups, human workforce value depreciation, overexploitation of resources, and focus on economic results rather than on social outcomes, have been noted as critical analysis points that have to be taken into consideration.

Before the concept of the fifth industrial revolution is analysed, first, the concept of

Society 5.0 is presented. The Society 5.0 initiative was proposed by the Japanese government five years ago in 2016 [3]. The main principles of this initiative include the preservation of environmental, economic, and social ecosystems through advanced technologies such as cyber-physical systems [4]. The main goal is the wellbeing of people and sustainable development of societies. Industry 5.0 derives from the main principles of Society 5.0, and at the same time, it includes the technologies that characterize Industry 4.0.

In this paper, the concept of the upcoming fifth industrial revolution is analysed. The paper consists of three main sections (excluding the Introduction and Conclusion) sections. First, the challenges of conducting business in the modern business environment, and the industrial revolutions are briefly noted. The second section presents the concept of Industry 5.0 in more detail. The third section discusses suggestions and guidelines when it comes to the domestic enterprises, global economic trends, and achieving competitive ability in such business environment. These suggestions and guidelines aim at addressing the challenges of the noted industrial revolutions in an analytical manner, and with main goal to open doors for future research on this emerging subject - Industry 5.0.

II. INDUSTRIAL REVOLUTIONS AND THE CHALLENGE OF SUSTAINABILITY

Industrial revolutions have brought dramatic changes to how business is conducted and affected the global economy in many aspects. The first industrial revolution - Industry 1.0 is characterized by the water and steam power application across industries. The second industrial revolution has introduced mass production and assembly lines. Further, as development in production advanced, the third industrial revolution arrived that introduced electronics and automation in production. The fourth industrial revolution - Industry 4.0 has been analysed and heavily discussed in the past ten years.

The main framework of Industry 4.0 are cyber-physical systems. The fourth industrial revolution includes the automation of processes and high-end computing, and it focuses on increasing efficiency. However, this approach negatively affects the human aspect of production and in the near future, this can lead to resistance from employees, labour unions, and politicians.

The main issue are employment rates, and cyber physical systems tend to decrease the number of jobs across industries. From here, balance between manufacturing efficiency, advanced technologies, and social aspects of employment is brought up as a necessity. The fifth industrial revolution - Industry 5.0 aims to be solution for achieving such balance and it includes personalized autonomies manufacturing concepts. Industry 5.0 is characterized by the synergy between a human worker and robotic and automated production tool [5].

It is not unusual that the development and application of new technologies is called a revolution. The current, fourth industrial revolution - Industry 4.0 is based on the application of Internet of Things (IoT), cyber-physical systems, and improved supply chains. Barcoding, interconnectivity, and the diverse application ICTs have enabled real-time, structural, dynamic, and functional mapping of manufacturing processes, enterprises, and living things. Industry 4.0 technologies aim at reducing repetitive manufacturing tasks by automating them through sensors, robots, AI, and other advanced technological solutions. When it comes to repetitive and complex manufacturing procedures, human workers are supported by collaborative robots - "cobots", which help improve productivity. In practice, AI supported "cobots" are equipped with wireless network connections and sensors. These robots and automated machines are different from the robots from the 20th century as those were pre-programmed. The newer, advanced "cobots" are based on AI technologies, machine learning, and can learn from big volumes of data.

Furthermore, Industry 4.0 technologies are not only implemented in manufacturing facilities, but are present in life sciences, medicine, research custom manufacturing, retail services, and customer services. Human intelligence - tacit knowledge is still important and relevant, however AI automation and extreme Industry 4.0 integration can cause fail-safe issues. More precisely, if not governed, modern information-communication technologies that characterize Industry 4.0, can create several challenges in form of design asymmetry. The main design asymmetries include:

- The lack of safe exit strategies from networks. Highly integrated networks can experience catastrophic failure if cyber-

attacks manage to compromise them. Therefore, exit strategies, backups, and failure localization is important.

- Filter bubbles, which present monocultures across industries due to high intensity integration of modern ICTs. These bubbles reduce critical thinking and analytical behaviour regarding science and technology.

- Prioritizing technologies over societal outcomes. The main drivers of Industry 4.0 technologies are industries and investors. Due to the economic aspects of technological development, the social aspects lack behind and the potential negative outcome are severely understudied. Simply, the concept of Society 5.0, a Japanese concept of applying modern technologies in balance with social outcomes is not fully complementary with the concept of Industry 4.0.

The noted asymmetries have to be addressed on a global scale. If a parallel line is drawn between the industrial revolutions and revolutions regarding the concept of societies it can be observed that the newest concept of Society 5.0 is not fully synchronized with Industry 4.0. When observing Society 1.0 (living in groups to hunt as means of survival), Society 2.0 (larger groups for agricultural cultivation), Society 3.0 (mass production and industrialization), Society 4.0 (economic value to intangible assets), and Society 5.0 (sustainable societal development without overexploitation of resources), it can be seen that there is an increased level of organization and value creation over the evolution of societal structures [6].

III. THE FIFTHE INDUSTRIAL REVOLUTION - INDSUTRY 5.0

The concept of Industry 5.0 emerges as the fifth industrial revolution, which aims to tackle the issues of that Industry 4.0 brought [7]. The concept of Industry 5.0 encapsulates the technological advancements that are present within the frameworks of Industry 4.0. More precisely, while Industry 4.0 focuses on transforming factories into AI-supported and IoT enabled infrastructures where everything is interconnected, Industry 5.0 focuses on the human aspect of production, and aims at addressing and putting forward an important societal metric - workforce and jobs. Industry 5.0

emphasizes the role humans in manufacturing and views robots and automation as a tool for improvement and not a solution that reduces the number of jobs [8].

Industry 5.0 addresses the asymmetries of Industry 4.0 through innovation accelerators and integrated brakes of such technological and innovation advancement. In addition, it includes safe exit paths from hyper-connectivity and incorporates next-generation global governance for technological policy. Industry 5.0 is an incremental advancement from a technological aspect compared to Industry 4.0, but it is critically necessary from a social aspect. As noted, Industry 5.0 aims at reducing the negative impact of Industry 4.0 and its asymmetries. Hyper-connectivity has to be addressed in a way that critical failures in one sector, doesn't cause failures across all elements that are connected within the network. Societal projections regarding the modern ICTs have to be innovation-based and adequate governing is an imperative.

The concept of Society 5.0 is complementary with Industry 5.0, as it aims at improving people's lives through the implementation and application of Industry 4.0 technologies [9]. From the aspect of Society 5.0, Industry 5.0 from an ethical, legal, and social implication aspect has to include and address:

- Critical research in the domain of social science, and bring new technologies into a wider societal context

- Conceptual frames of knowledge, research, and innovation.

- Crucial research in the domain of social sciences and its role in governing the adaptation and application of Industry 4.0 technologies [7].

In addition, Industry 5.0 includes the creation of value and framework that coincides with the creation of Society 5.0. The main platforms for this framework are energy value chains, infrastructure care systems, smart manufacturing systems, advanced social security, information and communication platforms, data standardization, and new business models that create value for the customer and for society [4].

Industry 5.0 will bring a new paradigm in manufacturing where humans and robots will co-work together [10]. This notion was discussed earlier in the paper, where the concept of

"cobots" is described where traditional manufacturing robots are improved and designed with AI technologies, and which, through machine learning, require less detailed programming. The base technologies are similar between the fourth and fifth industrial revolution.

In the context of Industry 5.0, robots are not viewed only in a manufacturing setting. Through complex systems of networks and interconnectedness of devices, sensors, and wireless communication, advanced technologies are seen in other industries including medicine (expert systems, AI diagnostics), transportation (autonomous self-driving cars and trucks), logistics (fuzzy logics, AI-supported routing), pharmaceuticals (AI supported drug development, Big Data Analytics) etc. Now, the noted technologies are already implemented and applied in various degrees within the frameworks of Industry 4.0.

Comparison between Industry 4.0 and Industry 5.0 is given in Table I.

TABLE I. INDSUTRY 4.0 AND INDUSTRY 5.0 COMPARISON [10].

Industry 4.0	Industry 5.0
Focus is on smart manufacturing.	Focus is on Human-Robot co-working and bio-economy.
Motivated by mass production.	Motivated by smart societies and sustainability.
Consumes electrical power, fossil fuels and renewable resources.	Excludes fossil fuels and focuses on renewable sources.
Technologies of interest include IoT, Big Data Analytics, Robotics and AI.	Focus is on Sustainable agricultural production, bionics, renewable resources and innovation in the domain of human-robot collaboration.
Main areas of research include innovation, business administration, organizational research, process improvement.	Main areas of research include smart environments, organizational research, process innovation, agriculture, biology, waste prevention, circular economy.

The concept of Industry 5.0 brings additional concepts such as sustainability driven technologies, renewable resource exploitation, decentralization of critical network nodes, co-working between humans and robots rather than excluding humans from the workforce, and bio-economy [10].

The current concept of Industry 5.0 is yet to be materialized, and future steps in the domain of industrial revolutions will be in the direction of sustainability and society-oriented development and application of Industry 4.0 technologies. Changes can be expected in the domain of cyber-security, as current defence mechanisms will be outdated. Network complexity has to be governed in order to reduce negative chain reactions in the event of critical failures in some parts of the network. As noted earlier, Industry 5.0 brings a new way, and improved approach on how modern and advanced technologies are used in manufacturing. The current state of the industrial revolution landscape is predicting future trends that will shape the actions and technological development within the frameworks of Industry 5.0 [11].

Furthermore, when it comes to the framework of Industry 5.0 and conducting business in accordance with its main principles, the necessity for an innovative managerial approach arises. The innovation management is an imperative to make new technologies and innovation implementable, applicable, and understandable. The main goal of these innovation management techniques is to make innovation human-oriented and to increase value for the customer. Industry 5.0 includes the underlying technologies and the necessary management for sustainable application of these technologies from a social aspect has to continuously evaluate innovations through complex and extensive networks, and to apply quick, flexible, customizable solutions where necessary [12].

Some of the main components of Industry 5.0 are similar to the framework technologies of Industry 4.0, and include additive manufacturing, Internet of Everything, complex adaptive systems, emergent artificial intelligence, collaborative robots, digital ecosystems, smart manufacturing, and multi-agent systems and technologies [13]. The workflow within the frameworks of Industry 5.0 include data collection by sensors and devices, the accumulation of big data, artificial intelligence analysis and implementation of ideas by machine tools and robotics [14]. Industry 5.0 is based on renewing the human/centred and human centric manufacturing paradigm. This new paradigm includes organizational, managerial, philosophical, cultural, and intellectual processes in manufacturing across industries. Compared to Industry 4.0, the framework of Industry 5.0 takes

into consideration the concept of Society 5.0 and its essence of providing a sustainable network and infrastructure for societal prosperity, improved quality of life, social responsibility, human-centred technological integration, and sustainable development [15]. Industry 5.0 takes into consideration the framework of Society 5.0, human work would not be devalued, but in the contrary, it would be increased though human-robot collaboration. [16]. The increased efficiency between humans and technology and the underlying synergy in this relationship positively can affect the economy, the environment, and society [17].

The change and moving forward from Industry 4.0 to Industry 5.0 is not a technological revolution, but a systemic transformation on how Industry 4.0 technologies are implemented and applied, how are they in-sync with sustainable development goals, and societal values. Industry 5.0 is revolutionary from the aspect of increased standard of living for humans and from the aspect of improved manufacturing and working conditions where the worker exploitation is eliminated and employment rates are not reduced due to automation processes [18].

IV. SUGGESTIONS FOR IMPROVING COMPETITIVENESS

Based on the analysed literature in the domain of Industry 4.0, Industry 5.0, and Society 5.0, the following suggestions and guidelines for domestic enterprises, regarding future trends and competitiveness, are proposed:

- Domestic enterprises should take into consideration the concept of Society 5.0 when planning to implement an advanced technology that characterizes Industry 4.0. This way, enterprises can have a better starting pint when the framework of Industry 5.0 is in full effect.

- Creating value should not be focused only on customers but also on local communities. Increasing the wellbeing of communities contributes to attracting new customers and customer retention.

- Innovation and technology should be in accordance with sustainable development. Besides economic, enterprises should address social and environmental aspects of sustainability.

- Overexploitation of resources should be contained at a required operational minimum, and progressing towards only using resources form sustainable sources.

- Human resource management has to take into consideration the changes that new industrial revolutions bring and update their practices in order to retain employees and employee satisfaction. This can further result in better work performance. The future of manufacturing dictates the collaboration of humans and advanced technologies.

- Sustainable business strategies should be preferred over short-term economic results.

- On a national level, the government should address national strategies of sustainability and develop solutions that will incorporate the existing sustainable goals with Industry 4.0 technologies. This will provide a basis for national competitiveness improvement within the frameworks of Industry 5.0.

Overall, the situation on a national level regarding advanced technologies is not favourable. Domestic enterprises lack the motivation and ability to integrate advanced technologies that characterize Industry 4.0 in their full capacity.

However, the current global economic and technological climate has given time to domestic enterprises for addressing the potential of these advanced technologies. Even though the majority of developing countries lack the Industry 4.0 framework, then how is Industry 5.0 relevant? As noted earlier, Industry 5.0 is a systematic transformation on how Industry 4.0 technologies are applied. Therefore, developing countries, and domestic enterprises should consider Industry 4.0 technologies in the context and approach of Industry 5.0.

V. CONCLUSION

The evolution of manufacturing and the emergence of a new paradigm in manufacturing across industries will depend on how Industry 4.0 technologies will be government from a societal and environmental aspect, and how the advancement of modern technologies will be in accordance with sustainability goals. Even though domestic enterprises and enterprises from

other developing countries lack behind in the domain of Industry 4.0 technologies, the concept of Industry 5.0 should be taken into consideration, as this revolution is a systematic transformation of Industry 4.0.

The main limitation of this paper is the lack of an empirical data. The paper contributes to the existing body of literature and provides an adequate basis for future research. For future research, enterprises could be surveyed and data from enterprises could be analysed.

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Personal Marketing Mix in the Slovak Republic

Lucia Bartková

Institute of managerial systems, Faculty of Economics, Marej Bel University, Poprad, Slovak Republic

lucia.bartkova@umb.sk

Abstract - **Human resources are the most important asset of a company because people decide about the provision, distribution, use and development of all other resources. Employers are increasingly concerned about how they are perceived in the labour market, and they are trying to build their image as an attractive employer to gain a competitive advantage and attract and retain quality human resources. Personnel marketing can be used as a company strategy to differentiate the company from the competition and obtain the best human resources on the market. The aim of the paper is to analyse the application of the mix of personnel marketing in Slovakia. The paper analyses secondary information, as well as the results of own empirical primary research, which reveals the expectations of university graduates from the labour market, where they will become customers of advertising companies in the future. As follows from the research, foreign corporations, which have the sources and experience to offer attractive working conditions to employees, are proactive in the application of the personnel marketing mix in Slovakia. At the same time, the Covid pandemic is changing employees' expectations in terms of greater freedom of work and a change in the system of work organization and remuneration. Slovak small and medium-sized enterprises will also have to adapt to this trend to acquire and maintain quality human resources.**

Keywords - Personal marketing. Employer branding. Marketing Mix. Expectations.

I. INTRODUCTION

People in organizations are a source of quality of their products and overall success. If a company wants to obtain quality human resources, it should understand jobseekers as well as current employees as customers whose needs and expectations should be met as much as possible. In this sense, it is necessary to apply a marketing customer-oriented approach to the promotion of the company as an attractive and reliable employer to achieve a competitive advantage in the labour market. On the other hand, employees as customers are becoming more and more demanding, their requirements are changing, and it is important for companies to know them and adapt to them. The legislation that should allow companies to respond flexibly to changes in the labour market is equally important.

II. THEORETICAL BACKGROUND

While the term personnel marketing is widely used in the European literature, in the Anglo-Saxon countries the problem is covered almost exclusively with the term employer branding. Both terms cover the similar area of human resources management (HRM) and they are able to create good position also in corporate social responsible [1].

HRM can be defined as the approach to working with people as the owners of their human capital in the work process. Its essence is a business-oriented philosophy in relation to human resources, which leads to increased performance of the organization to achieve a competitive advantage during achieving personal goals of employees. Its functions are strategic personnel management, personnel planning,

analysis of work, jobs, recruitment and selection of employees, redeployment and termination of employment, training and development of employees, performance management and its evaluation, employee remuneration, employment relationships and working conditions, and personnel information system.

The concept of personnel management was described by Kotler [2] and he expressed the idea that employees can be understood as customers, and thus their relationship between them and the organization can be viewed in terms of career or employment consumption. In today's environment with high competition also in the labour market, companies are constantly struggling to retain the best employees. Talented individuals are aware of their quality and price in the labour market. They know what they expect from work and go for it. It is therefore important for companies not to stop considering an employee as a candidate, because when it does not take care of him and it do not satisfy his or her needs, the employee will go to the competition [3]. The key task of personnel marketing is to create a good employer reputation of the company, create a reputation as an attractive employer, which positively affects people's interest in working in the organization [4]. And securing employee commitment has come to be seen as pivotal to the success of HRM [5].

Personnel marketing as a company philosophy focused on job seekers and current employees therefore combines several personnel functions: recruitment of new employees but also training and development of employees, performance management, remuneration, care for employment relationships and working conditions. It is about setting these functions up in the company so that they meet the requirements of employees (current and potential). As the job market becomes more competitive, it is more important than ever for employers to engage employees at both the organizational and personal levels [6].

Employer branding has the task to create and communicate such characteristics of the company that distinguish it as an employer from the competition, the employer's brand should emphasize the unique aspects of the job offered. It can be used as an effective organizational strategy to differentiate from competitors and gain a competitive advantage in the labour market [7]. Employer branding is an activity in which the principles of marketing are applied to the HR activities of the company oriented to current and potential employees [8]. Its main purpose is to serve as a tool for effective attraction, recruitment, engagement, and retention of talent in an increasingly competitive global environment. It is what organizations offer to potential and current employees with a view to promote within and outside the firm, a clear view of what makes it different and desirable as an employer [9]. Therefore, employer branding is not only about hiring and it is not only about HR at all. Rather than personnel management it is about marketing, communication, and company culture. It is concerned with improving the company's reputation, attracting potential candidates in the labour market, increasing the number of qualified CVs received, improving the loyalty of employees, engaging and retaining employees, improving the identification of employees with a company, lowering fluctuation and keeping healthy employee retention [10].

Both concepts, personnel marketing and employer branding are focused on building the image of the employer both in the eyes of candidates and in the eyes of employees of the company with an emphasis on achieving a competitive advantage in this area. Because the term personnel marketing is used in the European area outside the Anglo-Saxon countries, we will also operate with this term in the article.

Personnel marketing helps to identify the needs and wishes of employees, both existing and potential, which can bring a competitive advantage over other companies. The goal of personnel marketing is to plan and implement activities that increase the attractiveness of the company on the labour market. In the concept of personnel marketing, there is the marketing mix with 5 P - product, price, placement, promotion, and personality.

As a product in the context of personnel marketing we understand a specific job position. Each job position has its own attributes, whether it is the requirements for the candidate, the place of performance, the organization of work and working hours. The product in the personnel sense can be not only a job position but also a vacant job within the framework of internal mobility [11].

The goal of every business is to minimize costs and maximize benefits. However, in personnel marketing, the price is not so clear-cut

and it's not just about money. The price of a product is determined by what the buyer must pay for it, i.e. what he or she must give up in order to get the product. The price for a candidate is given, for example, by the time he or she must devote to the job; the organization of the work to which he or she must submit; the performance it must be delivered; approach to work and the required working relationship [12].

The availability of the product on the market is provided through distribution channels, directly or indirectly. In the field of personnel marketing, we also distinguish between direct and indirect distribution channels. In the case of direct placement, it is the delivery of the product directly to the customer, i.e. to an employee. In the case of indirect distribution, the employer uses partners such as personal agencies, where the employer is therefore an agency, not directly the company of employeer.

Promotion in personnel marketing aims to build a good name and strong brand of the company as an attractive and reliable employer on the internal and external labour market, to create a positive attitude and preferences to the company and to inform suitable candidates about vacant places in the organization through the media and employees. Traditional tools of marketing communication in the field of obtaining suitable candidates include, for example, recruitment advertising, open days and participation in job fairs or systems of internal references. Like the company, the candidate and the employee use this toll to present their product - the performance of work. To promote his or her product on the labour market, he or she can use a number of ways - cooperation with recruitment agencies, using the services of specialized job servers with the possibility of publishing a CV or contact with the employer through a social network [12].

The last tool of the personal marketing mix is personality. It describes the choice and role of mutual compliance of the future employee and the organization in which he or she will work. It is mainly about whether both parties will suit each other, and good relations will be established in the long run. When selecting a candidate, the organization sets many criteria, whether it is the professional and personality traits of the candidate, the attitudes of the candidate or the approach and value orientation of the candidate. It is essential for the organization that the selected candidate performs tasks related to a specific job in adequate quality, exhibits the employment rights required by the organization and he or she can accept and identify with the organization and its values in the long term. Emphasis is also placed on ensuring that the candidate fits into the work team.

On the other hand, the candidate is also looking for a job with certain criteria. He or she considers the personality of the organization, its image and corporate culture. As with people, the qualities of an organization's personality are always specific and unique. By these qualities organizations present themselves to their target groups. Through the strong personality of the organization, the applicant can identify it in the labour market. Applicants then personalize the organization and assign its human characteristics and traits.

Candidates with certain attitudes, characteristics and traits are usually interesting for companies with which they agree and align. The relationship between an employee and a company largely depends on how he or she can be identified and harmonized with the company [12].

III. RESULTS AND DISCUSSION

The aim of the research was to apply the tools of the personal marketing mix in the conditions of the Slovak labour market. To fulfil it, we used the results of secondary research of the Slovak labour market, and we confronted selected factors with the results of own empirical primary research. We conducted secondary research mainly through the job portal Profesia.sk, which is the largest one in Slovakia and has a huge amount of data about the Slovak labour market, so we can consider this data relevant. The primary research was conducted on a sample of 132 university students of economics in the form of a questionnaire with the intention to find out the expectations of future graduates about their future employment.

A. Product

In the context of personnel marketing, we understand a product as a specific job position and its corresponding requirements for the applicant, place of performance, work organization and working hours. As follows from the research of secondary data, the labour market in Slovakia is developing positively in 2021. The analysis of the largest job portal informs that employers published a record number of job offers during the summer, and the first days of

Industry	Work position
Trade	Shop assistant
Production	Production operator
Transport, forwarding, logistics	Warehouseman
Information technologies	Java programmer
Administration	Administrative worker
Management	Business manager
Economy, finance, accountancy	Accounter
Engineering	Assembler
Ancillary works	Worker
Tourism, gastronomy and hospitality	Waiter

September also indicate that this trend will continue [13]. The sectors where companies published the most offers in August are illustrated in Table I.

Regarding the expectations of the respondents from our primary research, most students will apply for the position of manager, administrative worker, and sales representative as graduates. But they are students of the faculty of economics. However, based on a comparison of primary and secondary research data, we can state that the demand and supply of jobs in the business, administration and economic sectors intersect, so we can assume that graduates of economic schools will have no problem to find employment after graduation.

The product of personnel marketing also includes the form of work - the place of performance, work organization and working hours. As follows from the analysis of secondary data, the number of job offers in Slovakia that do not require coming to work at all is growing. While in the second quarter of 2019 the job portal Profesia.sk registered only 0.2% offers that did not require coming to work at all, in the same period of 2021 there are 13 times more such offers, which represents 2.2%. These were not advertisements that provided the opportunity to work from home on some days, but permanent job at a distance, which did not require coming to work. This type of employment in Slovakia is officially called teleworking (it is necessary to use technology for work) and according to the Slovak Labour Code it is a profession that the

employee performs not occasionally, but regularly from home [14]. The higher number of offers for telework also complements the increased number of offers for work that is tied to one place, but companies offer the possibility to work from home when it is suitable or necessary. While before the pandemic there were about 7% of such offers, in the first quarter of 2021 it was 13.4% [15].

On the other hand, as follows from the analysis of secondary data, most employees do not require full remote work, rather they demand partial, respectively hybrid form [16]. However, remote work raises new needs of self-development employees, especially in the field of self-management (time management, stress management, wellbeing), digital skills, communication and building interpersonal relationships, building flexibility and adaptability to changes, cognitive skills development (problem solving, creativity, flexible thinking) and language skills. At the same time, employees expect that employers meet their needs, and some employers have already started to provide a contribution to support work from home [17]. According to the results of primary research, more than half of the respondents (59%) expect to be able to work from home as a graduate. At the same time, 57% of respondents expect flexible working hours as well as one-shift operation from their future employment (up to 93%).

B. Price

As a price for a career in personal marketing we consider the time that the employee must spend in the job; the organization of the work to which he or she must submit; the performance he or she must deliver; access to work and the required employment relationship. As follows from the secondary data results of the portal profesia.sk, employees currently demand more freedom and flexibility from employers, also in working hours, work organization and remuneration system in terms of greater focus on the result than time spent at work [16]. Employees demand more benefits related to health - support in maintaining a balance between personal life and work, but also a financial contribution to the equipment of the home workplace. This is also confirmed by the results of own primary research, as more than half of the respondents expect flexibility and freedom in both choosing a job and choosing working time. This should correspond to a

reassessment of the system of organization and remuneration of work in terms of shifting the focus from time spent at the workplace to rewarding the achieved results.

Job seekers are confronted with their own idea of what they must "pay" for getting a job with the amount of salary offered for that job. In Slovakia, the publication of salaries in job offers is mandatory. As practice shows, the statement of salary in the advertisement increases the motivation of candidates to respond to the offer [18]. However, the information in job offers is not uniform. About half of the offers state one number as the offered salary and a text about remuneration, commissions, and practice. The second most common way of stating a salary is a salary range, for example, from € 700 to 1000. Approximately 10% of offers present an hourly wage, and 5% of offers present a single number without accompanying text. Roughly 84% of offers state a monthly salary, followed by a tenth of advertisements with an hourly wage, and among the offers are also advertisements of employers with a wage for performance [19]. For this reason, it is often difficult for people to compare different offers. Most job seekers consider the salary information provided in advertisements to be insufficient and incomprehensible [20].

C. Placement

In Slovakia, employers are increasingly using services of agencies and headhunters [21]. According to the law, a temporary employment agency is defined in Slovakia as a legal or natural person who employs a citizen in an employment relationship for the purpose of his temporary assignment to a user employer in the Slovak Republic to perform work under his supervision and management. The agency may temporarily assign the employee to the user employer max 4 times for 24 consecutive months. The agency may not charge the temporary agency worker a fee for the assignment to the user employer or for the conclusion of an employment relationship with the user employer after the end of that assignment; however, it may collect compensation from the user employer in the agreed amount [22].

There are approximately 450 employment agencies in Slovakia [23]. According to estimates, a tenth of them use unfair practices, some of them e.g. do not have a license for job placement. The most common unfair practices include:

- deduction of part of the wage as a commission for job placement,

- an indication of a lower wage in the contract than that actually belongs to the employee,

- noncompliance with statutory comparable conditions for agency and regular staff in the same position,

- employment on an agreement basis instead of an employment contract, which the law does not allow in the case of agencies,

- requiring more overtimes to be worked than provided by law,

- nonpayment of social and health insurance for the employee.

The jobseeker should therefore always check the agency with which he or she intends to sign the contract. Personnel agencies that want to behave transparently are associated in the Association of Personnel Agencies of Slovakia. Its members are regularly audited and compliance with legislation and the association's code of ethics is checked.

D. Promotion

In Slovakia, employers have several options to promote their job offer. One of the possibilities is the Central Office of Labour, Social Affairs and Family, which also operates the online portal istp.sk. In addition, there are several online job portals in Slovakia, the largest one is profesia.sk. Other options for jobseekers where to find job are social networks and references. Based on secondary research, most people in Slovakia are looking for work through a job portal or through the recommendations of family and acquaintances. The minority uses contacts from student times or social networks [24].

When promoting job offers, there are often clichés that are repeated in many advertisements, which certainly does not contribute to the interest of candidates or their motivation. The most frequently recurring phrases include [25]:

- "Young dynamic team"

- "Inspirational/pleasant working environment"

- "Stable company/employment"

- "Career growth opportunities"

Some employers use nontraditional and original ways of formulating advertisements when promoting job offers in an effort to attract

candidates. For two years in a row, the job portal Profesia.sk has selected the most interesting and creative ways of addressing candidates:

- Specialist in the treatment of cattle cloven hooves

- Marketing magician (or witch)

- Chef/fulltime wizard in the kitchen

- Intergalactic online temporary worker

- Iron-man wanted! Master of metal processing

- OMG! Online Marketing Guru

- Caretaker for cattle - herding cows and milking

- Replace the fitness centre for a brigade - test the car seats

- Lizard tamer (lizard is a type of forklift truck)

- We will take you to work, you will drive at work. (Forklift Driver)

- Will you sell the fridge to the penguin? We are looking for you!

- Martinus is looking for a stylus and visual magician!

E. Personality

The last tool of the personal marketing mix is personality. There are many criteria how employers select employees. Among the basic requirements that employees commonly state in advertisements are education and experience. Other factors that often lead to discrimination in the labour market are gender and age.

Slovak labour market reflects the long-term mismatch between people's education and job supply. A secondary school is enough for the most job offers: the most required education in Slovakia has been a high school diploma for a long time. In second place is high school education without a high school diploma, which is enough for employers in more than 23% of advertisements. Overall, secondary education is sufficient for most job opportunities. In 2021, this is more than 60% of offers [26]. On the other hand, more people with a university degree are employed than high school graduates. This relates to the fact that university graduates have better salary conditions and also better prospect of wage growth [27].

Another criterion required by employers in job offers is work experience. According to secondary data, up to three quarters of university students work alongside studies [28]. As can also be seen from our primary research, 96% of respondents were already working during their studies. It is a positive trend that allows jobseekers to get a job earlier and achieve better salary.

In terms of gender equality, we must state that women in Slovakia earn less than men. As follows from the analysis of secondary information, the total average salary of men in gross in 2020 reached 24.6% more than the salaries of women [29]. These differences are due to several factors. Women are often employed in sectors such as health care and social work, education, but also others, which are remunerate below average in Slovakia. Another factor that affects the pay gap between women and men is maternity leave. In Slovakia, the care of a newborn baby is almost always on the mother. While women have been on maternity leave for several years, their male colleagues are gaining experience in working life, which is often linked to salary progress. Benefits to help mothers return to work include, for example, a split job, teleworking, working from home or creating a children's corner in the premises of the company, or the so-called onboarding - gradual learning into the changes that occurred in the performance of their position, reintegration into the work team or training in new processes. These benefits in Slovakia are provided mainly by foreign corporations with enough sources and experiences.

In terms of age, young people as well as older people before retirement are also actively interested in work in Slovakia. According to secondary data, the number of 15-year-olds interested in work has tripled year-on-year, with 18-year-olds seeking the most [30]. Young people currently have the most opportunities in trade, tourism, gastronomy and hospitality, auxiliary work and in production, among the individual positions, the most job offers are for salespeople, cashiers, and administrative staff. Many citizens of Slovakia are looking for work even in old age, currently the most in the last five years [31]. People over the age of 62 are most often looking for a full-time job in the areas of transport, logistics, forwarding, trade, and production. They are most interested in the positions of warehouseman, production operator, salesman, worker, and auxiliary worker. It is

assumed that these trends, especially the interest of older people in working, especially in connection with the aging population, will increase in the future, as the labour market and employers will adapt.

IV. CONCLUSIONS

The product of personnel marketing, i.e. the job itself and the form of work, is undergoing significant changes, especially recently due to the COVID-19 pandemic [32]. The structure of the economy and thus the supply of jobs is changing. In terms of the form of work, employees are interested in a hybrid form of remote work, when in addition to the classic work, they expect from the employer, if necessary, to work from home. At the same time, they expect the employer to help them adapt to working from home with a contribution to acquire the necessary skills and to equip a home workplace. It is ensuring stability and supporting employees in difficult times that is becoming a key factor in employers' competitive advantage in the labour market, so companies should consider such support.

Mandatory information about salary in advertisement offers candidates more information and motivation to respond to the job offer. Candidates should also be prepared that HR professionals ask them about their expected salary at the end of the interview. We therefore recommend that jobseekers should find out as much information about salaries as possible. There are portals on the market offering free access to average salaries for specific positions, tailored to regions, education, or years of experience.

In terms of indirect distribution of work, there are many personal agencies on the Slovak market, but some of them use unfair practices. It is therefore important for jobseekers to check the recruitment agency and to study the terms of the contract carefully before they sign it.

In terms of job promotion, online job portals are the most popular in Slovakia. When creating an advertisement, employers should avoid common clichés and rather create an original advertisement that will attract candidates and motivate them to respond to the offer.

Employers select employees based on various criteria. One of the most important is education and experience. From the point of view of education, there is a considerable

disproportion on the Slovak labour market, when most advertisements require secondary education, but university graduates are mainly applying for a job and they demand a higher salary and career progression. On the other hand, university students often have practical experience, which is often required by employers, as they also work alongside studies, so they have a better bargaining position in a job interview. Due to this trend and also the improving economic situation in Slovakia, companies will have to adapt to the increased salary expectations of applicants.

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Innovation Impact on the Performance of SME

Vanja Vukojević[1], Milenko Tanović[2]

[1,2]Innovation Centre, University of Niš, Niš, Serbia

[1]vanja.d.vukojevic@gmail.com, [2]milenkotanovic@gmail.com

Abstract—**SME sector is essential for every strong and healthy economy. It has a great impact on GDP, employment, and the overall stability of the economy. Nowadays, small and medium enterprises encounter numerous challenges. In these turbulent business conditions, the survival of small and medium businesses is very demanding. Moreover, the growth and development of SMEs are excruciating. It is necessary for them to follow market trends and to adjust to the changes. Implementation of innovation helps SMEs in adjusting. According to OECD, innovation represents something new, or notably improved, whether it is a product, process or method in organization or marketing [1]. This paper shows a review of various research conducted in different countries that shows the correlation between innovation and SME performances.**

Keywords - innovation, entrepreneurship, SME, performance

I. INTRODUCTION

The importance of the SME sector for the economy is immeasurable. Both developed and transitioning economies depend on small enterprises. Some data shows that SMEs are essential to the EU economy because they create over 85 % of new workplaces in the EU [2]. According to International Labour Organization [3], these enterprises have a great impact on GDP, in most OECD countries, SMEs contribute more than 50% of GDP. Christopher Arnold, Head of SME/SMP and Research, IFAC, in his article "The Foundation for Economies Worldwide Is Small Business" [4] says that not only that SMEs have a great impact and contribution to the economy, but they are its essential part. According to European Commission [5], this category is consisted of enterprises employing less than 250 people, have an annual turnover less that EUR 50 million, and/or an annual balance sheet less than EUR 43 million".

Annual report of the SME sector [6], published by Chambre of Commerce in 2018 shows similar situation in the Republic of Serbia. SME sector represents 99,9% of the overall number of enterprises, it employs about 67.8% of the overall number of employed and generates about 60.8% of gross value added.

SME as a type of conducting business has some advantages. They are more agile, because of their simple organizational structure, so they can react quickly and adjust to changes in the market. This is very important nowadays, considering turbulent business conditions. Furthermore, they are more innovative, because, it is easier to implement innovations in smaller, more flexible systems. Informal ways of communicating, which is characteristic of SMEs, make it easier to communicate and adopt changes. Lack of rigid hierarchy makes decision-making faster. Also, entrepreneurs are known as people who are willing to take risks, so they are often in new and uncertain business projects. Some authors [7] enounce that innovative SMEs can obtain competitive advantages in market niches.

There are few disadvantages of this form. First of all, small and medium enterprises have limited access to financial assets. Lack of money doesn't allow them to invest in new technology, because those kind of investments are expensive. Despite that, SMEs are known as innovators. In

this paper, it will be shown how innovations impact the performances of SMEs.

II. CONCEPT OF INNOVATION

A concept of innovation is present in the scientific literature for quite a along. Over time, different authors gave different definitions of innovation. They all agree that the word derives from the Latin word innovare, which means – to create. Nowadays, innovation isn't only about the creation, but also about improvement. For Sussanto [8], innovation is the process of creating something new. According to Schumpeter [9], innovation can be divided into five types: 1. new products or a variation of existing product; 2. new methods of production or sales of a product; 3. new market (the market for which a branch of the industry was not yet represented); 4. new sources of supply of raw material; 5. new industry structure. The accent is on the introduction of new things. Drucker [10], in his famous work Innovation and entrepreneurship, describes innovation as entrepreneur's instrument to utilize changes in the environment. The coherence between innovation and entrepreneurship is significant.

Porter [11], on the other hand, emphasizes the importance of innovation to the economy as a whole. This author says that a nation's competitiveness is based on its innovation and improvement. This macroeconomic approach has its covering in today's Global Innovation Index. This indicator was founded in 2007. as a project in INSEAD business school in France, to point out to the importance of innovation to society, and, at the same time, to overcome traditional innovation indicators. The Global Innovation Index (GII) was established in 2007, with the aim to quantificate innovation in different countries [12]. The reports are being published annually.

According to this report for 2020 [13], economies with the highest value of this index are, as expected, from the group of highly incomed. The only exception is China, at position no.14, as the only economy in the top 30 that belongs to the middle-income group. We can conclude that innovation, indisputably, they have a great impact on enterprises, but also on economies. That's why innovation as a concept is popular in scientific papers and, nowadays, as a subject of different research.

III. CONDUCTED RESEARCH

A various research has been conducted in different countries. All of them have the same goal, to prove the correlation between innovation and growth and development of SMEs.

Interesting research was conducted in Turkey in 2014. Turkey is well known for its entrepreneurial culture. As we can see in the OECD Policy brief [14]., 73.5% of employees in Turkey are employed in the SME sector (for comparison, in the OECD area, this is 63%). SME sector creates more than 50% of value-added and exports. They are *conditio sine qua non* for job creating. After a detailed analysis of the literature,a group of authors researched the most significant innovation factors. Author Lecerf [15] emphasizes the importance of financial resources for implementing innovation. According to different authors [16] institutional factors are crucial for SME's innovation. The economic factor is significant because SMEs function as a part of the economic system. Also, conditions at the market influence SME and their innovation capacity.

After the literature review, the authors [16] have chosen several factors: financial factor, firm size, institutional factor,technological capability, consumer preferences, market orientation, culture factor, management skills, learning capability, marker orientation and competive advantage. Data was collected from 33 SMEs in Istanbul, Turkey. For processing data, they have used a modified version of the analytic hierarchy process. After further statistical processing, the authors [16] calculated the weight and the normalized weight of every factor, according to mentioned model. The study goal is to examine the factors that impact the innovation performance of SMEs. The findings are: management skills, technological capability, financial factor, and firm size are influential.

Research about SMEs innovation was conducted in the United Kingdom. For this research, data were collected from 855 SMEs from different industries. The questionnaire used in the research had Likert scale questions. This research aimed to prove the impact of R&D, Innovation and Internalization on business performances, such as profitability and sales growth. Data were processed using correlation and regression analysis.

TABLE I. CORRELATION ANALYSIS (UK).

Variable	Mean	S.D.	1	2	3	4	5	6
R&D activities	2.92	1.81	1.00					
Innovation	3.51	0.82	0.45***					
International	3.31	1.04	0.49***	0.27				
ROA	3.41	1.06	0.36**	0.22	0.32*			
ROS	3.44	0.96	0.28**	0.29	0.27*	0.76***		
Sales growth	3.49	1.15	0.53***	0.34*	0.35*	0.55**	0.53**	
Firm size	2.74	1.48	0.42***	0.33*	0.38*	0.26*	0.27*	0.35**

Notes: *p<0.05, **p<0.01, ***p<0.001

TABLE II. CORRELATION ANALYSIS (ZIMBABWE).

Correlation analysis				
Type of Innovation		Correlation Coefficient		
Product Innovation		0.885**		
Process Innovation		0.674**		
Marketing Innovation		0.806**		
Organisational Innovation		0.015		
**Correlation is significant at the 0.01 level				
Regression Model Summary				
Model	R	R square	Adjusted R Square	Std. Error
1	0.641a	0.651	0.642	0.38743
a. Predictors: Product Innovation, Process Innovation, Marketing Innovation, Organisational Innovation				

TABLE III. PROCESSING DATA

Latent Variables	R^2	Path Coefficients	T-Values*
H1: Technology orientation >>Innovation	0.409	0.639	15.550
H2: Technology orientation >>Business performance	0.276	0.060	0.880
H3: Innovation >>Business performance	0.276	0.485	5.718
*The t-values were significant at p<0.05, 0.01 and 0.001 except technology orientation and business performance			

The research examined the correlation between innovation and different performance indicators, sales growth and profitability (represented as Return on Assets and Return on Sales). Authors' [17] findings show that innovation has an impact on sales growth and Return on Assets (as seen in Table I), but is not statistically significant for Return on Sales.

Very detailed research was conducted in Zimbabwe in 2020. According to some authors [18], SMEs in Zimbabwe are facing a lot of problems, which is one of the reasons why a lot of SMEs fail. This group of authors has classified all the innovations in the enterprise as these four types (as seen in Table II). Also, they have concluded that the performance of SMEs depends on these four types. Some authors [19]. claim that SME performance is determined by product, process, marketing and organizational innovations.

The research was conducted by quantitative survey research method. The sample was made from the population of manufacturing SMEs in Harare, Zimbabwe. About 200 enterprises were questioned. The authors used regression and correlation as a model. Results of correlation and regression are shown in Table II. These findings show a strong, positive correlation between product innovation and SME performance. So,

focusing on product innovation will improve SME's performance [19].

Another research was conducted in Dubai, where the SME sector is highly developed and successful. The research was conducted on a sample of about 200 SMEs from different industries. Although the main focus of the research conducted by this group of authors [20] was the influence of technology orientation of a firm on its ability to innovate, one of the hypothesis claims that there is positive correlation between innovation and business performance. The questionnaire had questions with the Likert scale. Data were processed by using different statistical methods, as shown in Table III.

As we can see in Table III, the findings affirm this hypothesis. According to some authors [21], innovation allows SMEs to obtain a competitive advantage, which results in improved performances.

Other research conducted in Pakistan analyzes the impact of different types of innovation and organizational learning on the business performance of SMEs. Authors [22] are questioning the impact of technological innovation, non-technological innovation and relational learning on SME performances. They

TABLE IV.   RESEARCH FINDINGS

Hypothesized Effect	Path Coefficient	p-value	t-value	Decision
H1: Technological Innovation has a positive significant effect on Firm performance	0.254[*]	0.37[*]	2.081	Supported
H2: Non Technological Innovation has a positive significant effect on Firm performance	-0.49	0.733	-0.341	Not Supported
H3: Relational Learning has a possitive significant effect on Firm performance	0.503[***]	0.000	5.775	Supported
[***]: $p<0.001$; [**]: $p<0.01$; [*]: $p<0.05$				

questioned SMEs from the manufacturing, trading and service sector, 352 of them. A structured questionnaire was being used.

As we can see in Table IV, findings show that it is essential for improving SME's performance to implement technological innovation, such as new products and production processes. We have to put these results in the context of Pakistan, their SMEs have troubles with the sustainability of their business. Also, the performances of SMEs in Pakistan are low, because of economic conditions and corruption. SMEs are not developed and technologically intensive and that is the reason why technological innovations are the most important for improving performances.

IV.   CONCLUSION

Nowadays, business conditions are dynamic and challenging. It is very difficult for all the economy subject to answer everyday changes timely. All the enterprises are giving their best to adapt and survive in the market, and innovations are crucial for sustainable and long-lasting organizations. SME sector is innovative, by using its advantage of size and agility.

The concept of innovations in SMEs is well-known in scientific literature. Last decades, it is also present in various research. This paper has shown results of five different research, conducted in different countries, with different business conditions.. Some of the findings are that there is a positive correlation between innovation and business performance. Other research proved a positive correlation between innovation and profitability (shown as ROA) and sales growth. Technological Innovations and product innovations are also related to improved business performances. Also, different factors impact the innovation performance of SMEs, and the findings of this research show that those are management skills, technological capability and financial factors.

However, all the findings are consistent and innovations questionless have a positive impact on SME performance.

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The Cycle of Money with and without the Enforcement Savings

Constantinos Challoumis[1]

[1]National and Kapodistrian University of Athens, Greece

[1]challoumis_constantinos@yahoo.com

Abstract— **This paper is about the comparison of the cycle of money including the enforcement savings and without them. Thus, it is plausible to extract the appropriate conclusions about the utility of savings in an economy when there the savings return to the market for investments and for consumption and when these savings are omitted and lost from the market for a long-term period. The fixed-length principle is the tax policy that the theory of the cycle of money suggests. The last decision of the 15 % complies with the fixed-length principle theory that supported the last decade by the theory of the cycle of money. Moreover, according to this theory, the governments should act more to reform the structure of their economics, to settled better with the principles of this theory. This analysis used the Q.E. method.**

Keywords - cycle of money, enforcement savings, Q.E. method.

I. INTRODUCTION

This paper is about the case of the cycle of money with and without the enforcement savings. This could happen when there are returned savings and when there are no returned savings. This economic comparison has as a result that in a market the consumption and the investments are in the minimum level when there are no enforcement savings [1-7]. Therefore the appropriate tax rate is the key element for the appropriate public policy. The fixed-length principle is served when the public policy with the lower taxation of uncontrolled transactions and the higher taxation of the controlled transactions is established.

The contracts and the agreements between the participants of control transactions are those which determine the allocation of profits and losses. The agreements should be mentioned the changes in the contracts. This is the reason why the tax authorities should make periodic inspections. The periodic specification of contracts is important for the comparability analysis [8-19]. These periodic inspections of the companies which participate in controlled transactions are crucial for the arm's length principle. Then, the determination of the cost-sharing depends on the periodic check of companies that are tested parties [20-30].

The scope of the companies of controlled transactions is to face the issues that are connected with the taxation of their activities. Therefrom, the requirements for the companies of controlled transactions with the tax authorities should be in the range of the arm's length principle. Thereupon, the appropriate agreement of the companies of controlled transactions is that which permits them the maximization of their profits in tax environments with low tax rates, and the maximization of costs in economic environments with high tax rates [8,9,13, 16,31-41]. The companies of controlled transactions and the same time the inspections of tax authorities are done under the condition of the proportional adjustments. The interpretation of the condition of the proportional adjustments is that the companies which participate in controlled transactions many times don't have the appropriate data and uncontrolled transactions of similar circumstances to compare and therefore they proportionally adjust their data. This means that if the companies which are tested parties conclude that the profits and losses of companies from uncontrolled transactions are much higher or much fewer then they make a proportional analogy to compare them with their data.

The structure and dynamics are defined using the concept of the cycle of money. The prior results of Latvia, Serbia, and Bulgaria, Thailand, and Greece revealed the behavior of these countries to a potential crisis. With similar logic, it is examined the case of Belarus. The theoretical background of the cycle of money supports that the dynamic of an economy is based on the idea of the number of times that money is used in an economy. An economy should be considered not as a closed system, but as a system with fragments. An economy with fragments means that the economy interacts with other economies but simultaneously protects its money. An amount of money in many cases is getting out from an economy to external banks, or other economies.

The mainstream is that the bigger companies and the international companies in most cases are saving their money to external banks and economic heavens. Therefore, according to this theory, the tax authorities should put an additional tax on this kind of companies to decline the losses to the economy. Additionally, the smaller companies and the freelancers should be taxed with lower tax rates [39-50]. Then, it would be plausible to increase the dynamic of the economy. In addition, the factories, know-how services of big companies, health care system, and educational system comprise a special case for the economy, as belong to those cases where the taxes improve the quality of the economy [4,51-53].

Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example.

II. LITERATURE REVIEW

The production of goods or services creates profits and costs for the companies. Based on the prior scrutiny we have that:

$$u = s\left(zf + \tilde{z}d\right), \qquad (1)$$

$$z = \left|\tilde{z} - 1\right|. \qquad (2)$$

The symbol u is about the impact factor of the comparability analysis which has any method to the s. The symbol z is a coefficient that takes values between 0 and 1. What value could receive is determined by the influence of the method (using the best method rule) to the s. The symbol of f is about the cost which comes up from the production of goods, and the symbol of d is about the cost which comes from the distribution of the goods.

According to equations from (1) to (6) is plausible to determine the following equations:

$$u_e = zf + \tilde{z}d, \qquad (3)$$

and

$$b = \left(p - u_c\right) * j_1. \qquad (4)$$

The symbol of b in the prior equation is about the amount of taxes that should pay the companies of controlled transactions in the application of the arm's length principle. The u_c is the amount of tax obligations that can avoid through the allocations of profits and losses. Moreover, j_1 is a coefficient for the rate of taxes. Then, equation (8) shows the case of the arm's length principle. In addition to the case of the fixed-length principle we have the next equation:

$$v = p * j_2. \qquad (5)$$

The symbol of v in the previous equation shows the taxes that should pay the enterprises of controlled transactions in the application of the fixed-length principle. Then, j_2 is a coefficient for the rate of taxes in the case of the fixed-length principle. Thereupon, we conclude according to the prior theory that:

$$v \geq b. \qquad (6)$$

The tax for the companies which participate in controlled transactions of transfer pricing in the case of fixed length principle is higher or at least equal with that of the case of the arm's length principle.

Thereupon, with the fixed-length principle, the enterprises of controlled transactions can tackle issues that come from the allocation of profits and losses. The tax authorities can face the transfer pricing effects to the global tax revenue.

The fixed-length principle permits recovery of the tax losses of the global tax revenue from the controlled transactions of the transfer pricing. The next scheme has illustrated the procedure that companies of controlled transactions follow

Figure 1. Cost sharing and application of fixed length principle
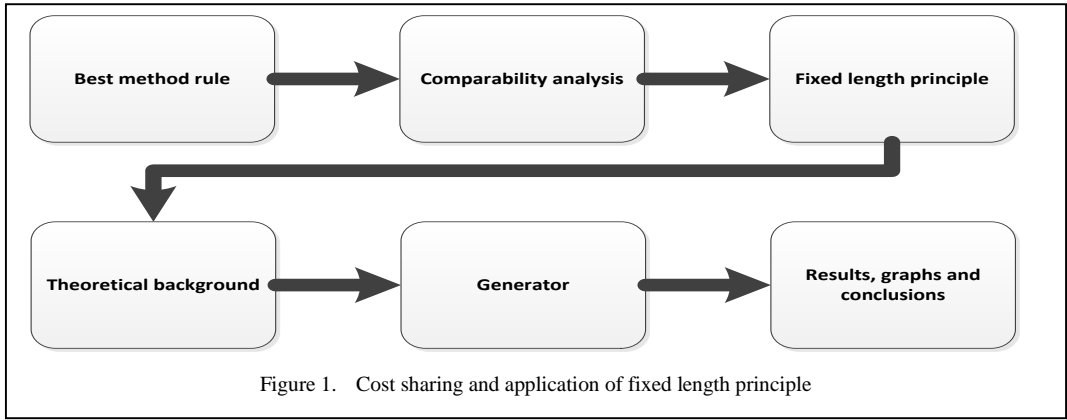
for their allocations of profits and losses, the proportional adjustments of data, and the fixed-length principle (Fig. 1).

Figure 1 is determined the procedure of the fixed-length principle and its quantity analysis for the determination of the behavior of the model. In the next section is presented the theory of the cycle of money. Moreover, the methodology which followed stands on the Q.E. method.

III. METHODOLOGY AND THEORETICAL BACKGROUND

The tax revenues correspond to the savings that the companies could have if the taxes were avoided. The way that these savings are administrated is different from case to case. Then the benefits of the companies could be managed in a completely different way, as could be saved or could be taxed. The theory of the cycle of money shows when the savings robust the economy and when the taxes robust the economy/ It is crucial for this determination to be a separation of savings into the non-returned savings (or escaped savings) and into the returned savings (or enforcement savings). For the scope of this analysis below are demonstrated the equations which are:

$$\alpha \geq \alpha_s + \alpha_t \ or \ \frac{1}{v} + \alpha_t , \qquad (7)$$

$$x_m = m - a , \qquad (8)$$

$$m = \mu + \alpha_p , \qquad (9)$$

$$\mu = \sum_{i=0}^{n} \mu_i , \qquad (10)$$

$$\alpha_p = \sum_{j=0}^{m} \alpha_{pj} , \qquad (11)$$

$$c_m = \frac{dx_m}{dm} , \qquad (12)$$

$$c_\alpha = \frac{dx_m}{da} , \qquad (13)$$

$$c_y = c_m - c_\alpha . \qquad (14)$$

The variable of α has symbolized the case of the escaped savings. This means that we have savings that are not returned to the economy or come back after a long-term period. The variable of α_s symbolizes the case that we have escaped savings that come from transfer pricing activities. The variable of α_t is symbolizes the case that we have escaped savings, not from transfer pricing activities but any other commercial activity. For instance α_t could refer to the commercial activities which come from uncontrolled transactions. The variable of m symbolizes the financial liquidity in an economy. The variable of μ symbolizes the consumption in an economy. The variable of α_p symbolizes the enforcement savings, which come from the citizens and small and medium-sized enterprises. The variable of x_m symbolizes the condition of financial liquidity in an economy. The variable

269

of c_m symbolizes the velocity of financial liquidity increases or decreases. The variable of c_α symbolizes the velocity of escaped savings. Therefore, the variable of c_y symbolizes the term of the cycle of money. Thereupon, the cycle of money shows the level of the dynamic of an economy and its robustness.

The principles of the cycle of money:

- The citizens, the small and the middle-sized enterprises substitute the services and the property of the companies which save their money and not invest them or consume it proportionally in the economy. Thereupon, the companies of the controlled transactions are the main cause for the escape savings.

- The escaped savings are responsible for the decline of the economic dynamic of the economy. The key point of escape savings is that the companies of controlled transactions of transfer pricing are responsible for the not reenter of this amount of money in the market. This situation causes the lack of financial liquidity in an economy.

- The substitution of controlled transactions is not substituted from the citizens and the small and middle-size companies when there is not plausible to offer the same added value to the products and the services. This case happens especially in the instance of factories, in the research centers, etc. Therefrom, these cases in the appropriate tax policy should be taxed as uncontrolled transactions independently if they participate in controlled transactions (using the fixed-length principle).

- The enforcement savings are responsible for the high economic dynamic of the economy. Therefore, the investments and the consumption are these elements that come from the savings of the citizens and the small and middle-size companies.

- The velocity of financial liquidity shows how rapidly the economy robustness grows or declines accordingly. Then is an index for how well structured is any economy.

- The velocity of escaped savings shows how rapidly the non-return savings are lost from the market, or by the lack of investments, or by the lack of consumption.

- The cycle of money represents the condition of the economy. The level of a well-structured tax system, and in general the dynamic of the economy. If this indicator is high then the economy could have high robustness otherwise has low financial liquidity.

- As controlled transactions in the theory of the cycle of money is considered not only the cases of transfer pricing, but any kind of administration of profits and losses to avoid taxation.

- As uncontrolled transactions in the theory of the cycle of money are the case of the commercial activity of citizens, the small and medium-sized enterprises, the factories, the research centers, and any kind of commercial activity that cannot substitute by the companies of controlled transactions.

- The fixed-length principle tackles issues subjects like the case cycle of money. But, this doesn't mean that restrictive must apply the fixed-length principle as the cycle of money is more widely theory which exceeds the transfer pricing scope.

It is obvious that cycle of money growing when there is a tax system like the case of the fixed-length principle which permits the low taxation of uncontrolled transactions and the higher taxation of controlled transactions. Should be mentioned that as uncontrolled transactions are considered the same happens and with the cases of the financial liquidity of citizens and the small and middle-size companies [57-69]. The prior analysis is illustrated in Fig.2.

Figure 2 (a) showed the case of the escaping savings and the enforcement savings. Then, we have the connection of the higher tax policy for the controlled transactions and the lower tax policy for the uncontrolled transactions which is supported by the fixed-length principle. In the model of the cycle of money without the enforcement savings (Figure 2(b)) we have the worst hypothetical case where lost savings happen in the market. Therefore, in the second scheme, we have an economy that indicated a low economic dynamic environment. For the mathematical approach of the cycle of money we use the prior equations subject to the next conditions:

$$m \approx \mu, \qquad (15)$$

$$\mu > \alpha_t > \alpha_s > 0. \qquad (16)$$

(a)

(b)
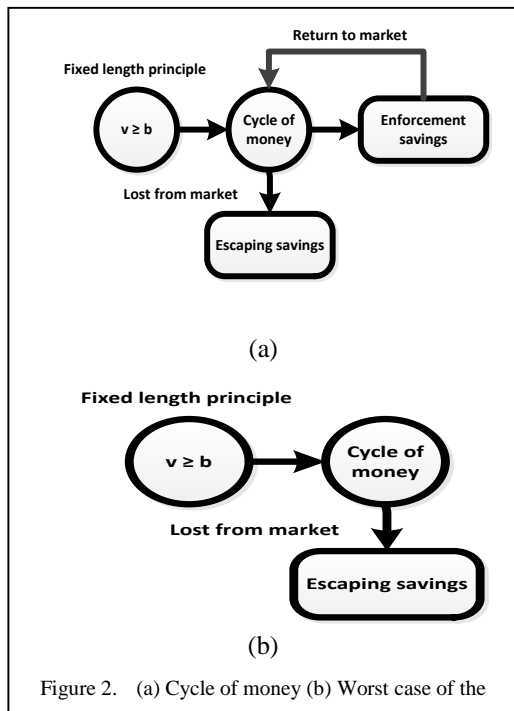
Figure 2.   (a) Cycle of money (b) Worst case of the

Figure 3.   Comparison of the cycle of money and the case cycle of money without enforcement savings

Thus, it is obvious that the case of α_s omitted. After those clarifications, we proceed to the application of the Q.E. method., we determine the values of the coefficients which are:

TABLE I.   COMPILING COEFFICIENTS.

Factors	Values	Values
α_s	0.6	0.6
α_t	0.7	0.7
μ	0.9	0.9
α_p	0.8	-

The generator of this procedure used the coefficients which appeared in the previous table. Therefrom, the factors have an upper limit of 1, and a lower limit of 0, but s and $\tilde{s}$ are plausible to receive values greater than one as their mathematical structure allows this. After 461 iterations extracted the next diagram:

Should be mentioned that the blue line is for the cycle of money with the enforcement savings and accordingly the red line without them.

IV.   CONCLUSIONS

It is extracted the conclusion that the absence of savings decline the economic dynamic of the market, and affect with their turn the tax and public policy. Therefore, the appropriate tax and public policy determine the robustness of the economy. To achieve a better structure and dynamic of an economy is required the appropriate economic policy of the fixed-length principle estimates the increase of the consumption and investments. According to OECD "The landmark deal, agreed by 136 countries and jurisdictions representing more than 90% of global GDP, will also reallocate more than USD 125 billion of profits from around 100 of the world's largest and most profitable MNEs to countries worldwide, ensuring that these firms pay a fair share of tax wherever they operate and generate profits". The last decision of the 15 % tax rate applies the fixed-length principle of the theory of the cycle of money and the concept of enforcement savings.

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Applied code for the case that the $\alpha_p = 0$, meaning that enforcement savings are omitted:

```
%Q.E method for Transfer Pricing

as=0;
at=0;
xm=0;
m=0;
m1=0;
ap=0.2;
cm=0;
ca=0;
cy=0;
t=0;

while t<10
   t=t+1;

if rand()<9
   as=0.6*rand();
end

if rand()<9
       at=0.7*rand();
end

if rand()<9
   m1=0.9*rand();
end
a=as+at;
m=m1+ap;
xm=m-a;
cm=xm/a;
ca=xm/m;
cy=cm-ca;
tab=[a,xm,m,cm,ca,cy;tab];
     end
```

Applied code for the case that the α_p=0.8, meaning that enforcement savings have a significant impact on the economy:

```
%Q.E for Transfer Pricing

as=0;
at=0;
xm=0;
m=0;
m1=0;
ap=0;
cm=0;
ca=0;
cy=0;
t=0;

while t<10
   t=t+1;

if rand()<9
   as=0.6*rand();
    end

if rand()<9
   at=0.7*rand();
end

if rand()<9
   m1=0.9*rand();
end

if rand()<9
   ap=0.8*rand();
end

a=as+at;
xm=m-a;
m=m1+ap;
cm=m/xm;
ca=a/xm;
cy=cm-ca;


tab=[a,xm,m,cm,ca,cy;tab];
    end
```

The Economic Importance of Transport Innovations

Milica Stanković[1]

[1]The Academy of Applied Technical and Preschool Studies – Vranje Department, Vranje
Republic of Serbia

[1]milica.stankovic@akademjanis.edu.rs

Abstract— **Transport affects the economy and society through its contribution to increasing competitiveness, through its contribution to increasing productivity and through encouraging geographical specialization that leads to the improvement of transport. Economic activity cannot take place without the transport factor and the mobility it provides. Investments in transport infrastructure are expected to lead to improved transport in terms of capacity, efficiency and reliability. In many parts of the world, developed transportation can help people gain greater access to work, education, services and leisure. Innovation is key to the continuous development of transport. It is very important to focus on the sustainability of transport and to direct the coordinated efforts of the government, business and academic community towards the decarbonisation of transport in line with the European Green Deal's objectives. The aim of this paper is to point out the importance of transport innovations for the economy. The first part of the paper analyzes the different modes of transport and the economic opportunities they offer, with reference to the contribution that transport has to the economy and society. The second part of the paper focuses on investments in transport and transport technology. The third part of the paper analyzes the implementation of modern technology and innovations in the transport sector. After a comprehensive analysis of the relevant literature, conclusions are presented.**

Keywords – transport, economics, innovation, sustainability

I. INTRODUCTION

The development of transport is associated with growing economic opportunities. Transport affects the economy and society primarily through its contribution to increasing competitiveness, through its contribution to increasing productivity and through encouraging geographical specialization that leads to the improvement of transport. There are a number of social and economic issues that have an impact on transport and mobility. On the one hand, an increasing number of people own their own vehicle. On the other hand, there is an obvious need to improve public transport. It is very important to pay special attention to the issues of energy efficiency and sustainability of transport, with the intensive use of modern technology and the implementation of innovations in transport. The aim of this paper is to point out the importance of transport innovations for the economy. The first part of the paper analyzes the different modes of transport and the economic opportunities they offer, with reference to the contribution that transport has to the economy and society. The second part of the paper focuses on investments in transport and transport technology. The third part of the paper analyzes the implementation of modern technology and innovations in the transport sector. After a comprehensive analysis of the relevant literature, conclusions are presented.

II. TRANSPORT AND ECONOMIC OPPORTUNITIES

The development of transport that has taken place since the beginning of the industrial revolution is associated with growing economic opportunities. In each development phase of the global economy, a certain transport technology with a number of influences has been developed or adapted. Economic cycles are associated with various innovations, including transport innovation, that affect the economic possibilities of production, distribution and consumption.

Historically, 5 major waves of economic development can be proposed in which specific transport technology has created new economic, market and social opportunities [1]:

1)   Seaports. The historical significance of seaports in trade has remained to this day. Seaports supported the early development of international trade. Later, many ports became important industrial platforms. With the advent of globalization and containerization, ports have increased their importance in supporting international trade and global supply chains.

2)   Rivers and canals. River trade has prevailed throughout history. The first phase of the industrial revolution in the late 18th and early 19th centuries was associated with the development of canal systems in Western Europe and North America, which served mainly to transport heavy goods.

3)   Railways. The second phase of the industrial revolution in the 19th century was associated with the development and implementation of railway systems that enabled more flexible high-capacity internal transport systems. This has opened up significant economic and social opportunities due to the increasing mobility of cargo and passengers [2].

4)   Roads. In the 20th century, there was a rapid development of road transport systems, such as national highway systems and car production, as the main economic sector. Individual transportation became widely available to middle-income social classes, especially after World War II. This was associated with significant economic opportunities to serve the market with reliable door-to-door deliveries.

5)   Airways and information technology. In the second half of the 20th century, global air and telecommunication networks developed together with economic globalization. The areas of logistics and supply chain management have developed rapidly. Although maritime transport is the physical backbone of globalization, air transport and IT support the accelerated mobility of passengers, specialized cargo and related information flows.

Transport affects the economy and society primarily through its contribution to increasing competitiveness, through its contribution to increasing productivity and through encouraging geographical specialization that leads to the improvement of transport [3] (Fig. 1).

•   Geographic specialization. Improvements in transport and communications favor the process of geographical specialization. An economic entity strives to produce goods and services with the most appropriate combination of capital, labor and inventory. Each region will therefore endeavor to specialize in the production of goods and services for which it has the greatest advantages (or least disadvantages) compared to other regions as long as appropriate trade-enabled transport is available. Through geographical specialization supported by efficient transport, economic productivity is promoted. This process is known as the comparative advantages that enabled the economic specialization of the region.

•   Productivity. An efficient transport system that offers advantages in terms of cost, time and reliability enables the transport of goods over long distances. This facilitates mass production and economies of scale because larger markets can be accessed. The "just in time" concept in supply chain management has further improved production and distribution
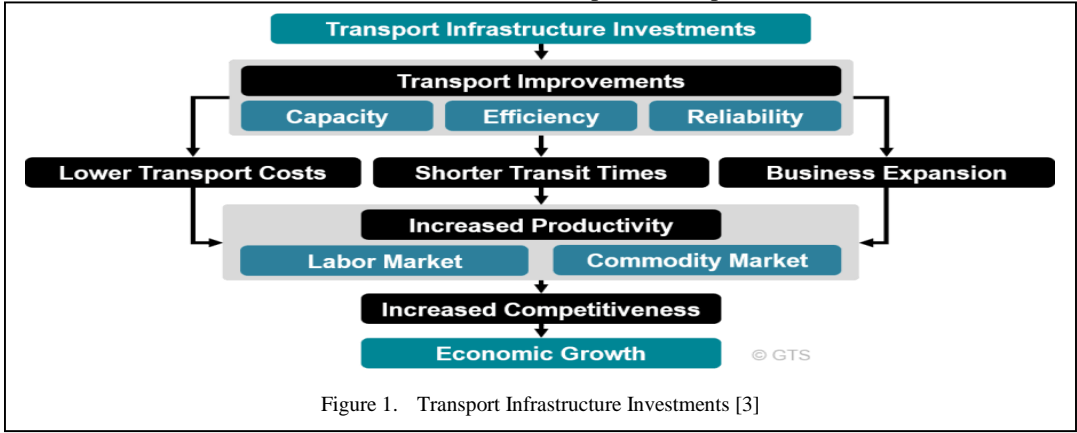
Figure 1.   Transport Infrastructure Investments [3]

productivity with lower inventory levels and a better response to changing market conditions. Thus, the more efficient the transport the larger markets can be serviced, and the greater the volume of production can be achieved. This results in lower production and transportation costs per unit.

• Increased competition. When transportation is efficient, the potential market for a given product (or service) grows, and competition also increases. A wider range of goods and services is becoming available to consumers by a large number of competing firms, which strive to reduce costs and promote quality and innovation. Globalization is clearly linked to an increasingly competitive environment globally, allowing consumers to access a wider range of goods and services.

There are a number of social and economic issues that have an impact on transport and mobility. The questions of traffic safety and increasing transport costs are increasingly being asked. In most European countries, there is an aging population, as well as changes in lifestyle, which implies much more flexible transport habits. It is very important to pay attention to environmental issues related to transport [4], as well as the importance of the use of modern

information and communication technology and innovation in the transport sector [5]. All these trends significantly affect the transport sector. There is a growing need for means of transport and there are more and more traffic jams. On the one hand, an increasing number of people own their own vehicle. On the other hand, there is an obvious need to improve public transport. It is very important to pay special attention to issues of energy efficiency and sustainability of transport, with the intensive use of modern technology and the implementation of innovations in transport [6] (Fig. 2).

III. INVESTMENTS IN TRANSPORT AND TRANSPORT TECHNOLOGY

In some circumstances, transport investment appears to be a catalyst for economic growth, while in others, economic growth puts pressure on existing transport infrastructure and encourages additional investment. Transport markets and related transport infrastructure networks are key drivers in promoting more balanced and sustainable development, in particular by improving the accessibility and opportunities of less developed regions or socially disadvantaged groups. Initially, there are different impacts on transport service providers (transport companies) and transport service

Mega-trends with influence on urban transport and mobility

- Stagnation of population and ageing of society in most European countries
- Lifestyle changes towards more flexible and disperse travel patterns
- Increasing danger of social exclusion for certain population groups through lack of accessibility
- Growing security and safety concerns
- Economic growth at lower growth rates & more flexible work models and work times
- Ongoing process of European integration and globalisation
- Rising external costs of transport
- Continued suburbanisation process and growth of agglomerations
- Increasing energy prices
- Increasing environmental concerns and awareness
- Noise pollution as a growing concern in urban areas
- Increased research and applications of use of ICT
- Increased importance of e-commerce and tele-working

Impacts on transport sector

- Increased transport demand and higher volumes of freight transport
- Rising car ownership (in certain European regions steep increase, others with stagnation)
- Challenges to provide competitive and convenient public transport
- Uncertain financing of public transport and increasing involvement of private sector in transport provision
- More complex travel patterns (time and space) require tailored individual transport services
- Increase of leisure traffic
- Rising costs of transport
- Improved energy efficiency and cleaner vehicles
- Improving air quality but also increase in transport related CO_2 emissions
- Increased use of ICT to optimise transport and mobility services

Figure 2.   The impact of social and economic trends on the transport sector [6]

users. It is commonly expected that investments in transport will generate economic returns, which should justify the initial invested capital in the long run. Like most infrastructure projects, transport infrastructure can generate an annual return of 5 to 20% on invested capital.

Modern economic trends indicate that economic development has become less dependent on the environment, and more and more dependent on space. Resources are the foundation of all economic activities, but at the same time resources, capital, and even labor show an increasing degree of mobility. This is especially important for multinational companies that can benefit from improved transport to two important markets [5]:

• Commodity market. By improving the transport infrastructure and transport networks, companies around the world gain greater access to inventory, but also to their customers. Thus, transport expands the possibilities for acquiring and selling various goods necessary for industrial and production systems.
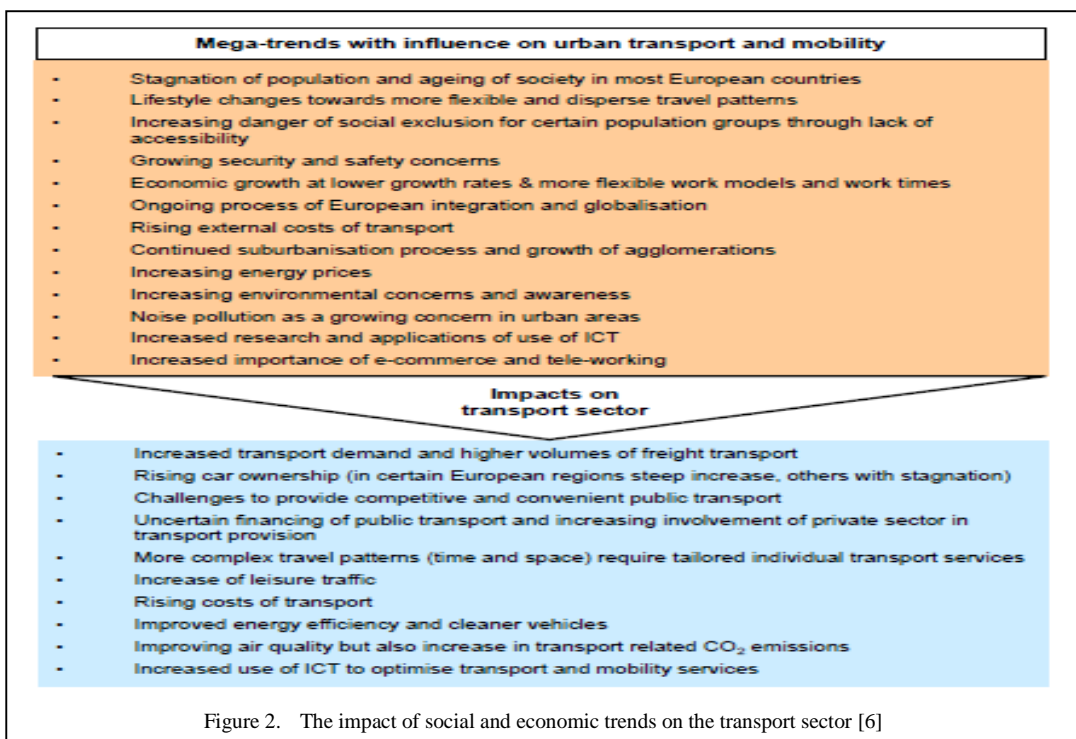
• Job market. Improving transport infrastructure and transport networks leads to both improved access to labor and reduced labor costs in two ways, through improved commuting at the local level and the use of cheap labor at the global level.

Transport provides access to the market by connecting producers and consumers so that transactions can take place. A common mistake in assessing the importance and impact of transport on the economy is to focus only on transport costs, which are relatively low; in the range of 5 to 10% of the value of the good. Economic activity cannot take place without the transport factor and the mobility it provides. Investments in transport infrastructure are expected to lead to improved transport in terms of capacity, efficiency and reliability. Lower transport costs, shorter transit times and business expansion make economic activities more productive and competitive. Transport improvements can affect both commodity and labor market by making resources, labor, and customers more accessible. The result is an increase in the efficiency and market effectiveness of existing firms, leading to an increase in production and employment. For the regional economy, that means growth. Improving transport systems can affect the

promotion of individual regions and attract investment in locations that provide greater accessibility to resources and labor [1].

IV. TRANSPORT INNOVATIONS

Transport significantly contributes to economic growth and a higher quality of life by facilitating the movement of people and goods. On the other hand, transport causes external impacts that can have a detrimental effect on the environment and health [8]. These externalities are a major incentive to support innovations that make transportation greener, safer and more efficient. Innovation in the transport sector has been historically characterized by small and incremental changes, often affected by the political and economic context, and in many cases being supported by policies and standards introduced by political and financial systems [9]. Technological advances and innovations, developed to address the often systemic nature of transport-related challenges, constitute part of a greater transport system which comprises a series of aligned elements [10].

The way in which the transport system is designed and functions affects both individuals and companies, as well as the conditions for sustainable development of entire cities and regions. In many parts of the world, developed transport can help people gain greater access to work, education, services and leisure. Technological development creates new opportunities for sustainable travel, but it can also lead to new challenges and problems. Innovation is key to the continuous development of transport [7]. Innovative activities in the transport sector are becoming more intensive, with new technologies often being adopted and implemented [11].

The transport sector is often critically assessed due to the large number of negative effects it has primarily on the environment. There is a great need to reduce the emission of pollutants and greenhouse gases, and pressure is being put on the automotive industry to reduce emissions of pollutants [12]. It is important to point out that innovation does not depend exclusively on technological progress, but on the development of successful business models and an appropriate legal and financial framework. Therefore, there is a need for coordinated efforts by business people, government and academia to work together to decarbonise transport [14] in

TABLE I.   TRANSPORT INNOVATION SYSTEM: SELECTED ACTIVITIES [13]

	Innovation Functions	Intervention Type	Important Instruments	Description
1	Guidance of research	Committee	Transport program Committee	Delegates of EU Member States convene to define the outlines of transport research calls under research framework programs
2	Entrepreneurial activities	Research grants	Framework Programs	Funding programs for research and technological development. Includes specific actions to promote entrepreneurial activity, such as the Small and Medium Enterprise (SME) actions.
3	Knowledge development	Research grants/ Information portals	Framework Programs/ Transport Research International Documentation	In addition to Framework programs, portals exist that disseminate knowledge on recent technological advances in transport (e.g. Transport Research International Documentation-TRID portal)
4	Knowledge diffusion through networks	Support networks	Public-private partnerships	Several partnership models exist to foster knowledge sharing, such as European Technology Platforms and Joint Undertakings
5	Market formation	Public procurement	Innovation procurement	Special attention is given under Framework Programs to promote procurement initiatives
6	Resources mobilization	Finance	European Fund for Strategic Investments/ Connecting Europe Facility	Financial instruments are put in place to bring mature innovations to market
7	Creation of legitimacy	Legislation	Directives and regulations	Legislative texts can foster the development and adoption of technologies, for instance by setting ambitious targets

line with European Green Deal's objectives [15]. In the transport sector, the number of companies with a strong digital focus is increasing. Several notable examples are Flexport in freight forwarding, Tesla in the automotive industry, Amazon in logistics or Uber in passenger transport [13].

In light of the challenges facing the transport sector, a large number of instruments are used to promote innovation in the transport sector. Table 1 shows the type of interventions and instruments used at European level to promote innovation in the transport sector [16]. There is a long tradition in the EU of financing transport innovations, promoting entrepreneurial activities, developing and exchanging knowledge and developing networks of researchers and organizations whose ultimate goal is the transformation of economic sectors in line with the goals of transport policy. There are well-established procedures for these activities. One example is how networking and knowledge sharing are supported. European institutions and the economy cooperated in so-called joint ventures, in which they pooled resources, designed research projects and exchanged knowledge. Such public-private partnerships have been accepted as a way to foster innovation [17] (Table I).

V.   CONCLUSION

Economic activity cannot take place without the transport factor and the mobility it provides. Investments in transport infrastructure are expected to lead to improved transport in terms

of capacity, efficiency and reliability. Transport improvements can affect both the goods market and the labor market by making resources, labor, and customers more accessible. The result is an increase in the efficiency and market effectiveness of existing firms, leading to an increase in production and employment. In many parts of the world, developed transportation can help people gain greater access to work, education, services and leisure. Innovation is key to the continuous development of transport. It is very important to focus on the sustainability of transport and to direct the coordinated efforts of the government, business and academic community towards the decarbonisation of transport in line with the European Green Deal's objectives.

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Critical Knowledge on Segmentation Strategy and Maintaining Competitiveness of Small and Medium Enterprises in Kogi State

Ibrahim Olawale Nafiu[1], Juwon Johnson Orugun[2], Danlami Joseph Aduku[3]

[1,2]Department of Business Administration, Kogi State University, Anyigba, Nigeria
[3]Department of Business Management, Abubakar Tafawa Balewa University

haliluuba01@gmail.com

Abstract—**This study explored critical knowledge on segmentation strategy and maintaining competitiveness of Small and Medium Enterprises in Kogi State. The study investigated the influence of segmentation strategy on the competitive advantage of SMEs in Kogi State. A descriptive research approach was employed. The object of the study was made up of SMEs owners; from which the sample size of 142 was chosen. Finding shows that demographic-inclined strategy, geographic-inclined strategy and psychographic-inclined strategy have strong effects on the competitive advantage of SMEs in Kogi State. The study concluded that the segmentation strategy of SMEs divides the consumers into groups based on demographic, geographic and psychographic characteristics. The study recommended that SME owners and policy makers should focus their segmentation strategy more on demographic and geographic characteristics.**

Keywords - segmentation strategy, demographic strategy, geographic strategy, psychographic strategy, competitive advantage

I. INTRODUCTION

A strategy reflects how plans are put together to attain marketing goals. The strategy is a result of the necessity for marketing flexibility. The dynamic capacities of SMEs in Kogi State are represented through marketing agility. According to [1], enterprises must have a thorough knowledge of vital competences as well as a thorough understanding of market rivalry in order to gain a competitive advantage. Marketers need to perform well in the face of fierce competition, with the awareness that various competitors display a wide range of products or services, and have special focus on the customer's value. The necessity of segmentation strategy for SMEs in Kogi State cannot be overstated. In [2] authors expressed that literature streams in management and strategy have emphasized the critical role of marketing in establishing and maintaining competitive advantages. The failure of a marketer to develop and implement a superior strategy could indicate that gaining a competitive advantage will be difficult. The need for critical knowledge on how to develop segmentation strategy cannot be eroded. In [3] it is added that how well relevant knowledge is gathered and applied determines whether or not an enterprise's goal is achieved. Authors in [4] went on to say that knowledge that is not required is simply that: superfluous, and the work required to get it is a waste of time.

There is need for SME owners to seek knowledge on how to carryout marketing activities efficiently in Kogi State. The knowledge may aid market segmentation for the achievement of desired objectives. This is likely to revolutionize the marketing mind-set of SME owners in Kogi State. The SME owners will get to know the 'what and how' of market segmentation strategy adoption and implementation. According to [5], what-how approaches frequently employ market segmentation strategies to give the focus required

for disciplined thinking about positioning the firm relative to the customers. In addition, the enterprise's vision may be redesigned to reflect what possibilities are available and how to make use of them.

In Kogi State, there is a discrepancy in the marketing strategies used by SMEs. The segmentation strategy was given little or no thought. The goal of this research is to uncover vital information about how segmentation strategy might be used to gain a competitive advantage. According to [6], segmentation strategy is critical in a competitive environment. In [7] it is demonstrated that market segmentation has a considerable favorable impact on the competitive advantage of SMEs. Thus, this study examined the influence of segmentation strategy on the competitive advantage of SMEs in Kogi State.

II. LITERATURE REVIEW

A. Conceptual Clarification

There is existence of game in every business environment. This is because actors are rationale, and often seek for better ways to outwit others. Authors in [8] alarmed that the business games has become very tough small firms now need to apply strategies rather than avoiding it. Strategy positions both the enterprise and customers through game plan. The game plan reflects strategic thinking towards creating new customers and retaining the existing customers through market segmentation.

The knowledge of segmentation strategy becomes highly imperative for SME owners and managers. Segmentation strategy reflects on the demographic, geographical, psychological and behavioural variables of customers. It helps SMEs deal in heterogeneity by balancing the variability in customers' needs with the available resources. Segmentation strategy can assist marketers in identifying and recognizing different types of customers, as well as leveraging experience to create more relevant solutions. Demographic-segmentation strategy includes variables like age, sex, educational attainment, ethnicity and income of customers. The most basic form of segmentation is the division of a market based on demographics. Managers can further narrow their market by blending demographic segmentation with other types in a strategic way. Psychological segmentation is comparable to demographic segmentation, but it focuses on mental and emotional factors. It divides customers into groups based on personality traits and attributes. These characteristics may not be as visible as demographics, but they can provide vital understanding of customers' motivations, choices, and demands. Psychological-segmentation strategy includes variables like values, the interests, the attitudes, the conscious-subconscious motivators, the lifestyles and the personalities of customers. Geographic segmentation is the process of segmenting a market depending on its location. It is a simple but effective segmentation strategy. The location of a consumer might help management better understand their needs.

B. Theoretical Underpinning

Business environment consists of actors who want to achieve similar goals. Sequel to this, they adopt strategies with the understanding that a game must be won. John von Neumann and Oskar Morgenstern brought the Game Theory into limelight with its first applicability in the field of mathematics in 1944. Its application in the field of business and entrepreneurship is quite relevant today. Game theory provides knowledge on the behavioural pattern of firm owners in the business environment.

The most critical knowledge is that business competition is a zero-sum game; where the winner has competitive advantage over others. That is, there must be a winner (+1) and a looser (-1). The Game Theory unveils the need to possess adequate knowledge of strategic approach to apply because the rivals are also using and modifying strategies based on what they believe every actor is doing.

The relevance of the Game Theory to this study is that it explains the need for SME owners to adopt the best segmentation strategy with constant understanding of rules attached to competition in the market place. It is believed that knowing these rules is not adequate to achieve a desirable pay off without the application of effective strategy. Prison dilemma supports the application of game theory. In a similar case of Prison dilemma, where both players have + : +, the likely outcomes is win-win; where one player has − and the other has +, the possible outcome may result to one loss for one win; and where both players have − : −, the outcome gives no headway. Thus SME owners need to consider business competition as a game, and adopt the rules.

III. METHODOLOGY

The research was conducted using a descriptive research approach. The rationale for this adoption, according to [9], is to answer the what, how, and why questions. The object of the study (also known as the target population) was made up of SMEs owners. This research focused on SMEs in Kogi State (totaling 1.027). The sample size of 142 was determined using Sallant and Dillman's (1997) technique, based on the population of SMEs in Kogi State. The formula is stated below:

$$N_s = \frac{N_p(p)(1-p)}{(N_p-1)(\frac{B}{C})^2 + (p)(1-p)}, \qquad (1)$$

where:

N_s=completed sample size required
N_p=Sample population
P=proportion expected to answer in a certain way (50% or 0.5 is most conservative)
B=acceptable level of sampling error (0.05=±5%; 0.03=±3%)
C=Z statistic associated with the confidence interval (1.645=90% confidence level; confidence level; 2.576=99% confidence level)

$$N_s = \frac{1027(0.5)(1-0.5)}{(1027-1)(\frac{0.05}{1.645})^2 + (0.5)(1-0.5)} =$$

$$= 142 \; approx.$$

A multistage random sampling technique was used in this study. The instrument's reliability was determined using the Cronbach Coefficient alpha. The Cronbach's alpha criterion was calculated according to the following formula:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Yi}^2}{\sigma^2 x}\right), \qquad (2)$$

TABLE I.   RELIABILITY OF CONSTRUCTS.

S/N	Constructs	No. of Items	Cronbach's Alpha
1	Demographic-inclined Strategy	2	0.830
2	Geographic-inclined Strategy	2	0.969
3	Psychographic-inclined Strategy	2	0.723
4	Competitive Advantage	2	0.750

where: K=Items of number
$\sigma^2 x$=Variance of observed total scores
σ_{Yi}^2=Variance of item I for the current sample

The results show that the constructs are reliable since they are above 0.70. Data were gathered and analysed using descriptive statistics and Stepwise Multiple Regression. The model is specified below:

$$CMA = a + \beta_1 DIS_1 + \beta_2 GIS_2 + \beta_3 PIS_3 + e , (3)$$

where:
CMA = Dependent Variable (Competitive Advantage)
a = Constant
DIS = Demographic-inclined Strategy
GIS = Geographic-inclined Strategy
PIS = Psychographic-inclined Strategy
$\beta_1, \beta_2, \beta_3$ are regression coefficients
e = residual or stochastic term

IV. DATA ANALYSIS AND RESULTS

This section focuses on the descriptive analysis of the demographic characteristics of respondents. Descriptive statistics were also employed to provide a clear nature of variables of concern. Table II shows gender of respondents. It is observed that 97 respondents (68.3%) were male and 45 respondents (31.7%) were female. The implication of this study is that majority of respondents were male. It is also an indication that SME sector is dominated by the male gender.

Table II shows age bracket of respondents. It is observed that 16 respondents (11.3%) were below 20 years; 33 respondents (23.2%) were within the age bracket of 21-25 years; 49 respondents (34.5%) were within the age bracket of 26-30 years; 25 respondents (17.6%) were within the age bracket of 31-35 years;11 respondents (7.7%) were within the age bracket of 36-40 years; 5 respondents (3.5%) were within the age bracket of 41-45 years; and 3 respondents (2.1%) were above 46 years. This result shows that majority of respondents in the study area were within the age bracket of 26-30 years. Also the respondents within the age bracket appear to have adopted different marketing strategies previously.

TABLE II. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS.

Demography	Responses	Freq.	%
Gender	Male	97	68.3
	Female	45	31.7
	Total	142	100.0
Age bracket	Below 20 Years	16	11.3
	21-25 Years	33	23.2
	26- 30 Years	49	34.5
	31-35 Years	25	17.6
	36- 40 Years	11	7.7
	41- 45 Years	5	3.5
	Above46 Years	3	2.1
	Total	142	100.0
Marital status	Single	39	27.5
	Married	64	45.1
	Widow	20	14.1
	Separated	12	8.5
	Divorced	7	4.9
	Total	142	100.0
Qualifications	Primary School Leaving Cert.	10	7.0
	Secondary School Certificate	21	14.8
	OND & Equivalence	40	28.2
	B.Sc/HND & above	71	50.0
	Total	142	100.0
Business Experience	Below 1 Year	13	9.2
	1-2 Years	27	19.0
	2-4 Years	37	26.1
	4-6 Years	26	18.3
	6-10 Years	17	12.0
	10-15 Years	12	8.5
	Above 15 Years	10	7.0
	Total	142	100.0

The Table II indicates marital status of respondents. It is observed that 39 respondents (27.5%) were single; 64 respondents (45.1%) were married; 20 respondents (14.1%) were widow; 12 respondents (8.5%) were separated; and 7 respondents (4.9%) were divorced. The implication of the study is that majority of the married respondents have improved marketing strategies idea.

Table II: shows academic qualifications of respondents. It is observed that 10 respondents (7.0%) were Primary School Leaving Certificate holder; 21 respondents (14.8%) were Secondary School Certificate holder; 40 respondents (28.2%) held Diploma Certificate or its equivalence; and 71 respondents (50.0%) held Bachelor of Science or Higher National Diploma certificate and above. The implication of this result is that the majority of respondents were Bachelor of Science or Higher National Diploma certificate and above. This implies that they have better or average knowledge of marketing strategies.

The Table II shows that 13 respondents (9.2%) have less than 1 year of business experience; 27 respondents (19.0%) have 1-2 years of business experience; 37 respondents (26.1%) have 2-4 years of business experience; 26 respondents (18.3%) have 4-6 years of business experience; 17 respondents (12.0%) have 6-10 years of business experience; 12 respondents (8.5%) have 10-15 years of business experience; and 10 respondents (7.0%) have more than 15 years of business experience. Based on the result, it is seen that the respondents have reasonable years of business experience that is good for the survey.

TABLE III. DESCRIPTIVE STATISTICS OF SEGMENTATION STRATEGY.

	N	Min.	Max.	Mean	Std. Deviation
Geographic location has influence on enterprise's success.	142	1.00	5.00	2.1197	0.91854
Enterprise adopts location decision strategies for improving business competitive advantage	142	1.00	5.00	2.2042	1.06217
Enterprise adopts strategy that stimulates the interest of the consumers to purchase.	142	1.00	11.00	2.2676	1.39866
Enterprise adopts strategy that consider the personality of consumers	142	1.00	5.00	2.2887	1.07572
Enterprise adopts strategy that focuses on demographic segmentation	142	1.00	5.00	2.1761	1.16265
Enterprise adopts strategy that focuses on gender characteristics of consumers	142	1.00	5.00	2.2042	1.13324

TABLE IV.   A: MODEL SUMMARY ON SEGMENTATION STRATEGY AND COMPETITIVE ADVANTAGE OF SMES.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.850[a]	0.722	0.720	0.53308
2	0.907[b]	0.822	0.819	0.42849
3	0.918[c]	0.843	0.840	0.40378

Predictors: (Constant), demographic-inclined strategy, geographic-inclined strategy, psychographic-inclined strategy
Dependent Variable: Competitive advantage

TABLE V.   B: ANOVA ON SEGMENTATION STRATEGY AND COMPETITIVE ADVANTAGE OF SMES.

	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	103.456	1	103.456	364.062	0.000[b]
	Residual	39.784	140	0.284		
	Total	143.239	141			
2	Regression	117.719	2	58.859	320.581	0.000[c]
	Residual	25.521	139	0.184		
	Total	143.239	141			
3	Regression	120.740	3	40.247	246.854	0.000[d]
	Residual	22.499	138	0.163		
	Total	143.239	141			

Predictors: (Constant), demographic-inclined strategy, geographic-inclined strategy, psychographic-inclined strategy
Dependent Variable: Competitive advantage

Table III shows that geographic location has influence on enterprise's success ($\pi = 2.1197$; $\alpha = 0.91854$),enterprise adopts location decision strategies for improving business competitive advantage ($\pi = 2.2042$; $\alpha = 1.06217$), enterprise adopts strategy that stimulates the interest of the consumers to purchase ($\pi = 2.2676$; $\alpha = 1.39866$), enterprise adopts strategy that consider the personality of consumers ($\pi = 2.2887$; $\alpha = 1.07572$), enterprise adopts strategy that focuses on demographic segmentation ($\pi = 2.1761$; $\alpha = 1.16265$) and enterprise adopts strategy that focuses on gender characteristics of consumers ($\pi = 2.2042$; $\alpha = 1.13324$). These are the areas of the respondents' segmentation strategy. The results show that segmentation strategy was strongly exploited to achieve a set of goals.

Table IV shows the effect of three variables (demographic-inclined strategy, geographic-inclined strategy and psychographic-inclined strategy) on competitive advantage of SMEs in Kogi State. The adjusted R-squared compares the goodness-of-fit for the regression models that contain differing numbers of the independent variables (demographic-inclined strategy- 0.720, geographic - inclined strategy-0.819and psychographic-inclined strategy- 0.840).The result of the coefficient of determinations shows that demographic-inclined strategy ($R2 = 0.722$),

geographic-inclined strategy ($R2 = 0.822$) and psychographic-inclined strategy ($R2 = 0.843$) have strong explanatory power over competitive advantage of SMEs in Kogi State. It is seen that 72.2% variation in the competitive advantage of SMEs in Kogi is explained by demographic-inclined strategy; 82.2% variation in the competitive advantage of SMEs in Kogi is explained by geographic-inclined strategy and 84.3% variation in the competitive advantage of SMEs in Kogi State is explained by psychographic-inclined strategy. The remaining unexplained variations (by demographic-inclined strategy- 27.8%; geographic-inclined strategy- 17.8% and psychographic-inclined strategy-15.7%) show that there are other variables that can predict competitive advantage of SMEs in Kogi State. Invariably, all the coefficient of determinations ($R2$ value) proved that these variables have strong effects on competitive advantage of SMEs in Kogi State.

Table V shows the levels of variability within the regression models and forms the basis for tests of significance. The ANOVA table also reports that using the model is better than guessing the mean. The mean square residual values (0.284 for demographic-inclined strategy, 0.184 for geographic-inclined strategy and 0.163

TABLE VI.   C: COEFFICIENT ON SEGMENTATION STRATEGY AND COMPETITIVE ADVANTAGE OF SMES.

	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.580	0.095		6.092	0.000
	Demographic-inclined strategy	0.737	0.039	0.850	19.080	0.000
2	(Constant)	0.135	0.092		1.473	0.143
	Demographic-inclined strategy	0.471	0.043	0.543	10.867	0.000
	Geographic-inclined strategy.	0.483	0.055	0.440	8.814	0.000
3	(Constant)	0.097	0.087		1.123	0.263
	Demographic-inclined strategy	0.720	0.071	0.831	10.155	0.000
	Geographic-inclined strategy.	0.582	0.057	0.530	10.295	0.000
	Psychographic-inclined strategy.	-0.326	0.076	-0.385	-4.305	0.000

Dependent Variable: Competitive advantage

for psychographic-inclined strategy) are smaller, indicating less deviation between the observed and fitted values. The p-value for the F test statistic (364.062 for demographic-inclined strategy, 320.581 for geographic-inclined strategy and 246.854 for psychographic-inclined strategy) are less than 0.001, providing strong evidence against the null hypotheses. The coefficient of determination for demographic-inclined strategy ($R2 = 0.722$), geographic-inclined strategy ($R2 = 0.822$) and psychographic-inclined strategy ($R2 = 0.843$) indicate significant effects on competitive advantage of SMEs in Kogi State.

Table VI shows the coefficients of the variables and the competitive advantage of SMEs in Kogi State. The coefficient of demographic-inclined strategy (unstandardized beta-0.737) shows a positive relationship with the competitive advantage of SMEs in Kogi State. The coefficient of demographic-inclined strategy (standardized beta-0.850; p-value = 0.01) shows greater contribution to the competitive advantage of SMEs in Kogi State. The demographic-inclined strategy has low coefficient than the geographic-inclined strategy; given the demographic-inclined strategy (unstandardized beta-0.471) and the geographic-inclined strategy (unstandardized beta-0.483). It is seen that demographic-inclined strategy has more contribution to the competitive advantage of SMEs compared to geographic-inclined strategy; given the demographic-inclined strategy (standardized beta-0.543; p-value = 0.01) and the Geographic-inclined strategy (standardized beta-0.440; p-value = 0.01). The results prove that both demographic-inclined strategy and geographic-inclined strategy have positive

relationship with the competitive advantage of SMEs in Kogi State.

Finally, the results in Table VI show that demographic-inclined strategy also has the highest coefficient (unstandardized beta-0.720) compared with geographic-inclined strategy (unstandardized beta-0.582) and psychographic-inclined strategy (unstandardized beta-0.326). Demographic-inclined strategy has the highest contribution to the competitive advantage of SMEs in Kogi State; given the demographic-inclined strategy (standardized beta-0.831; p-value = 0.01); the geographic-inclined strategy (standardized beta-0.530; p-value = 0.01) and psychographic-inclined strategy (standardized beta-0.385). The result proves that psychographic-inclined strategy has negative relationship with the competitive advantage of SMEs in Kogi State

V. DISCUSSION OF FINDINGS

The empirical investigate shows the predictive power of segmentation strategy over competitive advantage of SMEs in Kogi State. The segmentation strategy was decomposed into demographic-inclined strategy, geographic-inclined strategy and psychographic-inclined strategy. Finding shows that demographic-inclined strategy, geographic-inclined strategy and psychographic-inclined strategy have strong effects on the competitive advantage of SMEs in Kogi State. Demographic-inclined strategy has high contribution to the competitive advantage of SMEs in Kogi State on individual ground. Its contribution decreased (to about 54.3%) given the inclusion of geographic-inclined strategy. This also proved [10] to be right that no two strategies should be combined. Despite the inclusion, demographic-inclined strategy has

more significant contribution compared to geographic-inclined strategy. It was discovered that psychographic-inclined strategy has negative relationship with the competitive advantage of SMEs in Kogi State. This may be as a result of its combination with two other strategies.

VI. CONCLUSION

The segmentation strategy of SMEs divides the consumers into groups based on demographic, geographic and psychographic characteristics. Demographic-inclined strategy, geographic-inclined strategy and psychographic-inclined strategy have strong effects on the competitive advantage of SMEs in Kogi State. When the demographic-inclined strategy of SMEs adequately captures age, gender, income, occupation, marital status, social class, religion and education level of consumers, competitive advantage will increase. The empirical investigation has proven that demographic-inclined strategy has positive contribution to the competitive advantage of SMEs. Also geographic-inclined strategy (with respect to location or region) has positive contribution to the competitive advantage of SMEs.

Carving a niche markets based on psychographics may not yield satisfactory competitive advantage outcomes for SMEs in Kogi State. This is because the attitudes, value and interests of consumers in Kogi State changes almost rapidly. This present study has empirically proven that psychographic-inclined strategy has significantly negative relationship with the competitive advantage of SMEs in Kogi State. Thus, the study recommended that SME owners and policy makers should focus their segmentation strategy more on demographic and geographic characteristics. Demographic-inclined strategy and geographic-inclined strategy will boost the competitive advantage of SMEs in Kogi State. Meanwhile, less attention should be given to psychographic-inclined

strategy as it will negatively relate with the competitive advantage of SMEs in Kogi State.

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The Significance and Use of Simulation Software in Fire Protection

Radoje Jevtić[1]

[1]Electrotechnical school „Nikola Tesla", Niš, Serbia

[1]milan.jvtc@gmail.com

Abstract—**Fire protection presents wide scientific field intended to protect humans, animals and material properties from fire and its products. Fire, related to its own definition, presents occurrence with uncontrolled spreading. So, it is important to, as much as possible, apply the "main rule" in fire protection- the prevention. One of the safest, most practical and cheapest way of prevention is the use of simulation software. This paper was written to present use of FDS simulation software and its integrated graphical environment Pyrosim through different realized examples.**

Keywords – fire, simulation, prevention

I. INTRODUCTION

History showed that fire presents one of the most dangerous occurrences in human`s work and life. Many human lives and huge material properties were destroyed by fire. Related to that fact, fire protection presents discipline which is presumably old as the discovery of fire. This discipline has been developing related to scientific and technical prosperity of human`s society. Related many historical sources, one of the first written documents related to fire protection was Hammurabi`s law (Hammurabi was Babylon`s king). This document dated from 18 century B.C. and it consisted of 28 paragraphs and 16 articles. Historical sources also confirmed that the first organized fire protection units were operated during reign of roman emperor Octavian (Augustus Caesar), in 23-year B.C. Later, through history, fire protection and fire protection regulations were increasingly improved and became a mandatory and legally defined act. The first recorded law regulation about fire protection in America and Russia were in XVII century, while the first law regulation related to fire protection in Serbia dated from 1834 [1].

Law regulated fire protection was in connection with adequate fire extinguishers and alarming. One of the first attempt of fire detection was in Russia, in 1668, by ringing the bell. The first attempt of fire detection by electrical signal dated from 1851. That year German firm used Morse code machine for fire detection. The first automatic fire detectors were based on heat change. The first smoke detection device appeared in 1896. The first commercial smoke detector was appeared in 1969. The development of electronics and microprocessor technologies brought revolution in fire protection and fire protection systems [2].

Today, one of the most important tasks in object design is design of the adequate fire protection system. The efficiency of this system has a crucial importance in human and animal lives protection and material properties protection. Although there are rules for fire protection systems design defined by valid standards, fires and their consequences still make huge damages and take human and animal victims. The design of fire protection system implies considering of many different factors and presents very complex task. These factors can be different and significant: combustion, flame, smoke, object purpose, object location, technical and living surrounding etc. Neglect of only one factor or its insufficient analysis can lead to disaster.

The combustion presents one of the most significant factors for fire protection. Generally, it purports the series of chemical reactions between combustible material and oxygen. The most important consequence of this reactions is the releasing of smoke, heat and flame.

Smoke presents consequence of the combustion that depends from combustible material. In the material sense, this combustion consequence presents the suspension of different kind of particles: liquid, solid and gas particles. The biggest number of fire detectors used in fire protection are smoke detectors. The main reason for this is the fact that smoke is developing at the beginning of the fire.

Heat transfer also present important combustion consequence. There are three different ways of heat transfer: conduction, convection and radiation. The speed of heat release directly describes fire type.

Flame, as a fire consequence, presents gas environment, mostly located above combustible material, where many different physicochemical reactions are happening and it is very important factor for the fire detection [3].

Obviously, related to above noted, it can be concluded that design of effective fire protection system demands great knowledge and experience. However, new and new fires with tragic consequences are constantly emerging. One of the most dangerous properties of fire is uncontrolled and sudden combustion. Because of that, it is very important to predict the fire, its spreading and behavior through some object or environment. One of the most effective ways for prediction of fire and its spreading is the use of proper simulation software. The use of this software has great advantages that are reflected in safety, economy and accuracy.

II. FDS AND PYROSIM

One of the most famous and the most frequently used simulation software in fire protection is FDS with its graphical environment Pyrosim.

FDS (Fire Dynamic Simulator) presents powerful program, written in Fortran, intended to solve equations needed for description of fire evolution. Input parameters needed for calculation are presented as text file. Calculations are located in output files. For reading of FDS output files is intended Smokeview. This program presents results of calculations as animation. FDS can calculate and predict temperature, smoke, carbon monoxide and many other parameters during and after fire. The first version of FDS was publicized in 2000. Through its development, FDS has undergone many changes. There were more versions of this

program. Current versions, with possibilities of free usage, are FDS 6.7.6 and FDS 6.7.16 [4].

Software Pyrosim presents integrated graphic environment for FDS. The use of this software has great advantages. At the first place, it is enabled that input file can be created graphically. It is also possible to import appropriate CAD model for creation more complex geometry models. Supported formats are IFC, DXF, DWG, FBX and STL. The program itself can use 2D or 3D drawing tools and provides four editors for fire model: 2D view, 3D view, Navigation view and Record view. Heating, ventilation and air conditioning systems that can be used in this program are integrated into the CFD simulation. Generally, Pyrosim can be used to run any version of FDS. The first step in Pyrosim is to create proper simulation model. Pyrosim has an option for parallel processing what means that all computing can be divided into parts (meshes) and calculated independently. Pyrosim as a computer program demands very strong hardware configuration for optimal work. In the dependence of complexity, the duration of the simulation can take from several hours to several days [5].

III. REALIZED EXAMPLES

Next several examples show the potentials of Pyrosim software in fire protection design.

The first example presents potential fire and smoke spreading in Electrotechnical school „Nikola Tesla" in Niš. Schools present object with lot of humans (pupils) and fires in this object could cause serious victims and material damage. Design of simulation model of the school took several months and implied great number of measurements, because simulation model was in full size. It was also imprtant to note every possible material in the object that could afect on simulation (wood, steel, glass, aluminium, laminated wood etc.).

Realized results showed potential smoke and fire spreading related to fire source location, potential temperatures, times needed for smoke detectors reaction, material resistance on fire, optimal location for fire detectors, ventilation options and other results. Interior of the Electrotechnical school „Nikola Tesla" in Niš, its simulation model and simulation model after 900 seconds after begining of the fire are presented on Figs. 1, 2 and 3 [6].

Figure 1. Interior part of the Electrotechnical school „Nikola Tesla" in Niš (figure source: Jevtić, B. R., Ničković, T. J., *The determination of fire propagation by simulation*).
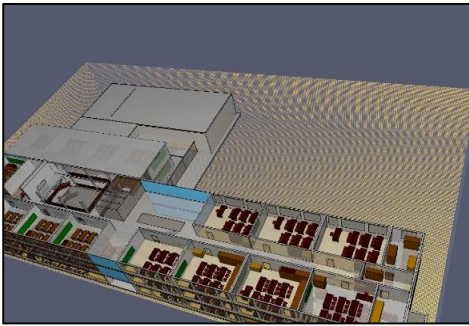
Figure 2. Simulation model in Pyrosim of the Electrotechnical school „Nikola Tesla" in Niš (figure source: Jevtić, B. R., Ničković, T. J., The determination of fire propagation by simulation).
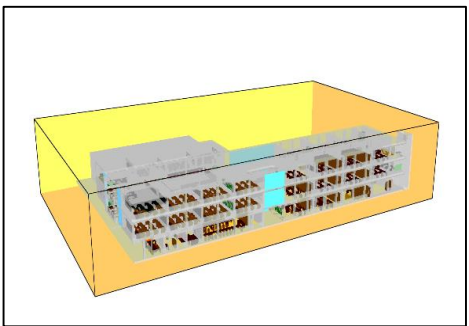
Figure 3. Smoke propagation after 900 seconds in the classroom at the second floor of the Electrotechnical school „Nikola Tesla" in Niš (figure source: Jevtić, B. R., Ničković, T. J., *The determination of fire propagation by simulation*).

The second example presents design, evaluation and simulation check of heat detectors in object. The heat detectors were arranged in object and their efficiency was tested for different positions of fire source. It is very important to note that fire detectors can be arranged in object related to different standards. Realized results showed the optimal arrangement of heat detectors and times needed for their reaction for different positions of fire source. Simulation model for heat detectors testing in Pyrosim, temperature and smoke development in object and the way of result representation are presented on Fig. 4, 5 and 6 [7].
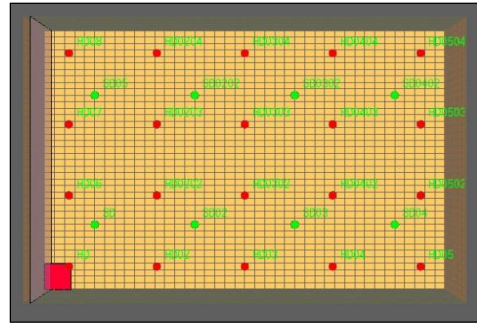
Figure 4. Simulation model for heat detectors testing in object (figure source: Jevtić, B., *Selection of the fire detectors and their arrangement in object*).
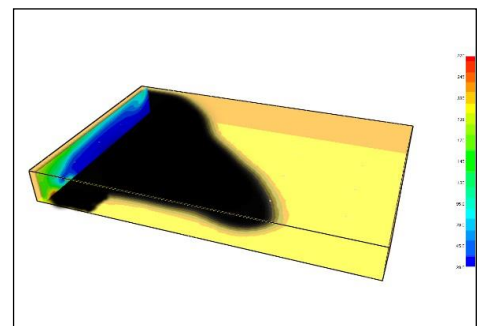
Figure 5. Smoke and temperature in the object during simulation (figure source: Jevtić, B., *Selection of the fire detectors and their arrangement in object*).
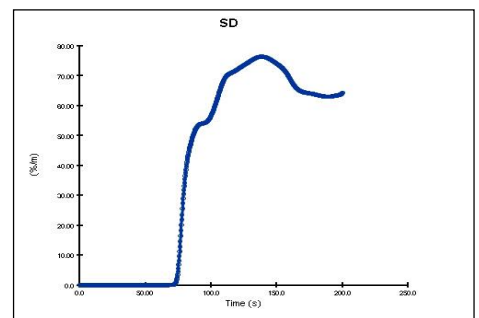
Figure 6. The result presentation of smoke detector`s reaction during the simulation (figure source: Jevtić, B., *Selection of the fire detectors and their arrangement in object*).

The third example presents design of fire detectors in rooms with no standard geometry. The problem of no standard geometry is very often and in that case, designers can be confused what to do and how to design fire detectors, which standard to use and similar. The simulation results showed the optimal smoke detectors arrangement in such object and times needed for their reactions. Simulation model of room with no standard geometry, fire source location and smoke detectors arrangement are presented on Fig. 7 [8].
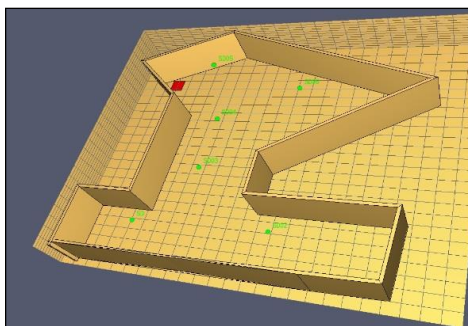
Figure 7. Simulation model of room with no standard geometry, fire source location and smoke detectors arrangement (figure source: Jevtić, B. R., *The fire detectors arrangement in rooms with no standard geometry*).

The fourth example presents simulation of smoke spreading in double (perforated) ceilings. Realized results showed smoke spreading through perforated ceiling and times needed for smoke detectors reaction, for different positions of fire source and different degree of perforation. Simulation of smoke spreading for perforation degree of 43,7 % is presented on Fig. 8 [9].
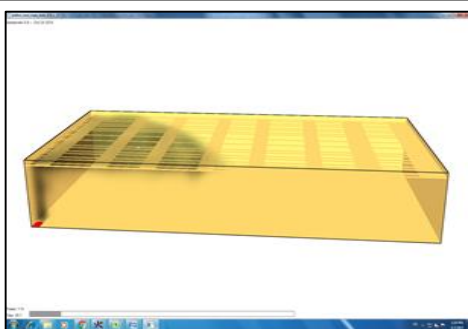
Figure 8. Smoke spreading in object with double (perforated) ceiling (figure source: Jevtić, B. R, *Smoke spreading simulation in double (perforated) ceilings*).

The fifth example presents arrangement problem of smoke detectors in object with slope roofs. In dependence of slope angle of the roof, smoke detectors can be arranged differently, related to different standards. Simulation model of the object with slope roof, where the (slope of the roof was bigger than 20° and proper smoke detectors arrangement for that case are presented on Fig. 9 [10].
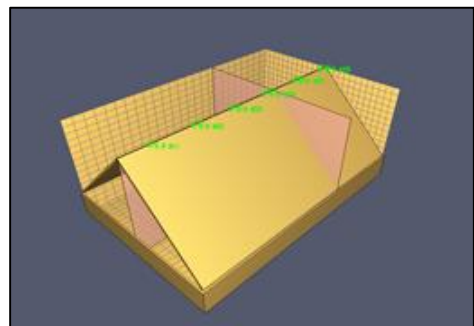
Figure 9. Simulation model of the object with slope roof (slope bigger than 20°) and proper smoke detectors arrangement (figure source: Jevtić, B. R., Blagojević, Đ. M., *Point Fire Detectors Arrangement in Special Cases-The slope Roofs case*)..

The sixth example presents simulation of drencher system as one of very frequently used fire protection system, especially for object with high fire risk. It is very important to design many important parameters for efficiency of this system (water tank volume, activation electronics, CO_2 tanks, nozzles locations, pipes net etc.). The activation of drencher fire protection system can be realized on several different ways: mechanic, pneumatic, hydraulic, electric and combined. Simulation of drencher fire protection system activation in auto garage is presented on Fig.10 [11].
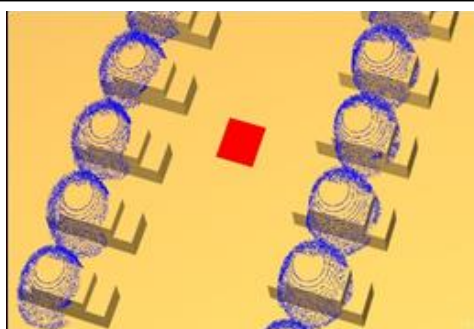
Figure 10. Simulation of drencher system activation above the cars with burner position at the center of the auto garage (figure source: Jevtić, B. R., *Stabile systems for fire protection-Drencher Type Systems*).

The seventh example presents simulation of fire extinguishing system that uses CO_2 as fire extinguisher. This kind of fire protection systems are very powerful in fire extinguishing. They also need very analytic and precise calculation for their efficiency. It is very important to calculate and predict needed quantity of CO_2 gas, which is different from object to object. The nozzles used for these systems are special elements of these systems which location, height, direction and quantity of CO_2 that can leak through it presents parameters from crucial importance for calculation. These systems must be tested from time to time for insight into their efficiency. Simulation of fire protection system that uses CO_2 as fire extinguisher after activation of alarm and start of CO_2 leaking into the room are presented on Fig. 11 [12].
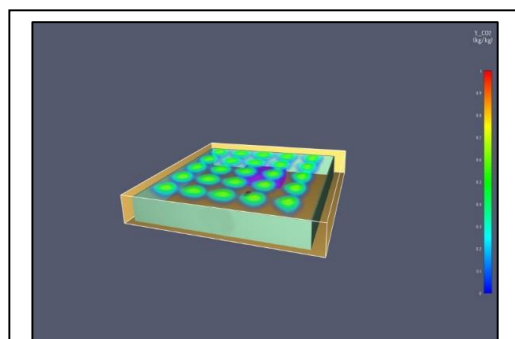
Figure 11. Simulation of fire protection system that uses CO_2 as fire extinguisher after activation (figure source: Jevtić, B. R., *Stabile systems for fire protection-Drencher Type Systems*)

IV. CONCLUSION

Realized examples showed in this paper present very small part of many simulation of fire protection systems. Although the limits of this paper don't allow to present every simulated fire protection system, these examples are enough to present very important advantages of simulation software usage.

The first and of course the most important advantage of simulation software usage is safety. Every simulation occurs in virtual environment. Any testing, try or calculation changes are completely safe. So, in prediction sense, simulation software presents unavoidable and obligatory engineer`s tool.

Very important aspect is, of course, an economic aspect. This software enables simulation of different situations, conditions and factors without any costs. Experimental and practical work is changed with simulation.

Only correct and proper designed and installed fire protection system can fully perform its role. Application of simulation software increases efficiency of fire protection systems while reducing risks and costs.

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The Legal Status of Permanent Single-Person Bodies of Belarusian and Polish Parliaments: Comparative Legal Analysis

Aksana Chmyha[1]

[1]Faculty of Law, Belarusian State University, Minsk, Belarus

ch.ok.vas@gmail.com

Abstract—**In the research article a comprehensive study of the legal status of permanent single-person bodies of the Parliaments of Belarus and Poland in a comparative aspect was carried out. The author formulated the main directions for improving both Belarusian and Polish legislation in this area, as well as the practice of its realization.**

Keywords - permanent single-person bodies, Parliament, legal status, Belarus, Poland, EU, comparative legal analysis.

I. INTRODUCTION

Every modern state vests a number of considerable powers in its Members of Parliament. The Parliaments of Poland and Belarus are no exception to this rule. Members of Parliament exercise their rights and perform their duties both individually and collegially within the national legislations of the said states. Permanent Parliamentary bodies direct these powers at securing proper functioning of the respective legislative chambers through single-person and collegial parliamentary bodies operating as provided for by the national legislation. Thus, in the course of exercising their powers and duties Members of Parliament "supplement and specify the powers vested in the body of deputies and their coalitions. This means that they exercise many of their powers collaboratively. This also concerns the duties performed by the deputies" [1].

II. THE MAIN PART

So it is hard to overestimate the role of single-person bodies – Heads of Parliamentary chambers – in the framework of Polish and Belarusian Parliaments.

Thus, Marshals, the "single-person bodies of the chamber" [2], direct the activities both the Sejm and the Senate during the whole term of the chambers' powers to properly coordinate the performance of the highest Polish legislature. The Marshal's position is the longest standing one among all the current chamber bodies. It dates back to the first half of the 16th century when deputies, rejecting the control of the King's Marshal, started electing a Sejm Marshal from among themselves [3].

These politicians are currently elected from among Members of Parliament – the parliamentary majority – at the first session of the newly elected chamber as nominated by the groups of at least 15 deputies (a person is considered elected having received the absolute majority of votes), as a rule, for the whole Polish Parliament convocation term. However, in fact, there may be exceptions to the above rule (e.g. the voluntary resignation of B. Komorowski in 2010 following his election as Polish President) [2].

The election procedure for deputy Sejm Marshals – Vice-Marshals, who normally represent the parliamentary opposition – is similar to that of the head of the chamber. Note that the number of Vice-Marshals is not

prescribed by the Rules of Procedure but set by the newly elected Sejm. Thus, in the 2nd Sejm convocation (1993 – 1997) there were three Vice-Marshals elected; in the 3rd (1997 – 2001), the 4th (2001 – 2005) and the 6th (2007 – 2011) ones – four Vice-Marshals, while in the 5th convocation (2005 – 2007) there were five [2]. It is worth mentioning that the Polish parliamentary practice knows just one case of removing a Vice-Marshal from office as a punitive measure (the removal of Vice-Marshal Lepper in November 2001) [2].

As both the Sejm and the Senate traditionally play quite a significant role in the Polish state, the Marshal's duties, fixed predominantly in the Constitution and Rules of Procedure of the Polish Parliamentary chambers, are vast and diverse.

For instance, in the framework of his/her powers the Sejm Marshal:

- guards the rights and dignity of the Sejm;

- acts in the name and on behalf of the Sejm;

- convenes Sejm sessions;

- chairs Sejm debates;

- ensures procedural compliance and good timing of the activities performed by the Sejm and its bodies;

- directs the activities performed by the Presidium of the Sejm and presides over its sessions;

- convenes the Council of the Seniors (Rada Starszych) and presides over its sessions;

- on advice of the Presidium of the Sejm, facilitates further progress of legislative initiatives and proposed draft resolutions, as well as proposals from the government authorities sent to the Sejm;

- handles matters concerning relations with the Senate;

- handles matters concerning Sejm's relations with the Parliaments of other states;

- from time to time estimates the efficiency of the government authorities' performance towards the Sejm, its bodies and deputies; delivers respective proposals to the Chairperson of the Council of Ministers, the Presidiums of the Sejm commissions and the deputies;

- assists the deputies in performing their functions, including supervision of the efficiency of the duties performed by the government and local authorities and other organisational units towards the deputies as provided for in the law "On exercising deputy's and senator's seat powers";

- secures law and order on the Sejm premises as well as issues instructions on good order, including the involvement of the Sejm Marshal's Guard if necessary;

- appoints and dismisses the head of the Sejm Secretariat as well as his/her deputies, approves the Sejm Secretariat regulations.

It should be noted that the above powers vested in the Sejm Marshal are fixed in Article 10 of the Sejm's Rules of Procedure. Alongside with that, a number of his/her key powers are also set in the Basic Law for the Polish state. Thus, Article 114 Part 1 of the Constitution of the Republic of Poland [4] states that the Sejm and the Senate sitting in joint session, shall act as the National Assembly, with the Marshal of the Sejm presiding; Article 128 Part 2 of the Constitution declares the Marshal of the Sejm's responsibility for ordering the election of the President; Article 131 of the Constitution of the Republic of Poland points out that if the President of the Republic is unable to discharge the duties of his office or is dismissed from office, the Marshal of the Sejm shall temporarily assume the duties of the President of the Republic (If the Marshal of the Sejm is unable to discharge the duties of the President of the Republic, such duties shall be discharged by the Marshal of the Senate (Article 131 Part 3 of the Constitution of the Republic of Poland).

Note that the Marshal of the Senate's powers for the most part correspond to those vested in the head of the lower chamber of the Polish State Parliament. Alongside with that, considering the duties imposed on the Marshals of the above chambers, we cannot but mention that "the Marshal's powers have been recently said to be too vast and limit the rights of the opposition" [3]. We also agree with the opinion of a Polish professor Wiesław Skrzydło who believes that the powers of this single-person chamber body as to setting the session procedure pursue the

interests of the ruling coalition, which runs counter to the Polish parliamentary tradition [3].

In line with the Polish Sejm and Senate Marshals' authority, the vast majority of the powers vested in permanent single-person bodies of Belarusian Parliament – the heads of the House of Representatives and the Council of the Republic – are fixed in the Rules of Procedure for the corresponding chambers. The range of duties imposed on the said elected officials of the National Assembly of the Republic of Belarus is no less significant than the responsibilities of the heads of the Polish Parliamentary chambers. Thus, the Chairperson of the chamber as its single-person body:

1. wields overall control over the National assembly chamber;
2. directs the sessions of the National assembly chamber;
3. is in charge of the internal procedures of the National assembly chamber;
4. presides over the Council of the House of Representatives, the Presidium of the Council of the Republic respectively;
5. instructs permanent commissions, the Secretariat and other bodies of the National assembly chambers on the issues in their power;
6. signs the resolutions passed by the National assembly chamber and the decisions of the Council of the House of Representatives, the Presidium of the Council of the Republic respectively;
7. puts forward proposals to be considered by the Council of the House of Representatives, the Presidium of the Council of the Republic respectively;
8. acts for and on behalf of the National Assembly chamber dealing with the President of the Republic of Belarus, the other chamber of the National Assembly, the Government of the Republic of Belarus and other public authorities as well as non-governmental organisations, foreign bodies and organisations and international organisations; coordinates the interaction between the National assembly chamber and the above bodies, associations and organisations;
9. participates in the inauguration ceremony of the President of the Republic of Belarus, the ceremony of

swearing in the Constitutional court judges of the Republic of Belarus;
10. directs and supervises the activities performed by the Secretariat of the National assembly chamber;
11. issues orders concerning the matters in his power;
12. cancels the orders issued by the deputy-Chairperson of the National Assembly chamber;
13. exercises other powers provided for by the current legislation of the Republic of Belarus.

Note that the chairperson of the Chamber is elected for the whole term limit of the Parliamentary chamber by secret ballot vote provided he / she receives the majority of the total chamber headcount.

III.   CONCLUSIONS

Summing up and analysing the activities performed by Polish and Belarusian Members of Parliament within permanent single-person bodies, we cannot but mention a succinct statement by a French legal researcher P. Lokke who compared parliamentary activity with an iceberg, with public parliamentary sessions being just a visible emerged part of it. They are just a performance staged for the public after the parliamentary majority and the government have come in commissions to an agreement concerning the legal initiatives to be passed [5]. We believe that this statement presents quite a fair description of MPs' activities within permanent single-person bodies in any developed state, including Poland and Belarus.

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The Role of Organizational Culture and Human Resource Management in Knowledge Management

Dragana Milosavljev[1], Edit Terek Stojanović[2], Mihalj Bakator[3], Maja Gaborov[4], Mila Kavalić[5]

[1, 2,3,4]University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Serbia
[5]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

[1]milosavljevd@yahoo.com, [2]terekedita@gmail.com, [3]mihaljbakator@gmail.com, [4]majagaborov26@gmail.com, [5]milazakin@gmail.com

Abstract — **Organizations are facing constant changes in modern business. For that reason, they must be ready to constantly learn, improve their knowledge and skills, as well as to manage that knowledge in the right way. People have always been a source of knowledge and its users. Therefore, it could be said that knowledge depends on the people within the organization and that human resource management activities, such as employment, selection, education, training, reward system, are necessary for proper knowledge management. Also, successful knowledge management is subordinated to the culture of employees in the organization. Therefore, the organization must create such a culture, which would motivate employees to constantly improve their knowledge, but also to share it with other employees.**

Keywords – management, knowledge, human resources, organizational culture

I. Introduction

The only thing that is certain in modern business conditions are changes. In order to achieve stability in their business and be competitive in the market, organizations must turn to the most important resource of today - knowledge. Thus, promising organizations are knowledge-based organizations, which suggest that intellectual capital is a key organizational asset, which gives them a competitive advantage [1]. Using, manging and exchanging knowledge is an important task in organizations, and good practices of knowledge management can affect performance, growth and innovation [2,3]. Knowledge management deals with the development, exchange and application of knowledge in organizations, in order to gain and maintain a competitive advantage [4,5]. The popularity of knowledge management has been growing during the last two decades, when it has become a central theme of management philosophy [4,6].

Although knowledge management brings many benefits to people and organizations, its application encounters a number of limitations. One of the most important factors influencing knowledge management activities is organizational culture [1,7]. Organizational culture is a system of assumptions, values and norms of behavior that members of an organization have developed and adopted through shared experience and that guide their thinking and behavior [8]. Organizational culture influences knowledge management, through the formation of organizational values and behaviors, which support learning, development, sharing, application and knowledge management [9,10]. Good cultural values, such as sharing, openness and trust, lead to successful knowledge management (eg contributions and knowledge exchange), which further leads to innovation and greater efficiency. For this reason, organizations should strive to promote and build an organizational culture that will support the specific goals of knowledge management [11,12].

It is quite clear that people have the most important role in the creation, use, exchange and managing of knowledge itself. One of the ways in which the exchange of knowledge within the organization can be encouraged is to set the basic practices of human resource management in an appropriate way [13,14]. Human resource management implies the development of employees in accordance with the business strategy, ie, recruitment and selection of people, employment, training and development of employees, evaluation of their performance and rewards [15]. The practice of human resource management is related to the practice of knowledge management, because it concerns intellectual and human capital. The success of knowledge management largely depends on the proper selection and employment of people, their training, motivation to learn and sharing their knowledge [2,16]. Thus, the success of knowledge management in an organization is tied to human resources and is subordinated to culture.

II. Definition of Terms

A. Knowledge Management

The knowledge of a company determines its economic strength and ability to develop other resources and increase the efficiency of their use. Therefore, it could be said that modern business conditions take place in a society based on knowledge [17]. Given the fact that knowledge is the most important economic resource for achieving sustainable competitive advantage, it is crucial for organizations to acquire the right knowledge to succeed [18]. In order for knowledge as the most important resource of today to be used in the right way, it needs to be managed. There are numerous classifications of knowledge, and the most important classification of knowledge for the purposes of knowledge management is: implicit (tacit) and explicit knowledge. Tacitus is personal knowledge, it is difficult to formalize and communicate. This knowledge is implanted in the human mind and memory, through experience [19]. Explicit knowledge is codified and formalized. It is written/recorded (documents, formulas, books, videos, etc.), it consists of facts and skills that can be easily transferred to someone else [20]. Full use of knowledge implies the transition from implicit knowledge to explicit and vice versa.

Knowledge management can be defined as the process of collecting, storing, exchanging and using knowledge, i.e. as a systemically and
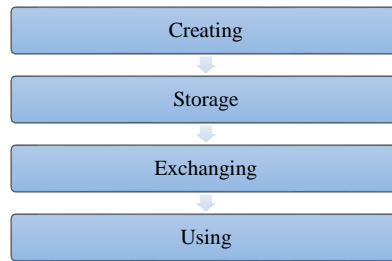
Figure 1. Knowledge management process

organizationally specific process for acquiring, organizing and communicating implicit and explicit knowledge of employees, which other employees could use to be more efficient and productive in their work [1]. The goal of knowledge management is for the organization to become aware of its knowledge, on an individual and collective level, and to use in the most efficient and effective way the knowledge it possesses or can acquire [11]. The process of knowledge management (Fig. 1) implies four phases: knowledge creation, knowledge storage, knowledge transfer and using knowledge [1, 20].

Knowledge creation is a knowledge management phase that includes activities related to the introduction of new knowledge into the organization and consists of the development, discovery and acquisition of knowledge [20]. Through social and collaborative processes, as well as the cognitive processes of individuals, knowledge is created, shared and increased within the organization [21]. Storage is the phase of knowledge management in which organizations must organize and structure knowledge, thus facilitating access to and distribution of knowledge within the organization. Combining or integrating knowledge can increase efficiencies and reduce redundancies [1,22]. Knowledge transfer implies activities that include the transfer or sharing of knowledge from one part of the organization or from one person to another part of the organization or to another person [20]. The use or application of knowledge refers to its actualization. This means that knowledge in itself is not valuable if it is not used. Proper exchange and use of knowledge contributes to organizational innovation, better problem-solving results, leads to better business opportunities, increases profitability, reduces costs, etc. [13]. So, nowadays, which are characterized by constant changes, organizations depend on the knowledge they possess, so

knowledge management is a key factor for achieving success in the market.

The success of the implementation of knowledge management depends on a number of factors that affect it. Some of the most important factors are [23]:

- organizational culture - a culture that supports learning and knowledge exchange;

- human resource management - employees who are willing to learn and share knowledge;

- leadership - support of top managers to develop and support knowledge exchange;

- information technology - IT infrastructure enables storage and distribution of knowledge and

- control - supports targeted activities of knowledge creation and application.

B. Organizational culture

Global business is also characterized by the diversity of the workforce in terms of cultural and ethical origin. Cultural differences from country to country require the harmonization of these differences in management practices [7]. Definitions of organizational culture are numerous, and some of these definitions are:

- Organizational culture is a set of common values, which help members of the organization to understand organizational functioning and thus direct their thinking and behavior [24].

- Organizational culture is the software of the mind [25].

- Organizational culture is a system of assumptions, values, forms and attitudes, manifested through symbols, which members of an organization have developed and adopted through shared experience and which helps them determine knowledge of the world around them and how to behave in it [26].

To explain organizational culture, researchers have developed different models of organizational culture. One of the most famous models is Schein's model of organizational culture [6]. With this model, organizational culture is explained on three levels: values, basic assumptions, and artifacts [27]. Values include criteria adopted by members of the organization when assessing events, situations, and behaviors. The basic assumptions include the fundamental beliefs of the members of the organization about the nature of reality, the nature of human actions and the nature of human relations. Artifacts include visible aspects of culture, symbols, myths, legends, art, technology. In other words, they contain patterns of behavior that can be heard and seen, that is, they explain how certain things are done in the organization [6,27].

Organizational culture is important, because without knowing the actions of cultural forces, unforeseen and undesirable outcomes could occur. It is the organizational culture that facilitates change and brings stability to organizations [20]. In a competitive environment, sometimes in order to survive, organizations have to change their organizational culture, otherwise they may be doomed.

Numerous classifications of types of organizational cultures can be found in the literature. One of the most well-known classifications is the Handy's classification, which includes [28,29]:

- The culture of power or family culture is an authoritarian type of culture. It is characterized by a high degree of centralization, social structure and interpersonal relations are dominant over the work structure and tasks. The power of leaders in this culture is inviolable, and the members of the organization readily accept all changes that come from leaders.

- The culture of roles or the culture of the "Eiffel Tower" is a bureaucratic culture. It is characterized by a high degree of standardization, specialization, formalization and depresonalization. The organization is seen here as a machine, in which each part must perform its role in a pre-prescribed manner. It implies an unequal distribution of power. Role culture does not support change, because change disrupts the harmonious functioning of the organization.

- Task culture or "guided missiles" is a culture in which the organization is seen as a tool for solving problems and accomplishing tasks. Results, competence, creativity, achievements, changes and teamwork are highly valued here. Power is relatively evenly distributed in this type of culture.

- A culture of support, or an incubator of cultures, largely singles out individualism and individual development. For members of an

organization that possesses this culture, personal goals and development are above organizational ones. This type of organizational culture prefers equality in the distribution of power.

Organizational culture is a non-physical resource, which if built well can bring organizations a competitive advantage, especially because this is a resource that is almost impossible to imitate [6]. For that reason, the task of management is to build such a culture in which employees will feel good, which will certainly affect business results.

C. Human resource management

One of the areas in which organizations can achieve a competitive advantage is its human resources, which are considered one of the most important resources of organizations and the source of their success [30,31]. People with their knowledge, professional experience, skills and enthusiasm represent a significant resource of any organization. They have a crucial role and importance in the production process, they are the bearers of introducing changes, creating added value, increasing business efficiency and improving the performance of the organization. For successful and efficient business activities, it is necessary to have an optimal staff and appropriate management structure, which emphasizes the importance of human resource management. Human resource management is a concept of attitudes towards employees and the way they manage their work, and it was created in response to changes in the sphere of economy, organization and management. Great contribution to the emergence of human resource management was given by: communication, sociology, psychology, organization theory and others. Human resource management is defined as a strategic and coherent approach to managing the most valuable resource of an organization - the people who work there and who individually and collectively contribute to achieving its goals [32]. The function of human resources management is determined by various and interconnected processes, i.e. activities, of which special importance are: human resources planning, recruitment, selection of candidates, socialization of new employees, training and development, motivation, performance evaluation, rewarding [15,33].

In general, human resource management concerns policies, practices, and systems that influence employee behavior, attitude, and performance [34]. Organizations can use some human resource management practices as a means of motivating increased employee commitment, engaging in creative thinking and innovation, shaping their attitudes, skills, abilities, and behaviors to achieve organizational goals [35]. According to studies of strategic human resource management, human resource management practices can be divided into: "low cost" and "high commitment" [36]. Low-cost human resource management practices focus on work efficiency and cost reduction. In doing so, a formal system of control and monitoring of employee behavior is adopted, which has clear job descriptions, including their tasks, duties of responsibility. The task of employers (managers) is to carefully recruit and select their employees, monitor their performance and pay them according to their ability to perform tasks efficiently. The basic principles of human resource management with high commitment are the acquisition of talented employees and encouraging the achievement of innovative goals through long-term investment in employees. Comprehensive training and development aim to improve the abilities of employees, which leads to a sense of belonging and attachment to the organization [37, 38].

III. THE ROLE OF ORGANIZATIONAL CULTURE IN KNOWLEDGE MANAGEMENT

Organizational culture affects all aspects of the organization and is recognizable in the behavior of individuals, organizational performance, motivation, job satisfaction, creativity and innovation [20]. Organizational culture has a special place among the factors that influence knowledge management. It is considered to be the driver of knowledge management. Organizational culture can affect the abilities, motivation and ability of employees to share their knowledge. In organizations with a culture of knowledge sharing, competition between employees is limited. Here, employees share their knowledge and ideas and consider it natural [13]. However, organizational culture can also be a major obstacle to knowledge management success. Therefore, the organizational culture should be examined in order to identify the reasons that lead to the success or failure of the organization [39]. A study conducted in 2000 on 158 global companies found that the second biggest obstacle to knowledge management is organizational culture. For this reason, one of the most important priorities of organizations is to launch

initiatives to understand and overcome cultural barriers [40]. Organizational culture should be such that it promotes and supports activities related to learning and knowledge.

The knowledge-focused organizational culture includes the following factors [41]:

- the existence of a common language, which enables a greater exchange of knowledge among employees;

- supporting employees to express their new ideas;

- acknowledging mistakes as learning outcomes and tolerating them to a certain level;

- the structure of social interaction is based on trust and openness;

- encouraging employees to exchange information informally and

- development of a vision of knowledge, which supports the transfer and sharing of knowledge.

The values that lead to effective knowledge management are [7]:

- Formalization - refers to rules, procedures and written documentation, such as policy manuals, job descriptions, etc. Effective knowledge management requires a balance between an open and flexible organizational system, along with formality and discipline, to ensure a tangible result. Formal rules enable learning and increase the efficiency of organizational communication [42];

- Trust - the most important value for knowledge management. An atmosphere of trust and security is necessary to encourage innovation, experimentation, risk-taking, with the ultimate goal of developing new and using existing knowledge;

- Learning - a strong learning culture is associated with the creation, acquisition and transfer of knowledge;

- Cooperation - represents the degree of active support and assistance to the organization. A culture of cooperation helps to create knowledge by increasing the exchange of knowledge [43].

One of the best models that can show the relationship between organizational culture and knowledge management is the model of De Long

and Fahey. This model shows how organizational culture affects knowledge in the organization. First, culture shapes assumptions about what kind of knowledge is valuable to an organization. Second, it explains the relationships between cultural levels of knowledge (individual and organizational levels) and determines who should control knowledge and who should share it. Third, culture creates an environment for social interaction, which determines the way in which knowledge is created, shared, and received. Fourth, culture forms processes in which new knowledge is formed, legitimized and spread to organizations [6,44].

It is believed that 80% of knowledge management refers to organizational culture and people, and 20% to knowledge management technologies [44]. For this reason, the culture in the organization is vital to the success of knowledge management. To be successful in knowledge management, organizations must develop a learning culture and provide the necessary conditions for lifelong learning. If an organization has an organizational culture focused on knowledge, it will be difficult for other organizations to imitate its strategies of knowledge and innovative abilities, which will give it a competitive advantage in the market [45].

IV. THE ROLE OF HUMAN RESOURCES MANAGEMENT IN KNOWLEDGE MANAGEMENT

Modern business is characterized by constant improvement of knowledge. In order for organizations to cope with this, managers must constantly strengthen people-oriented management, where the creation and exchange of knowledge would take place successfully. One of the ways in which the exchange of knowledge within the organization can be achieved is to set the basic practices of human resource management in an appropriate way [13,46]. Most of the accumulated knowledge in the organization is created and shaped by human resources. When employees leave the organization, a good portion of the accumulated knowledge is lost. This is especially true for high-tech organizations, where knowledge leakage is large, due to the high rate of staff transfers. The loss of knowledge, when employees leave, the organization leads to defeat in the fight for competition. Human resource management practices not only significantly affect the motivation and behavior of employees,

but also increase their efforts in creating, acquiring, using and exchanging knowledge. For this reason, organizations need a knowledge-oriented human resource management system, in order to ensure constant organizational learning through the exchange and application of explicit and implicit knowledge [6,47].

Knowledge-based human resource management practices include [2,6,13,15]:

• Recruitment, selection and employment oriented to knowledge - it is important to select and employ those individuals who possess the necessary knowledge and skills, in order to achieve the goals set by the organization. Organizations should focus on hiring candidates who provide access to new knowledge and who are willing to constantly improve [6, 47]. In short, knowledge-oriented employment includes the selection of employees with special abilities, knowledge and skills, participatory, creative, with team spirit and a culture of knowledge exchange;

• Knowledge - oriented training and development - continuous professional development is considered key for professionals and knowledge-based workers [13]. Training and development not only affect the improvement of individual characteristics, but also have a positive effect on the exchange of knowledge, increase the level of understanding in groups and facilitate communication among employees [6].

• Knowledge - oriented career system - refers to the career development of those employees who are engaged in the acquisition, exchange and change of knowledge [6]. In general, efforts should be made to retain employees who exceed expectations in order to avoid the risk of losing valuable knowledge. However, when employees do not show enough initiative or do not meet the goals, they may have to be fired [13].

• Knowledge - oriented job design - affects the motivation of employees to share knowledge. The design of the job should be such that the employee shows all his abilities in the full sense. In relation to the provision of knowledge exchange support, the following aspects related to job design appear: teamwork, job rotation, employee autonomy and common practices [13].

• Knowledge - oriented work teams - refers to the creation of teams in which employees are encouraged to share their knowledge and experiences with other team members, which contributes to the spread of individual knowledge in the organization and better interaction among employees [6]. Creating good teams reduces the physical and psychological distance between people, so it is recommended for organizations to organize various events in which all employees will participate, such as: jubilee celebrations, joint trips, sports competitions, etc. [6,34].

• Knowledge - oriented performance appraisal - is a formal system of reviewing and evaluating the performance of individual and team tasks. Some of the criteria for impact assessment should be: employee readiness to share their knowledge, creativity and motivation of the employee to engage in innovative activities, achieving favorable innovation results, taking risks and problem-solving skills [13].

• Knowledge - oriented reward - reward systems indicate what the organization values and shape the behavior of individuals, and these awards are considered one of the basic motivators of employees. Rewards can be tangible (salaries, bonuses, incentives, profit share) and intangible (travel, benefits, specializations, official car) [15].

The success of an organization in the knowledge economy first of all depends on the successful management of knowledge. Thus, as already mentioned, knowledge depends on the people within the organization, and human resource management activities, such as employment, training and development, reward systems, are necessary for proper knowledge management [46]. For this reason, human resource management and knowledge management must be integrated.

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Knowledge as a Factor of Destination Competitiveness: The Case of Republic Serbia

Jelena Petrović

Faculty of Sciences and Mathematics, University of Niš, Niš, Serbia

jelena25@pmf.ni.ac.rs

Abstract— **Destination competitiveness represents an important research topic and has significant attention from many researchers in the literature. However, no study has yet been conducted to measure the impact of knowledge on destination competitiveness. The purpose of this paper is to analyze the place of the Republic of Serbia according to the global knowledge index and travel and tourism competitiveness index in the relation to the members of European Union and other Western Balkan countries. The aim of this paper is to quantify the impact of knowledge on destination competitiveness of observed countries. The results of the research indicate that the countries with the lowest level of destination competitiveness record a positive correlation between the global knowledge index and travel and tourism destination index while the countries with highest level of destination competitiveness record a negative correlation between the global knowledge index and travel and tourism destination index.**

Keywords – knowledge, destination, competitiveness, Republic of Serbia

I.   INTRODUCTION

Extreme growth of number of tourists in the past decades clearly defines tourism as the most significant economic and social phenomenon. Number of international tourists shows a growth from 25.3 million in 1950 to incredible 1,5 billion in 2019 [1]. Tourism as one of the world`s major economic sector accounted about 7% of global trade [2]. Europe is the major contributor to the global tourism industry and European Union tourism represents about 50% share of worldwide tourism [3].

The present pandemic COVID-19 has resulted in global challenges, healthcare and economic crises, and the tourism industry lies among the most damaged global industries [3]. Export revenues from tourism could fall by $910 billion to $1.2 trillion in 2020 [2]. In 2020, the Republic of Serbia is recorded the declined the number of foreign tourists for 75,9% year-to-year [2].

During XXI century, tourism companies are characterized by knowledge and innovation as competitive advantage. Today, knowledge represents the basic strength of every tourism company. More input of technology and research and innovation as well as cultural and scientific knowledge provides great supports to attract more tourists and for improving destination competitiveness [4].

In the literature, destination competitiveness has received increasing attention. During XXI century, the topic of destination competitiveness has been addressed in numerous journal articles [5]. But in the literature, special attention is not paid to the impact of knowledge on the destination competitiveness.

The destination competitiveness is measured by Travel & Tourism Competitive Index (TTCI), while the knowledge was measured by the Global Knowledge index (GKI). The paper is structured in the following segments: a) analysis the place of the Republic of Serbia in the relation to the developed, transition and other

Western Balkan countries according to knowledge and destination competition; b) analysis of correlation between the knowledge and destination competition; and c) analysis the impact of knowledge indicators on destination competitiveness.

II. THEORETICAL BACKGROUNDS

Knowledge can be represented as a global public good [6]. During XXI century, tourism has been recognizing the importance of knowledge-based economy which emerged from the information age in the late 1990s. There was a recognition that not only was knowledge more than information but also that it was a resource to be valued and managed [7]. Knowledge can be viewed as sum of information and wisdom [8]. In the literature can be found many definitions of knowledge, but its essence is the usage of ability, competence and experience to create information useful for making efficient and effective decisions. Knowledge is one of the most important competing tools for tourism destination and their subjects.

Knowledge has positive impact on tourism supply and tourism demand. Increasing usage of technology as well as cultural and scientific knowledge is positively correlated with tourism demand [4]. Knowledge has a positive impact in promoting tourism supply [4]. For example, technology and social media enable information about tourism destination. In the XXI century, the combination information technology with knowledge has become increasingly close. Today, tourism companies and destinations use various tools to capture relevant information with modern information technology. Tourism destinations can increase online presence via the Internet and become competitive in the global tourism market [9].

But many tourism companies fail to effectively use and manage with knowledge as one of the most important edge. Policy makers would be stimulated the tourism companies to transfer and share knowledge through innovate, research and development policies [10]. Bearing in mind that investing in knowledge is uncertain to predict in tourism industry, the government should invest in the collection of data for tourism surveys at local, regional and national level. Their policy should be focus on providing equal access to knowledge and encouraging the diffusion of knowledge across networks of tourism companies because the managing knowledge represents the key factor of tourism destination competitiveness [11,12,13,14].

III. RESULTS AND DISCUSSIONS

A. Analysis of the Positioning of the Republic of Serbia According to the Knowledge and Destination Competitiveness

In the paper are grouped the developed, transition and Western Balkan countries in

TABLE I. MEMBERS OF CLUSTER AND DISTANCES FROM RESPECTIVE CLUSTER CENTER

Cluster 1		Cluster 2		Cluster 3	
Members	*Distance*	*Members*	*Distance*	*Members*	*Distance*
Cyprus	1.800526	Austria	1.309523	Greece	0.455607
Italy	0.522907	Belgium	1.247337	Bulgaria	0.945425
Malta	2.659809	Denmark	0.761479	Croatia	2.582165
Portugal	2.193515	Finland	2.243847	Romania	0.711567
Spain	0.933340	France	2.889091	Albania	0.407834
Czech	0.753944	Germany	1.438002	Serbia	4.333310
Estonia	2.451759	Ireland	1.177646	Bosnia and Herzegovina	1.731712
Hungary	2.506064	Luxembourg	1.815172	Macedonia	2.060662
Latvia	1.538346	Netherlands	1.315238		
Lithuania	0.853257	Sweden	1.815172		
Poland	1.659579				
Slovakia	1.747297				
Slovenia	1.530073				

Source: Prepared by the author (STATISTICA 7)

clusters according to their knowledge (GKI - Global Knowledge index) and destination competitiveness (TTCI - Travel & tourism Competitiveness index) by using cluster analysis (Table I). The second cluster includes developed countries which have the GKI greater than 62,50 and highest average values of TTCI in the relation to the other observed countries. This cluster includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, Netherland, and Sweden.

The third cluster includes countries with the GKI from 40.9 to 50.60: Greece, Bulgaria, Croatia, Romania, Albania, Bosnia and Herzegovina, North Macedonia, and Serbia. This cluster represents the lower average values of GKI and TTCI. The first cluster includes countries with the GKI from 52.90 to 60.20.

The interdependence between knowledge and destination competitiveness is tested by calculating the Pearson correlation coefficient between the GKI and the TTCI for three clusters. The results of the correlation analysis are shown in Table II. There is a significant positive correlation between the GKI and the TTCI for III cluster, while there is a significant negative correlation between the GKI and the TTCI for I cluster.

The results indicate that the countries with the highest destination competitiveness record a negative correlation between the knowledge and destination competitiveness while the countries with the lowest destination competitiveness record a positive correlation between those indexes.

TABLE II.   PEARSON CORRELATION COEFFICIENT – INTERDEPENDENCE BETWEEN THE GKI AND TTCI

		TTCI		
		I cluster	*II cluster*	*III cluster*
GKI	Person Correlation	0.378	-0.634*	0.664*
	Sig. (2-tailed)	0.102	0.024	0.036
	N	13	10	8

Source: Prepared by the author (SPSS Statistics 19)

TABLE III.   THE COMMON IMPACT OF INDICATORS WITHIN THE GKI ON THE TTCI (I CLUSTER)

Model	R	R Square	Adj. R Square	Std. Error of the Estimate	Sig.
1	0.708	0.501	0.456	0.32986	0.007
2	0.822	0.675	0.610	0.27913	0.043

Source: Prepared by the author (SPSS Statistics 19)

B. Analysis of the Impact of Knowledge Indicators on Destination Competitiveness

In order to avoid the issue of multicollinearity when analyzing the impact of indicators within the GKI on the TTCI, the forward method was applied in regression analysis.

The determination coefficient is 0.822 for cluster 1. We can conclude that the impact of indicators within the GKI on TTCI is 82.2%. The value of the observed regression coefficient is statistically significant because Sig. value is less than 0.05 (Table III).

TABLE IV.   THE VALUE OF REGRESSION COEFFICIENTS – OF INDICATORS WITHIN THE GKI ON THE TTCI (I CLUSTER)

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	*Std. Error*	*Beta*		
1	(Constant)	2.545	0.565		4.503	0.001
	Research, development and innovation	0.054	0.016	0.708	3.325	0.007
2	(Constant)	4.868	1.111		4.381	0.001
	Research, development and innovation	0.062	0.014	0.819	4.393	0.001
	Economy	-0.050	0.022	-0.432	-2.316	0.043

Source: Prepared by the author (SPSS Statistics 19)

TABLE V. THE COMMON IMPACT OF INDICATORS WITHIN THE GKI ON THE TTCI (II CLUSTER)

Mod	R	R Square	Adj. R Square	Std. Error of the Estimate	Sig.
1	0.653	0.426	0.354	0.28711	0.041

Source: Prepared by the author (SPSS Statistics 19)

Based on the results of the applied method of regression it can be concluded that subindex Research, development and innovation and the subindex Economy have significant impact on destination competitiveness of I cluster (Table IV).

The determination coefficient is 0.653 for cluster 1 (Table V). We can conclude that the impact of indicators within the GKI on TTCI is 65.3%. The value of the observed regression

coefficient is statistically significant because Sig. value is less than 0.05.

Based on the results of the applied method of regression it can be concluded that subindex General enabling environment has significant impact on destination competitiveness of II cluster (Table VI).

The determination coefficient is 0.968 for cluster 1 (Table VII). We can conclude that the impact of indicators within the GKI on TTCI is 96.8%. The value of the observed regression coefficient is statistically significant because Sig. value is less than 0.05.

Based on the results of the applied method of regression it can be concluded that subindex Research, development and innovation and the subindex Technical and vocational education and training have significant impact on destination competitiveness of III cluster (Table VIII).

TABLE VIII. THE VALUE OF REGRESSION COEFFICIENTS – OF INDICATORS WITHIN THE GKI ON THE TTCI (II CLUSTER)

	Model	Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.697	2.426		4.410	0.002
	General enabling environment	-0.073	0.030	-0.653	-2.437	0.041

Source: Prepared by the author (SPSS Statistics 19)

TABLE VII. THE COMMON IMPACT OF INDICATORS WITHIN THE GKI ON THE TTCI (III CLUSTER)

Model	R	R Square	Adj. R Square	Std. Error of the Estimate	Sig.
1	0.921	0.849	0.823	0.20154	0.001
2	0.968	0.936	0.911	0.14301	0.047

Source: Prepared by the author (SPSS Statistics 19)

TABLE VI. THE VALUE OF REGRESSION COEFFICIENTS – OF INDICATORS WITHIN THE GKI ON THE TTCI (III CLUSTER)

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.859	0.357		5.204	0.002
	Research, development and innovation	0.091	0.016	0.921	5.797	0.001
2	(Constant)	3.705	0.746		4.064	0.004
	Research, development and innovation	0.081	0.012	0.819	4.393	0.001
	Technical and vocational education and training	-0.032	0.012	-0.312	-2.630	0.047

Source: Prepared by the author (SPSS Statistics 19)

IV. CONCLUSION

In this paper special attention was paid to the analysis of the positioning of the Republic of Serbia according to the knowledge and the destination competitiveness. The results of cluster analysis indicate that the Republic of Serbia belong the third cluster or the cluster with lowest average values of GKI and TTCI.

The results of correlation analysis indicate that the interdependence between the knowledge and the destination competitiveness depend on the level of economic development. The developed countries that belong II cluster, cluster with highest average values of GKI and TTCI record negative significant correlation between the GKI and TTCI while Western Balkan countries and Greece and Romania record positive significant correlation between the GKI and TTCI. The results of regression analyses indicate that the Republic of Serbia and other Western Balkan countries should pay special attention to the more input of research and innovation as well as to the education and training of human resources with the aim of increasing destination competitiveness.

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Modern Economics Students' Perception of University Education Quality and its Implications During Covid-19 Pandemic

Lenka Veselovská[1], Lucia Hudáková[2]

[1,2]Institute of Managerial Systems in Poprad, Faculty of Economics, Matej Bel University, Poprad, Slovakia

[1]lenka.veselovska@umb.sk, [2]lucia.hudakova@umb.sk

Abstract—**This research study focuses on a current topic of business students' attitude towards university lectures in a form of quality perception and its impacts on outcomes in the form of achieved grades and gained knowledge. The main aim of this research study was to explore how modern economics students perceive quality of university education and implications of such perceptions for future trends in management. The attendance rates were examined of students from different fields of economics study program who represented the sample file for this empirical research study. The reasons for absence were explored in terms of perceived quality of provided university education and various personal factors. It was discovered that nowadays these personal factors have more importance and stronger impacts than objective factors that universities can directly influence. The comparison of findings before and during the COVID-19 pandemic was conducted.**

Keywords - quality of university education, economics students, University education, attendance, COVID-19

I. INTRODUCTION

In the 21st-century business sector of the economy has gone through significant changes that put that much pressure on its managers. Several factors significantly affected the business environment in progressive countries and therefore considerably changed the requirements for successful managers. The premise of this study is that such changes in practice need to be reflected by different courses at universities that are supposed to prepare economics students to become successful managers in the future. However, economics students themselves need to adapt to these changes as early as their preparation provides the opportunities. One of the key factors of such changes is the management students' attitude towards their university education influenced by their perception of its quality.

The literature on the effects of attendance on course outcomes is vast, however not entirely current. There are missing links between various factors, as well as the modern aspects of the business environment that has recently significantly changed its needs for managers in terms of educational preparation and its quality. Therefore, research studies conducted as far as 5 years ago may no longer provide relevant information concerning the perspectives for future quality management since the changes in businesses shifted the attitude of the students and such findings can no longer be considered valid in current business reality. Moreover, the COVID-19 pandemic created new needs for organizing lectures due to social distancing. This study strives to provide a clear image of how the changing attitude of modern economics students affects their knowledge gained by a university education and prepares them for their roles as managers in the future.

II. MATERIAL AND METHODS

The main aim of this research study was to explore how modern economics students perceive quality of university education and implications of such perceptions for future trends in management. In order to meet the aim two surveys were conducted among university students whose field of study is economics and management oriented. A questionnaire was used to collect data from students who meet these requirements. Data collection was conducted during two periods, firstly between February 2018 and October 2018 and secondly between October 2020 and January 2021 at the university located in Slovak republic. Overall, 268 undergraduate and postgraduate students

attendance is not necessary to achieve a passing grade from the subject.

H4: Students attend more lectures of courses they consider to be of higher quality.

H5: The majority of students gain knowledge about management functions mainly at universities.

H6: The attendance rates of economics students increased during the COVID-19 crisis.

III. LITERATURE REVIEW

Nowadays university education is a product available on the market to anyone who can meet certain requirements. Such view may be considered harsh, but necessary if the quality of

TABLE I. STRUCTURE OF SAMPLE FILES BASED ON THE FIELD OF STUDY

Study program	2018 survey		2020 - 2021 survey	
	Number of students	Percentage	Number of students	Percentage
Tourism	45	16.79%	32	12.31%
Corporate Economics and Management	79	29.48%	66	25.38%
Finance and Accounting	32	11.94%	41	15.77%
Public Economics and Regional Development	8	2.99%	2	0.77%
Marketing Management of Business*	27	10.07%	23	8.85%
Management	56	20.90%	59	22.69%
Business management systems*	21	7.84%	37	14.23%
Total	268	100.00%	260	100.00%

participated on the first survey. Out of which 62.69 % were female students. The age varied between 19 to 36 years. The second survey was conducted on a sample of 214 students (64.95 % female). These research sample files were created from the existing pool of students in 7 slightly different economics fields of study. Detailed information is provided in Table I. Study programs marked with the star symbol are postgraduate studies and others are undergraduate studies.

Six hypotheses were formulated to further examine the effects of attendance on achieved results of modern economics students and future trends in university quality management taking under consideration the implications of COVID-19 crisis.

H1: Less than 20 % of students attend more than 80 % of their lectures.

H2: There is a relationship between level of student's attendance and his or her perception of university education quality.

H3: The main reason for not attending lectures is student's conviction that his or her

university education needs to be ensured. Its quality perception is similar to the ability of consumers perceiving the quality of product or service [1-6]. Results of such comparison between expected quality and actually received quality of product or service can significantly affect how the consumers focus their attention on achieving their outcomes. In the case of education this could mean their engagement in lectures. However, education is not entirely like other products. Its main purpose is to prepare students for their future careers and its outcomes may take a long time to become visible. Therefore, participation on university education can be similar to making a long term investment that may or may not pay off in the future. The difference is the fact that economics students themselves have the abilities to influence this sort of pay off and increase their chances to capitalize on their investment with the effort they put into their education in the present. However, such effort has to be motivated by a clear linkage between achieved outcomes at the university and achieved outcomes in their future jobs as business managers. The perceived quality of education is the main factor that can influence

students to participate more during lectures, but it is a complex one. There are many elements of quality which can be either motivational or hindering in terms of the importance students assign to their education as well as the possibilities of their future success as managers. Several authors focused their research on discovering such factors and measuring their influence [7-11]. These factors can be of motivational nature or of psychological nature. The reasons and motivators for such decisions have not yet been explored by researches.

Literature provides a lot of evidence that increased attendance may lead to achieving better results in a form of grades [8,12,13]. Students not regularly attending their lectures seem to become a progressively more widespread observable fact and its commonness is upsetting because of its possible harmful consequences on not only the students' grades as immediate outcomes of their effort, but also on

teaching for students' learning outcomes and their continuous effort to optimize [15]. This study may not be focusing on a novel topic in perception of university quality, but it strives to provide new revelations that contribute to the current pool of knowledge in an innovative way and may provide inspirations for academia and practice. Furthermore, the findings also focus on changes that occurred during the pandemic of COVID-19 that significantly affected the university education.

IV. RESULTS

Firstly, the actual attendance rates were examined in order to create a current image of their perceptions. The data was structured by study program and the type of course since the level of attendance may vary depending on interest students have on the subject with the assumption that students tend to participate more in lectures of courses they selected in opposite to

TABLE II. ATTENDANCE RATES BASED ON THE STUDY PROGRAM AND TYPE OF COURSE

Study program	2018 survey		2020-2021 survey	
	Attendance rate for mandatory courses	Attendance rate for elective courses	Attendance rate for mandatory courses	Attendance rate for elective courses
Tourism	45.39%	72.41%	72.58%	93.36%
Corporate Economics and Management	63.72%	89.53%	87.42%	91.54%
Finance and Accounting	78.32%	74.56%	86.38%	92.57%
Public Economics and Regional Development	62.01%	68.38%	83.12%	84.03%
Marketing Management of Business	78.29%	79.62%	91.46%	87.41%
Management	61.83%	62.03%	79.51%	91.45%
Business management systems	81.02%	82.67%	92.76%	92.19%
Average	67.23%	75.60%	84.75%	90.36%

their future careers in management. The negative impacts of not attending lectures have been explored even with regard to students' dropout rates since skipping classes can lead to not being able to follow with other more advances courses [14].

There are many research studies that focus on the issue of university education and its quality. Each of them brings some new information that emphasizes its importance on achieved outcomes. The findings of such studies are applicable to lecturers and students alike. Primarily, such results can be applied and presented as a motivational factor for students to attend their lectures and actively participate to gain knowledge, not just information. Furthermore, discoveries made by these research studies can be useful for lecturers who need to be constantly aware of the significance of their

courses that are mandatory. Overall the attendance rate for elective courses was at 75.60% and 67.23% for mandatory courses in 2018 and 84.75% for mandatory courses and 90.36% for elective courses in 2020 (Table II). Postgraduate study programs have significantly higher attendance rates in both mandatory and elective courses. The lowest attendance rate was marked on a mandatory course in the Tourism study program during both research periods. However, its elective courses had significantly higher rates of attendance. Study program

Finance and Accounting was the only study program with mandatory courses with higher levels of attendance than its elective course in 2018, but the difference was not very significant.

The average rate of attendance of all analyzed students in 2018 was at level 71.41%. During the

TABLE III.   STUDENTS' REASONS FOR NOT ATTENDING THE LECTURES

Reason	2018 survey		2020 - 2021 survey	
	Number of students	Percentage	Number of students	Percentage
The lectures were not interesting	61	22.76%	57	26.64%
Teaching was not good	45	16.79%	50	23.36%
The duration of the class was too long	40	14.93%	28	13.08%
I can pass the exam without attending lectures	191	71.27%	179	83.64%
All materials are available online	128	47.76%	177	82.71%
My friends also didn't go to class	140	52.24%	10	4.67%
I had other social responsibilities	64	23.88%	14	6.54%
There was not a pleasant atmosphere in the lecture room	42	15.67%	32	14.95%
I had other job responsibilities	173	64.55%	57	26.64%
Participation in lectures is not compulsory	75	27.99%	78	36.45%
I got information and materials from my friends	104	38.81%	85	39.72%
I didn't understand teaching	17	6.34%	24	11.21%
Disease or fatigue	29	10.82%	39	18.22%
The teacher was boring	31	11.57%	24	11.21%
I had to work on assignments for other courses	9	3.36%	3	1.40%
Travelling / problem to arrive at a given time	52	19.40%	26	12.15%
Total	268	-	214	-

pandemic of COVID-19 virus, university conducted all lectures on-line. The differences in attendance rates can be noted when comparing the pre-pandemic and pandemic situations. Notably, all of the attendance rates increased during the pandemic. The average attendance rate in 2020 was 87.56% which represents an increase by 16.14%. The hypothesis H1 focused on examining the assumption that less than 20% of students attend more than 80% of their lectures. In 2018 it was discovered that 47 students (17.54%) attend more than 80% of their lectures and only 32 students (11.94%) attend more than 90% of all lectures. The binominal test was used to verify and confirm hypothesis H1 using the 2018 survey data. However, since the attendance rates were higher in 2020, the hypothesis H1 could not be confirmed using the later survey data. Hypothesis H6 focused on exploring the differences between pre-pandemic attendance rates and the rates during the actual crisis. The initial assumption of an increase was confirmed by binominal test.

Table III provides the main reasons for not attending the lectures as stated by students themselves. Some students provided multiple reasons since the questionnaire enabled such an option. These 16 reasons can be divided into two categories. The first group contains reasons of personal nature resulting from student's attitude, mood or current conditions. The second group contains reasons relating to perceived quality of

lectures and their objective characteristics. These factors include the teaching qualities of lecturer, availability of course materials elsewhere and not compulsory participation in lectures. Factor analysis was conducted to explore the relationships between the level of attendance and each particular reason for not attending the lecture. It was discovered that the first group of factors affect the level of attendance more significantly than the second group factors. Furthermore, hypothesis H4 which assumed that students attend more lectures of courses they consider being of higher quality was not confirmed. However, the hypothesis H3 was confirmed since it was discovered that the main reason for not attending lectures is the student's conviction that his or her attendance is not necessary to achieve a passing grade from the subject. Other reasons such as job responsibilities and peer pressure have also significant effects on students' attendance.

The most significant objective reason for not participating in the lecture was the availability of all materials online. The observed results indicate that the perception of quality of university education is shifting from more general requirements to personalized variables that are much more difficult to influence by institutions providing education. And there rises the challenge of modern economics education and its quality perception which requires creation of more flexible study conditions for students

who consider such options as more desirable and consequently of higher quality that accommodates their needs better.

There were no significant differences between students of different study programs in terms of their reasons for not attending lectures. However, the reason "I can pass the exam without attending lectures" was stated mostly by students of undergraduate programs. Only 35 of total 191 students from the first sample who declared this reason for not attending classes were students from postgraduate programs. On the other hand, the reason "I had to work on assignments for other courses" was declared by 8 postgraduate students and only by 1 student from undergraduate program (Public Economics and Regional Development) from the first sample. Furthermore, the reason of having other responsibilities resulting from part-time job was stated nearly equally by students from both degrees. The reasons for not attending lectures varied only slightly during the COVID-19 pandemic. The main difference can be noted precisely on the reason of having a part-time job. During the second survey only 57 students (26.64 % of students in sample file) stated this reason. Even more significantly, the influence of peer groups of friends decreased significantly during the COVID-19 pandemic since only 10 students declared this reason for not attending (4.67% of all students). On the other hand, the reason "All materials are available online" become the second most significant reason for not attending lectures during the COVID-19 pandemic.

Since no other research studies focused on the effects of having a part-time job on attendance it may be interesting to further explore this reason for skipping class. Since this reason proved to be significant only during the pre-pandemic situation, only the data from the first survey was considered during further examination. This reason was stated by as many as 173 students, which represents nearly two thirds of all students in our sample file. Furthermore, it was discovered that only 6.36% of students who provided their job as a reason for not attending the lectures have in a fact attended more that 80% of their classes and as many as 18.50% of them only attended 30% of lectures. With their part-time job clearly being the priority these students may not achieve higher grades in their courses. This assumption was explored by examining the relationship between the level of attendance and the achieved grade on the sample file of 173 students who do not attend all their lectures due to having a part-time job. The findings support this assumption since the relationship between these variables was calculated as strong with correlation coefficient at the level 0.683. Furthermore, these part-time jobs provide a valuable source of experience for economics students in all functions of management. What they learn at work they can apply in their future jobs at managerial positions. Such experiences also enable these future mangers to draw the best examples from practice to apply in their school works. Figure 1 provides the data on how the current economics students view their future abilities as managers. The data shows the management functions these future managers developed either during their part-time job or during the lectures they attended at university. All 173 students who declared having part-time jobs provided relevant information. According to the data future managers learnt about planning mostly at universities (89.02% of 173 students with part-time job) since only 17.92% gained knowledge and experiences about this management functions at their jobs. This is the highest disproportion among all management functions. The situation was similar

Figure 1.   Developed management functions
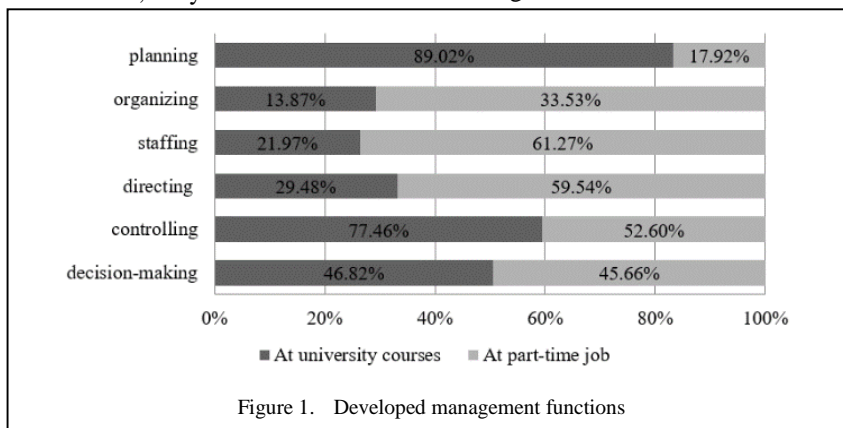
with controlling and decision-making, but not as drastic differences were observed. In a fact, the proportion of people who leant about decision-making at school and at part-time job was almost identical with the difference of only 1.16%. However, the other management functions such as organizing, staffing and directing had the opposite results. The data clearly shows that young people nowadays gain more knowledge and experiences with human resources management in practice than during their university lectures. These results were also used to verify the hypothesis H5, which was not confirmed since the knowledge about all management functions was not mainly gained at universities.

The foundation of this study (also hypothesis H2) was the fact that there is a link between student's attendance and their quality perception of university education. Pearson correlation test was conducted to examine this relationship and to verify hypothesis H2. The results of the test confirm this assumption since the existence of direct dependence between these variables was discovered (0.782). This finding was achieved when the Pearson correlation test was conducted on the combine sample file from data collected during both surveys. However, to further explore this relationship the tests were performed individually on the sample of mandatory courses and sample of elective courses. The results varied significantly (Table 4). The finding that higher quality perception affects the attendance of students is true for the elective courses (0.921). The attendance rates for elective courses of students who perceive these courses as high-quality ones were at the level 92.45 % in the first sample file. On the other hand, if students believed the elective courses to be of inferior quality their attendance rates dropped to 58.75 %. However, the relationship between perceived quality of course and its attendance can only be described as medium strong for the mandatory courses (0.505). The attendance rates for high-quality courses and low-quality courses were nearly identical with the difference of less than 5 %. Therefore, it is possible to conclude that direct attendance of provided lectures is a result of students' perception of quality of courses they can directly select. However, the way they perceive the quality of mandatory courses does not significantly influence their decision to attend them.

V. DISCUSSION AND CONCLUSION

The main aim of this research study was to explore how modern economics students perceive quality of university education and implications of such perceptions for future trends in management. The linkage between quality perception and attendance rates was examined. It was discovered that the levels of attendance have decreased in the last decade in comparison to levels discovered by similar studies several years ago [16-22] The reasons for not attending lectures and the motivation factors of future managers have also changed. Many research studies focused mainly on motivations related to perceived quality of education and availability of materials elsewhere. Friedman et al. [23] and Mearman et al. [13] discovered that putting lecture content up on-line negatively affected attendance rates. However, our results revealed that this is not a significant reason for not attending lectures since other reasons were stated as more significant by students.

Not entirely surprising finding was the increase of all the attendance rates during the COVID-19 pandemic. This situation decreased the amount of other activities that could potentially distract students from their education. Moreover, since many countries implemented lockdown the opportunities for part-time jobs also significantly decreased. Therefore, students were able to focus on their studies and the difference in attendance rates between mandatory and elective courses were blurred. The peer pressure not to attend lectures also decreased.

The most surprising discovery was the fact that perceived quality of lectures has no significant effect on students' attendance of mandatory courses in comparison to other more personal reasons. This finding can have considerable implications for further research into the quality of university education since the focus of the research into this topic was based significantly on the premise of its importance for students' engagement [4,24-26]. The possibility that psychological factors play a key role in affecting students' motivation and attendance was also examined by Rijaveca and Miljkovic [27]. These authors focused their research solely on personality traits and omitted factors such as the perception of lecturers' teaching qualities or students' belief that he or she can pass the exam without attending lectures that our study proved to be significant. Furthermore, several authors

[28,29] suggested that it is possible for universities to encourage students' attendance through some measures that appeal to quality of lectures such as attendance policies and monitoring, timetabling and style of teaching. However, our research findings deemed such implications for adjustments in universities' policies irrelevant since other, personal factors influence students' attendance in more significant ways. Therefore, universities should nowadays focus more on individual needs of students to support them in their education and to create means for students to better link their personal lives with their education, even at the price of creating more demanding processes of quality assurance for universities.

Moreover, the discovery of differences in the relationship between the level of attendance and achieved grades depending on the type of course based on its possible students' selection is a novel knowledge that has not yet been explored by other authors. Lukkarinena et al. [4] focused on the relationship between lecture attendance and student performance, however, they did not differentiate the nature of courses between mandatory and elective. Moreover, no other studies have focused on the issue of having a part-time job while studying. Our findings have discovered that the skipping classes in favor of job responsibilities have strong negative effects on both the levels of attendance and achieved grades by these students.

This study provides significant implications for both practice and researchers that could lead to the better understanding of antecedents of university education quality perception. Achieved results can serve as a premise for further exploration of the examined topic by researchers and enrichment of information concerning the topic of modern economics students' attitude towards university education which given its ever-changing conditions should be examined continuously since the present will affect the future, especially in the case of future quality management at universities. The trends and perspectives in management are currently being set by a highly quality demanding students who understand the main resource they have is time and think carefully on how to allocate this resource to their best benefit.

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Modelling the Application of ICTs in Domestic Enterprises

Mihalj Bakator[1], Dragica Radosav[2], Mila Kavalić[3], Nataša Đalić[4], Dragana Milosavljev[5]

[1,2,5]University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia
[3]University of Novi Sad, Faculty of Technical Science, Novi Sad, Serbia
[4]University of East Sarajevo Faculty of Transport and Traffic Engineering, Doboj,
Bosnia and Herzegovina

[1]mihalj.bakator@uns.ac.rs, [2]radosav@tfzr.uns.ac.rs, [3]milazakin@gmail.com,
[4]natasa.djalic@sf.ues.rs.ba, [5]dragana.milosavljev@tfzr.rs

Abstract—**Information communication technologies (ICTs) present a main construct and crucial part of the fourth industrial revolution - Industry 4.0. In order to achieve and maintain a competitive position on the market, enterprises have to adapt to the dynamic changes that characterize the modern business environment. Enterprises that conduct business in developing countries are facing challenges on the globalized market, as they don't have adequate competitive ability. The application of modern ICTs has additionally put pressure on enterprises in developing and developed countries as well. In this paper the implementation and application of ICTs in domestic enterprises is analyzed. The main goal of the paper is to develop a structured and theoretical model of ICT application in domestic enterprises. The model takes into account the specific economic and social aspects of the domestic economy, and the overall situation in domestic enterprises. The paper contributes to the existing body of literature and provides an adequate basis for future research in the domain of ICT application in developing countries. This can further include enterprises from developed countries, thus allowing meta-analyses in this domain.**

Keywords - ICT application, domestic enterprises, model, competitiveness, technological innovation

I.   INTRODUCTION

The fast development, implementation, and application of advanced information-communication technologies (ICTs) which characterize the fourth industrial revolution - Industry 4.0, has brought tremendous challenges to the majority of enterprises across industries. Additionally, the COVID-19 pandemic caused major issues to structural mechanisms of the global economy. Domestic enterprises lack competitive ability due to the low productivity, low quality, inadequate application of modern management tools and techniques, and old and obsolete manufacturing equipment [1]. In order to improve competitiveness, enterprises have to adapt and act in accordance with the changes that brought by advanced ICTs. These new technologies include Big Data Analytics, Internet of Things (IoT), Internet of Value (IoV), cyber-security, artificial intelligence, machine learning, and advanced networking. The noted technologies are also included within the framework of Industry 4.0 [2]. ICTs are now established as an adequate solution for potentially solving business performance issues. The application ICT-based business solutions, if properly implemented, can significantly improve multiple business processes, including and not limited to quality management, customer relationship management (CRM), accounting, inventory, distribution, market analysis etc. [3]. It is important for domestic enterprises to realize that without the implementation and application of ICT-based solutions within their business strategies, there is almost no chance to survive long-term in the international market. The application of ICTs can contribute in the form of tools and methods to existing business models, or they can provide necessary infrastructural support for operational and strategic business activities [4].

In this paper the application of ICTs in domestic enterprises is analyzed. The analysis includes several main ICT-based solutions that could be implemented and applied in a transitional setting. The main goal is to develop a theoretical model with several sub-models regarding the application of ICT solutions in domestic enterprises. The models are generic in nature and can be modified in accordance with the enterprises' business goals. The paper consists of three main sections (excluding the Introduction and Conclusion sections). The first section concisely notes ICT-based solutions. The second section presents the main model and the sub-models with detailed explanation of each model element. In the third section, suggestions and guidelines regarding ICT implementation and application in domestic enterprises are proposed. Finally, conclusions are drawn.

II. ICT TRENDS AND APPLICATION IN ENTERPRISES

The application of ICTs in small and medium-sized enterprises (SMEs) can be a key factor of successful business strategies and achieving and competitive position on almost any market segment. ICTs include a wide array of options when it comes to implementation and application in enterprises.

ICT-based solutions can be tailored to suit the enterprises needs and goals, regardless of industry, enterprise size, and business goals [5]. ICTs can significantly improve sustainability in business as it provides support across multiple aspects of the modern business environment. Further, ICT application in enterprises additionally increases the need for IT and ICT specialist in various domains. These changes in enterprises positively affect national competitiveness, which further opens doors for enterprise clustering, development of technological parks, and business incubators.

Collectively, enterprises can collaborate and they can mutually support each other in the process of increasing competitive ability on the international market [6]. ICTs can increase reachability to information, it can improve market expansion and customer satisfaction, and overall it can increase organization management efficiency [7].

ICT technologies characterize the fourth industrial revolution - Industry 4.0 and involves the digitization of value chains, digitization of customer management, and the digitization of business models [8]. This further indicates that ICT technological solutions are complementary to the framework of Industry 4.0. Implementing and applying ICT-based solutions includes several important elements such as financial capabilities, manager's and employees' competences, employees' creativity and socio-cultural competences, incentive systems, aligning business strategy with ICT, supporting business models through ICT, and effective and efficient management procedures [9]. Some of the main factors of successful ICT adoption include cultural barriers, expertise of employees and managers, organic development strategies, and broader strategic overview of implementation and application [10].

Some of the main technologies that could be considered, implemented and applied in domestic enterprises are in the domain of data analysis. More precisely, Internet of Things and Big Data Analytics can be viewed as two main integral cogs of how ICT adoption could look like. Social data, machine data, and transactional data can be obtained and through data analysis, significant information can be extracted. This information is then used by the enterprise to conducted specific and effective business strategies [11]. Internet of Things includes four key constructs such as detecting scenarios and trends, communication of data, data analysis, and action in accordance with the analyzed data [12]. Further, Big Data Analytics refer to the analysis of high volume data collected and stored from mainly sources on the Internet. Big Data Analytics make it possible to extract valuable information on any specific factor that the enterprise has interest in. Large datasets on their own are not useful for enterprises, therefore data analysis tools and methods are necessary in order to acquire information that is relevant for the enterprise. Big Data Analytics can be optimized, scaled, and are mostly flexible solutions and are eligible not only for big corporations, but for SMEs as well [13]. The obtained data through ICT-based solutions and overall the adoption of ICTs can involve various business processes including accounting, marketing, inventory, supply chains, logistics, decision-making, quality management, CRM systems etc. [14,15,16]. In sum, the application of ICTs in enterprises can include a wide segment of business functions and processes. It is up to the enterprise's management to determine what type of ICT-based solution is the most appropriate for achieving business goals.

III. ICT APPLICATION MODEL

Based on the analyzed literature a model for ICT application in domestic enterprises is developed. More precisely, a main theoretical model is presented with the key elements and further these elements are presented in more detail. The main model for ICT application is presented on Fig. 1.

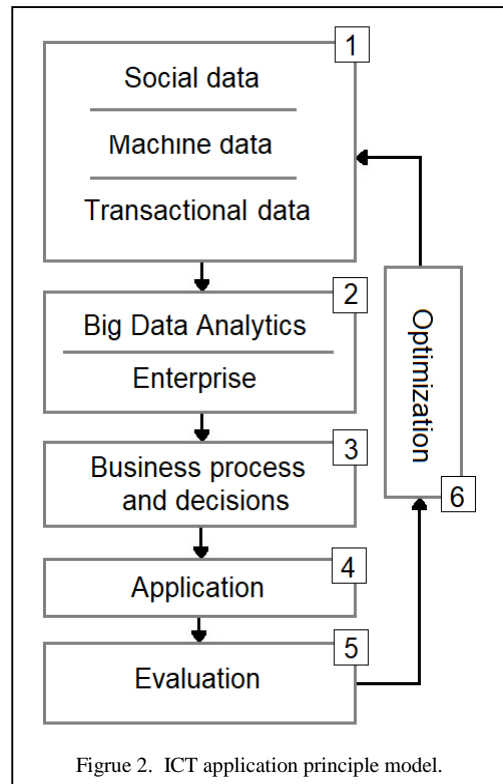Fig. 1. present the main model that includes four key layers. The first layer (1) is the enterprise infrastructure that includes equipment, storage facilities, vehicles, and even employees as integral parts of any enterprise. The second layer (2) is the ICT technology application that refers to the adoption of ICT-based solutions and applying it in accordance with the enterprises goals. The third layer, data layer (3) presents the core of the ICT-based solution as it is the main component of data flow and data distribution in the internal and external environment of the enterprise. The final, fourth layer (4) presents the final step of ICT application which is market assessment in a broader sense. At this layer the enterprise aims to answer to the customer needs through collected data and data analysis. The main component of data analysis is Big Data Analytics. On Fig. 2 a sub-model the provides additional detail on ICT application in enterprises is presented.

Through ICT application enterprises can collect data from the three main sources that characterize the digital market (1). These are social data, machine data, and transactional data. These high volume data sources are high in noise and complexity, therefore Big Data Analytics as an ICT-based solution should be applies. Big Data Analytics within an enterprise (2) analyzes the high volume data, and extracts valuable information. In the next step (3), based on the extracted data, business process, activities and decisions are defined. Afterwards, the defined processes, activities are decisions are applied in a specified manner (4). The conducted activities have to be evaluated (5), and based on the evaluation report, optimization is conducted (6). The optimization process involves the defined and applied strategies, activities and decisions. From here, the cycle returns to data collection. On Fig. 3., another sub-model is presented where additional details on ICT application are presented.
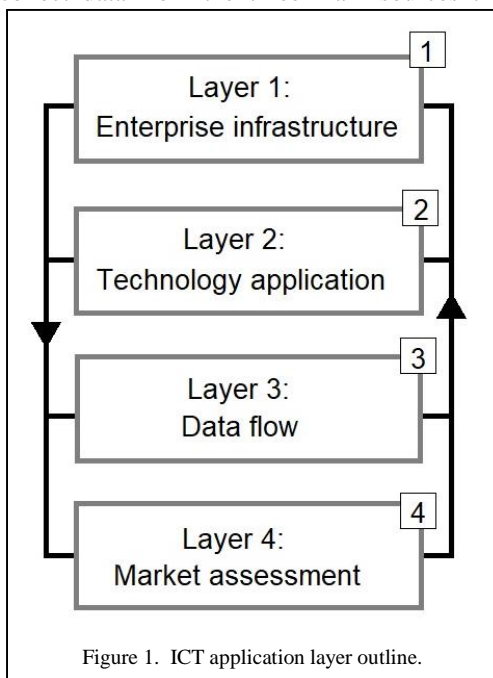
Fig. 3. presents how the enterprise (1) applies ICT-based solutions in various business processes and functions such as CRM, accounting, marketing, communication, production etc. (2). When the certain adoption of ICT has taken place, specific business activities are defined and conducted (3). These business activities are mainly aimed at the market

Figure 1. ICT application layer outline.

Figrue 2. ICT application principle model.

Figrue 3. ICT application in business processes in the enterprise.
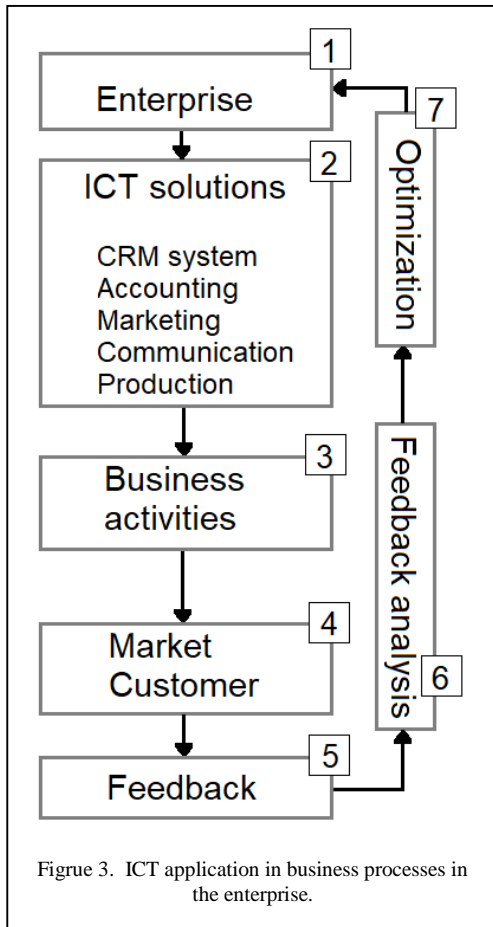
(customers) (4). Next, feedback data is collected (5). This data can include customer satisfaction, market trends, market fluctuations, new competitors, new technologies etc. When the data is collected it is analyzed (6) in order to determine if the conducted business activities are adequate and they in-sync with the enterprises goals. Based on the feedback analysis results, optimization of business activities is conducted (7).

Overall, the model and the sub-models are based on a cycle of activities, evaluation, and optimization. The main goal of such approach is the continual improvement of business processes and maximizing the effects of an adopted ICT-based solution.

IV. SUGGESTIONS FOR IMPROVING COMPETITIVENESS

Based on the analyzed literature and the developed theoretical model and sub-models, the following suggestions and guidelines for domestic enterprises are proposed:

- Enterprises have to identify what type of ICT-based solution could be implemented. In addition, the necessary infrastructure should be assessed.

- If there is no adequate infrastructure for any ICT implementation and application, steps should be taken towards providing the necessary resources for developing an adequate infrastructure.

- Enterprises have to assess their employees' skills and knowledge and determine if these are adequate for a new technology.

- From here, employee skills and knowledge should be improved, and effective intellectual capital management systems should be practiced.

- Internet of Things and Big Data Analytics solutions should be considered where market assessment is a key business factor.

- Enterprises should focus on organic implementation, rather than "on paper" solutions.

- ICT adoption should be in accordance with the enterprise's ability to effectively manage the newly introduced technology. This includes employee skills and knowledge, as well resources.

Overall, ICT-based solutions have to be taken into consideration by SMEs as well as by large enterprises across all industries. A specific ICT solution should be in accordance with the enterprise's goals and its capability of effectively adopting and applying a new ICT-based solution.

V. CONCLUSION

It is evident that the implementation and application of ICT-based solutions is an imperative for achieving and maintaining an adequate competitive position on the market. Domestic enterprises have to address the importance of advanced technologies and act in accordance with their business goals. The dynamic changes on the international market are constant and require action from enterprises across all industries. It can be concluded that the implementation and application of ICTs in domestic enterprises can improve various

business processes including CRM systems, quality management, inventory, marketing and other vital business functions. The proposed suggestions and guidelines can be analyzed by enterprises and they can start planning from there.

The advantage of this paper is the generic theoretical model, and its sub-models. These provide a concise overview on the key elements on how ICT application can materialize within an enterprise. The main limitation of the paper is the lack of empirical data analysis that are obtained from domestic enterprises. Therefore, for future research it is recommended to obtain data from domestic enterprises and compare the results in a meta-analysis study with enterprises from developed countries.

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The Impact of Organizational Culture on Knowledge Management

Bojana Jokanović[1]

[1] Department of Industrial Engineering and Engineering Management, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia

[1]bojanajokanovic@uns.ac.rs

Abstract— **In today's age of the knowledge economy, the main resource for achieving and maintaining a competitive advantage is knowledge. Today knowledge is considered as a valuable key in competition. Knowledge must be adequately managed, in order to ensure that the firm achieves sustainable competitive advantages. Organizational culture is considered a critical factor of knowledge management, because it affects how members of the organization learn, acquire and share knowledge with each other. Therefore, organisational culture has been identified as a major catalyst, or alternatively a major hindrance, to knowledge creation and sharing. This paper provides an overview of previous research in order to gain a better understanding about relationship between organizational culture and knowledge management.**

Keywords - knowledge management, organizational culture, knowledge – supporting culture

I. Introduction

Organizational culture can be described as the foundation on which every organization is built. Culture develops over a long period of time and consists of characteristics that are quite permanent and unchanging. It consists of values, norms, beliefs and traditions that represent guidelines for doing business. Although it is intangible, organizational culture has a significant role and affects all aspects of organizational life.

Organizational culture is a complex section of employee's beliefs, values, attitude, behavior and opinions, therefore one of the major barriers of establishing knowledge management in organizations [1]. The important point for organizations is promotion of knowledge-sharing culture or knowledge culture. Knowledge culture is one of the specific branches of organizational culture, which show an organizational life method which uses people in the process of creation and exchange of information [2].

Knowledge management consists of utilization and development of knowledge assets of an organization to achieve organizational objectives. Organizational culture supports knowledge management by influencing how members learn and share knowledge. Paradoxically, organizational culture has been identified as a major barrier to knowledge management, and yet very little is known about how organizational culture contributes to or hinders knowledge management [3]. Thus culture is an important as well as complicated issue in knowledge management.

II. Organizational Culture

Although studies on organizational culture began to emerge in the early 1970s, the concept of culture was widely accepted by management researchers only in the 1980s. The greatest contribution to the study of organizational culture was made by Schein, who also proposed a conceptual framework for the analysis of organizational culture. According to Schein's model (1985), organizational culture exists on three levels: artifacts (visible organizational structures and processes), which are on the surface itself; adopted values (strategy, goals, philosophy) and at the very core are the basic assumptions (unconscious assumptions, beliefs and feelings) [4].

Organizational culture is an integral part of the overall functioning of the organization. The roles that culture has within an organization can be divided into its functions and influences on various processes. Organizational culture is defined through literature in different ways.

Organizational culture is a basic pattern of shared assumptions, values, and beliefs that are considered the right way to think about problem solving and the opportunities the organization faces [5].

Reference [6] define culture as deep-rooted, often unconscious values and beliefs shared by members of an organization. Organizational culture is manifested through typical organizational characteristics. Reference [7] list two functions of organizational culture: internal integration and coordination. Internal integration can be described as the process of socializing new members in an organization, creating organizational boundaries, a sense of identity among employees, and a commitment to the organization. The function of coordination refers to the creation of competitiveness and adaptation to the external environment in terms of creating acceptable behavior for the stability of the social system. Organizations use a variety of resources and processes to manage behavior and change. Organizational culture fills the gaps between what is officially announced and what is actually happening. It is an indicator of the direction that leads the strategy to the right path [8].

According to Comeron and Quinn's (1999) theoretical framework about competitive values, four distinctive kinds of culture can be identified: [2]

- Group (tribal) culture

- Developmental culture (adhocracy)

- Hierarchical culture

- Market (logical) culture

Group (tribal) culture: In family culture the main value is put on the internal concentration as well as flexibility, team work, freedom, participation.

Developmental culture: The emphasis of this culture is on the external concentration, compatibility, flexibility and creativity, risk taking personality and also ability to predict.

Hierarchical culture: This culture is characteristic of organizations which have

hierarchical formal places with formal rules, principles and processes. The main value is put on internal concentration and constancy, efficiency and predictability.

Market culture: A market culture is a type of corporate culture that emphasizes competitiveness not only between the organization and its market competitors but also between employees.

III. KNOWLEDGE MANAGEMENT

Knowledge management activities are part of organizational life. These activities relate mainly to the discovery of new knowledge, the acquisition of existing knowledge, the exchange of knowledge with others and the application of knowledge. Knowledge is in the mind of individuals. Knowledge management practices should focus on discovering ways to stimulate employees to create new knowledge. Knowledge management methodologies and technologies must enable effective ways of acquiring, presenting, organizing, reusing and improving this knowledge.

The knowledge management cycle and the activities it encompasses provide the key to understanding knowledge management and the optimal methods for its implementation within the organization. To understand the concept of knowledge management, it is necessary to understand the knowledge management cycle. Knowledge management models provide the theoretical basis for knowledge management by describing the best way to manage knowledge in an organization. Leading thinkers in the field of knowledge management agree that although knowledge management processes differ in their importance depending on the type of organization, they are crucial for the success of any knowledge management system.

Knowledge management is the management of organizational knowledge through the processes of creating, maintaining, applying, sharing and renewing knowledge, in order to increase organizational performance and value creation. Knowledge management not only acts as a catalyst for innovation and creativity, but also provides the means by which innovative ideas can be won, shared while contributing to the creation of new ideas [9].

Effective knowledge management implies the identification, creation, acquisition, dissemination and adoption of knowledge, which

will give the organization a strategic advantage. One of the main steps in the knowledge management process aims to recognize and locate knowledge as well as the source of knowledge within the organization. Knowledge, which has value for the organization, is transferred through networks, practices, incentives and becomes part of the organizational memory.

Essentially, knowledge management implies the unity of three components: people, processes and technology. People are the bearers of knowledge management, processes determine the direction of management, and technology is necessary for efficient process management.

Knowledge management encompasses a set of processes, through which knowledge is acquired, developed, collected, shared, applied, and protected by an organization, in order to improve business performance [10-12].

IV. THE EFFECT OF ORGANIZATIONAL CULTURE ON KNOWLEDGE MANAGEMENT

Some knowledge management research addresses managerial and social issues, emphasizing the impact and importance of knowledge management strategies and organizational culture. Other studies focus exclusively on the activities and processes that make up the knowledge management lifecycle [4].

Table I lists the authors, who investigated the factors of knowledge management success, as well as the factors that they single out as key.

As can be seen from the previous table, organizational culture is recognized as the dominant factor that largely affects the effectiveness of knowledge.

TABLE I.   INFLUENTAL FACTORS OF KNOWLEDGE MANAGEMENT [13].

	CULTURE	LEADERSHIP	MEASUREMENT	STRUCTURE	REWARDS AND INCENTIVES	INFORMATION AND COMMUNICATION TECHNOLOGY
ALAVI & LEIDNER, 2001	✓			✓		✓
BOOZ•ALLEN & HAMILTON, 2001	✓	✓			✓	✓
BOTHA & FOUCHÉ, 2002	✓	✓	✓	✓		✓
GOLD ET AL, 2001	✓			✓		✓
MERTINS & AL, 2003	✓	✓	✓		✓	✓
HOLSAPPLE & SINGH, 2001		✓	✓		✓	
GUPTA & GOVINDARAJAN, 2000	✓	✓		✓	✓	✓
SKYRME, 2007 LAI & CHU, 2001	✓	✓	✓		✓	✓

Research in the field of knowledge management is mainly focused on cultural values that hinder or encourage the creation and sharing of knowledge. As reference [14] point out, there are several cultural values that facilitate, encourage, or hinder the creation, transmission, and use of knowledge. They believe that trust and cooperation encourage the sharing of knowledge with others, while value systems that favor and emphasize personal power and competition lead to stagnation of the organization and to the accumulation of knowledge. Similarly, [15] show that organizational, shared values have a significant impact on the willingness of knowledge owners to share knowledge with other members of the organization. Other studies, although focused only on the process of knowledge creation, come to similar conclusions. Reference [16] find a positive relationship between organizational culture, defined as a set of values that includes cooperation, trust and learning, and improving the knowledge creation process. Similarly, [17] view culture as a mechanism of social control that, depending on whether it promotes critical awareness and open behavior or is oriented toward a system that sanctions an individual who works outside the rules, stimulates or hinders knowledge creation and sharing in organization.

Two researchers believe that organizational culture (organizational subcultures) could affect knowledge management in four different ways [14].

- Supposed culture which indicate the most important kind of knowledge.

- Culture in interpersonal and organizational relations act as a mediator variable.

- Culture set the scene, for social interaction (reciprocal relationship between members of an organization.

- Culture formulates needed processes for modern knowledge production and selection.

V. CONCLUSION

It can be concluded that an important element of knowledge management success is certainly the creation of a knowledge - supporting culture that motivates, supports and encourages the acquisition, creation, sharing, codification and reuse of knowledge at the individual, group and organizational level. The culture of the organization provides order and structure for knowledge management activities. Before establishing an appropriate knowledge management system, organizations should consider their cultural environment. Organizations that want to gain the knowledge of their employees must establish a culture of knowledge sharing, collaboration, coordination, and teamwork. The concept of knowledge management cannot be implemented without an appropriate knowledge-friendly culture.

It is also important that managers support the predefined vision in order to promote organizational missions as one of the most notable characteristics of organizational culture and become successful in implementation of knowledge management. The managers should promote group-work to achieve common objectives and develop employees' skills and competencies.

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COVID-19: Accelerating the Transition to the Knowledge and Open Innovation Society

Slađana Čabrilo[1]

[1]I-Shou University, Kaohsiung City, Taiwan (R.O.C.)

sladjana@isu.edu.tw

Abstract—**This paper aims to shed more light on the role of knowledge management (KM) and open innovation (OI) in managing the Covid-19 pandemic based on the analysis of previous literature linking knowledge and innovation with crisis and pandemic management. The main findings reveal that knowledge from different domains (health, economy, social), appropriate KM activities, and openness at organizational and societal levels, play a strategic role in mitigating damage caused by the Covid-19 pandemic. As a global challenge, the Covid-19 requires collective, coordinated, and collaborative efforts from a variety of actors and becomes a driver of knowledge and open innovation society. This study informs scientific community and decision-makers how KM and OI theories may be used in crisis management to address emerging challenges they face in practice with a systematic and integrated approach.**

Keywords – knowledge management, open innovation, Covid-19, crisis, pandemic

I. Introduction

The Covid-19 pandemic has been like a knowledge storm, changing the way we view the world, do business, communicate, collaborate, and live our lives [1]. Within a short period of time, the pandemic has hit the whole world with unpredictable consequences. Governments, organizations, agencies, companies, health organizations, medical experts, scientists, and all people around the world have been trying to restore stability.

This pandemic is a grand challenge [2], being not only health catastrophe, but also an economic, social, and human crisis that can lead to global unemployment, exclusion, poverty, and collective depression [3]. According to [4] Covid-19 includes all the three main aspects of a grand challenge, complexity (nonlinear dynamics), uncertainty (difficult forecasting), and evaluativity (beyond jurisdictional boundaries). It brings large-scale and difficult to solve problems and initiates a paradigm shift on the level of the society and its organizations and individuals.

In crisis, such as the Covid-19 pandemic, when rapid responses, prompt actions, and innovations are required, it is essential to conduct effective knowledge-management (KM) activities to facilitate effective decision-making [5; 6]. In addition, effective collaboration, communication, and open innovation (OI) between government, research, and education institutions, and the marketplace have been crucial to the global success in finding solutions for the problems during the pandemic [2,7]. Open innovation, as introduced by Chesbrough [8], is an innovation practice that strives to speed up innovation processes [9] and make innovations more effective through exchanging ideas fostered by collaborative and open network environments [10]. It is characterized by sharing of knowledge, critical resources, and capabilities, within and across the boundaries of organizations and countries in order to pursuit bold ideas and adopt less conventional approaches [11].

Covid-19 pandemic like some earlier crisis has raised many knowledge-related questions such as: What do we know? What don't we know? [1,6]. The pandemic has painfully exposed how "we don't even know what we

don't know" and revealed an absence of critical knowledge and effective knowledge management processes [1] to keep the crisis under the control. Like a double-edged sword, the pandemic has created a mass disruption destroying entire economies and lives around the world, but at the same time it has brought rethinking, learning as well as work-life balance opportunities [12]. The pandemic thereby poses a unique challenge to knowledge and innovation research and practice. In this paper the main questions are as follows:

- What is the role of KM in managing the Covid-19 pandemic?

- How does knowledge fundamental to address problems caused by Covid-19 evolve in the pandemics?

- Is Covid-19 a driver of transformation into knowledge and OI society?

Although KM has one of the critical roles in pandemics, the literature of this specific topic is still thin and fragmented [6] with a larger number of articles published by the world organizations such as the World Health Organization and the World Bank, and health journals, then published by management and specialized KM journals [6]. To fill the gap and highlight the pandemic from the knowledge and innovation perspective, this paper provides analysis of the main findings from the previous recent literature.

The remainder of the paper is structured as follows. This introduction is followed by the analysis of the role and specific characteristics of KM in Covid-19 pandemic. While section three explains knowledge and learning trajectory in Covid-19 crisis, section 4 discusses how open innovation approach helps in addressing challenges caused by Covid-19. Section five presents the main findings and concludes the paper.

II. KNOWLEDGE MANAGEMENT IN COVID-19 PANDEMIC

Although knowledge has been proved to dominate in business, economy, and life [13,14], it is a static resource that does not operate independently of the management context [15,16]. Proper management mechanisms multiply the leverage of resources, while poor management can undermine the value creation potential of even the best resources [17]. KM is a dynamic interpretation of intangibles [18] and can be defined as a set of systematic managerial activities and processes focused on effectiveness and efficiency of organizational knowledge resources [19]. KM should put knowledge-based resources into action and facilitate creation, sharing and transfer, storage and protection and application of the company's knowledge base [15], facilitate knowledge productivity and enhance firm's competitiveness [19].

Pandemic is a type of natural disaster different from the others in its specific characteristics [20]. First, unlike other natural disasters, pandemic is not a single, discrete, and time-bounded event. It is instead a continuous process, that operates over a time horizon which lasts until there is extinction of the pathogen or introduction of a vaccine [6]. Second, KM in pandemics has a higher strategic objective than in other disasters. While other disasters are mostly limited in spread and damage, pandemics can spread globally, and their economic loss distribute over time and across countries [6]. Particularly powerful about Covid-19 has been the speed with which it has spread out on a global scale. The disease has crossed geographic boundaries becoming a global phenomenon and re-affecting previously affected population/ areas/countries/regions.

Therefore, managing a pandemic is a complex and long-time process. Decisions made and actions taken in managing pandemic can significantly change the course and the effects of a pandemic [6]. Thus, decision makers actively shape and mitigate destructing effects of pandemics through right and timely decisions. Decisions are critical to manage the spread of the pandemic, and the effectiveness of these decisions depends upon the capacity to create, share, collect, transfer, and use/re-use knowledge, that is by an effective and efficient KM process in pandemics [21].

KM during Covid-19 crisis needs to cross different knowledge domains (health, economy, social), political and governmental boundaries, making the balance among contrasting objectives in different domains. Appropriate KM activities facilitate efforts of governments, managers, and other decision-makers to use effectively key resources and develop strategies to ensure survival and recover [22] by mitigating damage caused by the crisis [5]. As the threats are constantly mounting, the first KM task is to identify the crucial knowledge that is required to carry out the epidemic prevention plan successfully [5]. The more knowledge we can

create and capture about the characteristics of this emerging disease and the way it spreads, the better we can put the crisis under the control and mitigate its impact. In the first step, it is critical to establish and deploy a KM platform for collecting and managing the most up-to-date knowledge [5]. The second task is to promote KM activities within societies by designing organizational structures and enabling members (organizations and individuals) to collaborate to generate new ideas or knowledge that can assist organizations and governments in coping with the crisis [5]. Information technology (IT) can serve as a facilitator of the KM performance [23] especially after the lockdowns caused by the pandemic outbreak when the content and activities have been entirely delivered online [5,24]. Therefore, the third task is to make extensive utilization of IT to support collaboration and KM processes and decrease the risk of exposure to the virus [5] keeping high level of information security and improving the reliability of data transmission and knowledge exchange. The final task is to develop the application of knowledge repositories to extract and generate useful information and knowledge, to transform and accumulate it into organizational assets, store in knowledge repositories, which helps to make refined use of available resources and assist organizations to make more informed decisions [25] in response to crises.

A recent literature review on KM in pandemics [6] has confirmed that the previous studies related to KM in pandemics present fragmented body of research, but identified several key pandemics-related issues and topics dealing with knowledge:

- *Modelling and Simulation* – these studies emphasize the crucial role models and simulations to facilitate and support decision-maker interactions and coordination around crisis-response scenarios [26]. Multi-agency coordination that is based on a shared on a common and shared understanding of the problem by all the inter-related parties during the outbreak to support the complex knowledge transfer process during different phases of Covid-19 is crucial for success [20].

- *Community Resilience and Continuity* - During Covid-19 crises health systems have a dual mandate to manage

exceptional situations without interrupting essential services to the population [27], which is at the heart of resilience strategies [6]. Continuity deals with the interruption of economies to comply with lockdowns. From a medical perspective, a lockdown is the control of epidemic spread, while the economic effect is a loss of production and employment, with immediate socio-economic effects on the most exposed businesses (retail, restaurants, and hotels), and long-term effects on the national economic system. Business continuity addresses both, business continuity (identification of basic economic services that should be unlocked during lockdown) and business reopening (strategy to restart after lockdown).

- *Systems' Preparedness* - preparedness has been studied regarding population [28], health systems [29], businesses [30], institutions, politics, and public institutions [31]. Once a pandemic strikes, there is little time for thoughtful and rapid analysis, reflection, and strategy formulation [32]. Therefore, preparedness of all societal stakeholders, in sense of possessing the crucial knowledge, is an unavoidable priority. Preparedness is basically addressed as the process of capturing, storing, elaborating and transfer of knowledge about pandemic, health systems, hospitals, public institutions, people and public [6]. In [31] authors argue that pandemics management needs the strategic combination of pandemic's specific knowledge with disasters' general knowledge as well as that planning process for pandemics should be done by a single entity that coordinates both types of activities. Business preparedness tackles building and testing the capacity of businesses to resist to pandemics breakthrough [6].

- *Mitigation Strategies & Compliance with Containment Measures* - Willingness of social groups to comply with public health pandemic control measures depends basically on the quality of knowledge received by a recipient, and on the severity of the pandemic [6]. Public's knowledge of

Covid-19 is an antecedent of public's willingness to comply with containment measures [33]. Therefore, knowledge transfer to public to promptly educate population [34], media as knowledge transfer means [35], and health authorities' public relations effort [36] have crucial roles in the management of pandemic.

- *Knowledge Management* - These studies more strictly relate pandemics and knowledge management body of literature, highlighting the benefits from well-integrated knowledge-based emergency management information systems [37], and explaining how to innovate approaches to design knowledge in pandemics [38] and improve knowledge dissemination models during a pandemic outbreak [39].

III. THE TRAJECTORY OF KNOWLEDGE AND LEARNING IN THE COVID-19 CRISIS

In [1], learning theory and "conscious competence" matrix [40] helped to explain the progress of knowledge, critical to the Covid-19, from unconscious to conscious, and to identify four evolving stages of a learning trajectory. The knowledge transition begins with fear and uncertainty in the domain of unconscious and ends with knowledge-enabled actions in the domain of conscious.

A few months after the strike of Covid-19 crisis, the world was shocked, and had no conscious, coordinated, and systematic reactions. This is the beginning of knowledge and learning trajectory and the fear zone, characterized by uncertainty, mainly because of inability to predict the consequences of control measures, and ambiguity referring to a lack of clarity and consistency of information [41]. Fear zone has been full of 'misinformation, scaremongering and conspiracy theories' [1] which additionally increased fear and ambiguity in public. After the first unconscious reactions, the world has intensified learning, first by mapping the crucial knowledge about the pandemic and then collecting, storing, sharing, and using the identified knowledge. This stage has been referred to as learning zone, characterized by awareness about the role and value of knowledge to address the problems in the crisis. Although knowledge creation (learning) in the early part of this stage has been mostly in an uncoordinated

manner [42], questions such as "what we know we don't know" were essential to guide learning process and to measure progress in learning. Pieces of knowledge collected worldwide by answering important questions, if integrated properly, help to shape reality relevant to the crisis. The next stage is knowledge-enabled zone in which knowledge becomes actionable. Although actions may initially lack competence, a progressive learning rapidly contributes to the development of further expertise [6]. New created knowledge when integrated with existing knowledge empowers purposeful actions. Finally, the last stage is embedded knowledge zone which represents deeply embedded expertise. Experimental knowledge in this stage works as a potential reservoir that, if successfully documented and recovered, may be exploited and re-harnessed for purposeful action in another similar crisis. Full mastery enables the decision-making and execution of actions in an innate manner [6].

IV. OPEN INNOVATION IN RESPONSE TO THE COVID-19 CHALLENGES

Crises and large-scale disasters usually work as great stimulants of innovation and collaboration that should tackle large scale complex challenges and help people, organizations, and societies to develop new solutions in order to mitigate and overcome crisis [43]. In this respect, the Covid-19 pandemic, as a grand and global challenge, requires collective and collaborative efforts that go beyond individuals, organizations, and countries to enable necessary scientific and technological advancements and enhance our collective ability to protect human life [2,7].

Traditional closed innovation approaches have become ineffective in addressing the emerging global challenges and OI has slowly become a dominant paradigm in innovation management [44]. Innovation has moved from being something invented by a brilliant researcher or a team, through the era of open innovation, and now to an ecosystem-centric view of innovation, where the ecosystem is often the distinguishing unit of success, not an individual company or university [45]. Concept of 21st century research is characterized by visioning, inventing, validating, and venturing, and driven by teams of boundary spanners that possess multidisciplinary skills.

The concept of OI was introduced by Chesbrough [8] who suggested that valuable

ideas can come from inside or outside the company and can go to market from inside or outside the company. Thus, companies should use all available knowledge sources in innovation processes by adding external ideas and knowledge to internal research and development to foster innovation. OI highlights integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption [46]. Therefore, most definitions of OI have been focused on extensive networking between all involved stakeholders and co-creative collaborative procedure, as well as availability of and access to open platforms for interaction [10,23,47,48]. In sum, shift from a 'closed innovation' to 'open innovation' implies broadening definitions, and a move toward collaborative and integrative innovation [7].

There is a growing literature showing that OI might play a role in influencing societal issues, especially in crises, emergencies, or natural disasters [49]. This is because crisis bring grand challenges which require urgent actions, less conventional thinking and solutions that go beyond a single individual, organization, or government [2]. During emergency periods, innovative solutions need to be accessed quickly, forcing governments to deregulate and open their traditional boundaries, so that they may collaborate more intensively with external actors [7]. To achieve such an open innovation approach and leverage distributed external and internal knowledge potential, a growing number of governments have tried to promote OI as part of their innovation strategies and policies [7]. Findings in [7] also showed that countries either kept or switched toward an OI strategy during Covid-19 benefited from a higher number of innovations.

Innovation thrives during crisis to [43]. The sudden Covid-19 outbreak resulted in the creation of large scale formal and informal innovation networks to tackle a lack of critical knowledge, tools, and equipment important for solving extensive and complex problems during the pandemic. Recent developments in distributed manufacturing, remote collaboration, and the growing open innovation concepts, for better response to this pandemic, allowed the creation of innovations at scales, paces, and impacts never seen before.

V. MOST IMPORTANT FINDINGS AND CONCLUSIONS

Covid-19 is a global catastrophe, which is still raging around the world [5]. The global impact of the Covid-19 pandemic is yet to be evaluated in the future. To ensure the survival, individuals, organizations, governments, and world institutions must effectively take advantage of their knowledge to deal with the crisis. Knowledge is a crucial to drive decision-makers in the management of the Covid-19 pandemic, to mitigate health and socio-economic effects [6]. Decisions taken in such a complex process significantly decrease uncertainty for governments, businesses, and people around the world and change the effects of the pandemic.

Considering 'knowledge management of pandemics' as a research stream, it is important to indicate that while knowledge is not central issue in the literature about pandemics, it is recognized as one of strategic success factors for the management of pandemics [6]. Other critical success factors for the management of health disasters include combining the best of traditional and modern approaches, investing in preparedness and recovery, encouraging community engagement and compliance with containment measures, cultivating collaboration to speed up innovation, and ensuring sufficient human and financial resources [50].

From the knowledge and learning perspective, the analysis confirms that we already know about the evolution of knowledge through learning. Intensive learning about the Covid-19 around the world is enabling global transition from fear and uncertainty to purposeful and knowledge-based action on multiple fronts such as testing and diagnostics, the adoption of social measures aimed at controlling further spread of the virus, and development of vaccine. However, learning is a non-linear and context-dependent process that exhibits both progress and setback [1].

Being a global challenge, the Covid-19 pandemic requires collective, coordinated, and collaborative efforts from a variety of actors and thus become great stimulants of open innovation that result in developing new solutions to fight back [43]. This study reveals that knowledge flows and open innovation play a strategic role in addressing challenges during the Covid-19 crisis, which require both urgent action and long-term thinking [2]. The most important findings also indicate the need for a broader perspective on

open innovation, suggesting that openness should go beyond organizational boundaries, and to include openness at societal level.

Implications of this research are primarily for the scientific community, which has been motivated to start testing the KM and OI theories in pandemics and provide specific improvements, and decision-makers and emergency authorities that could have more knowledge to shape reality and see problems they face in practice with a systemic and integrated view.

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The Legal Framework of the Personal Data Protection in Turkey

Mustafa Yasan[1]

[1]Sakarya University Faculty of Law, Sakarya, Turkiye

[1]avmyasan@yahoo.com

Abstract—**The protection of personal data was one of the institutions that the legal system in Turkey dealt with before Law No. 6698. However, for the first time, personal data was tried to be protected under the Law on the Protection of Personal Data No. 6698 specifically and in accordance with the European Union standards. This codification has undoubtedly filled a critical theoretical gap. However, from 2016, when the Law came into force, to the present, it has led to significant handicaps in the implementation of the legal regime envisaged by the Law. It was necessary to complete this legislative framework carried out to complete the codification phase of the EU harmonization process, with the independence and, of course, the impartiality of institutions and organizations authorized for the protection of personal data. From this point of view, it is necessary to admit that there are serious question marks about the success of the Turkish implementation of nearly five years.**

Keywords - personal data protection, processing of personal data, data controller, Personal Data Protection Authority

I. INTRODUCTION

Transparency, auditability and accountability can be listed as targets that are desired to be valid in social life in the 21st century. The most important way for this is to access information. Technological developments occurring today have facilitated access to information. However, this development has created a handicap for real persons, especially personal data owners. There was a particular need in the legal system for mechanisms that would eliminate this handicap. As a matter of fact, this need was in terms of specific regulations related to the personal data protection [1]. Personal data covers all kinds of information belonging to real persons. No distinction is made between whether this information is professional or private, and it is tried to be specially protected by the Law on the Protection of Personal Data No. 6698 [2]. The Law is a result of Turkey's EU candidacy process in the field of legislation. The Law is just one of the more than 100 codification efforts that Turkey, which gained the status of candidate country at the Helsinki Summit in 1999, undertook to harmonize its legal system with the EU legislation. From this point of view, the Law, which fills a crucial theoretical gap, essentially contains principles similar to EU countries [3]. However, the fact that the Grand National Assembly of Turkey, which has a political aspect, and the President, who is a member of a political party, are compelling and distinctive to form the institutions and organizations which are authorized and also assigned to implement the legal regime envisaged by the Law, cause severe questions about the impartiality and independence of these institutions and organizations. Although its reflections on social life have been beginning to be felt, there are severe signs that the 5-year Law implementation has not been successful in terms of transparency and auditability criteria. In this study, the protection of personal data within the framework of Law No. 6698 will be examined within the framework of Turkish law, and in the shadow of the question marks we have pointed out.

II. A CRITICAL TURNING POINT FOR THE PROTECTION OF PERSONAL DATA: LAW NO. 6698

A. Period of Pre-Law No. 6698

One of the contributions of Turkey's EU candidate country status to the legal system is that the protection of personal data is subject to a

particular legal regime. Personal data protection was explicitly regulated by the "Law on the Protection of Personal Data" numbered 6698, published in the Official Gazette No. 29677 on April 7, 2016. The Law was amended twice in 2017. These amendments were made first with Law No. 7061 and then with Decree-Law No. 703. After the Law came into force, the Personal Data Protection Board and the Personal Data Protection Authority, in which the Board operates, were established.

However, it is not correct to claim that the protection of personal data in Turkish law did not exist before the legal regulation in question [4]. The use of elements such as name, picture and sound, which are among the personality elements, by others without the owner's permission was the subject of the legal mechanisms that ensured the protection of the personality. The use of promotional tools used in business life, such as trade name and business name, by others in violation of the rule of good faith, could be the subject of lawsuits that ensure the protection of trade name and business name, as well as unfair competition lawsuits. In addition, the safety of banking secrecy constituted one of the requirements of the legal relationship between the bank and its customers, account holders in terms of banking law. To summarize briefly, the protection of personal data was legally possible thanks to the mechanisms of the Turkish legal system even before Law No. 6698. However, this protection could only be realized with the legislation consisting of scattered provisions in an unsystematic way, and this was, of course, a substantial handicap. In addition, the diversity of institutions authorized to implement the provisions of the legislation in terms of the protection of personal data made it impossible to ensure coordination between these institutions. This lack of coordination also led to conflicts between the practices on the protection of personal data. Although it is a reflection of the European Union candidacy process, Law No. 6698, on the one hand, put an end to the disorganization in the legal regime regarding the protection of personal data and harmonized this legal regime with the legislation of the European Union, on the other hand, it ensured that the policies for the protection of personal data are managed from an only single source.

B. Ratio-Legis and Scope of Law No. 6698

The purpose and application field of Law No. 6698, in other words, its scope was specially regulated. Accordingly, protecting the fundamental rights and freedoms of individuals, such as the privacy of private life while processing personal data, and regulating the obligations and procedures and principles to be followed by real and legal persons who process personal data has been determined as the ratio legis, which the legislator bases on in the enactment of Law No. 6698 (LPPD Article 1). Therefore, the scope of LPPD includes both real persons whose personal data are processed and real and legal persons who process this data fully or partially automatically or non-automatically (LPPD Article 2). The fact that legal persons are accepted within the scope of Law No. 6698, and real persons who process personal data entirely or partially both automatically and non-automatically is a result of trying to keep the framework regarding the protection of personal data as broad as possible [5].

III. PROTECTION OF PERSONAL DATA ACCORDING TO LAW NO. 6698

A. The Concept of Personal Data

What is personal data? The sharpest answer to this question is given by Article 3 of Law No. 6698. Accordingly, any information belonging to an identified or identifiable real person is considered as personal data. Therefore, only the personal data of real persons can be gained validity. The information and data of legal persons are not deemed personal data worth protecting in terms of Law No. 6698. In addition, data belonging to real persons, not only those whose identities are determined but also those whose identities can be determined, meet the definition of personal data [6]. Therefore, the essence does not need to be specific, and it is sufficient for the identity to be identifiable. In addition, the legislator underlined all kinds of information belonging to the real persons in question and stated that all information belonging to real persons would be considered personal data in terms of Law No. 6698 without any discrimination.

B. Processing of Personal Data

1) Processing of Data

The processing of personal data is an essential subject of Law No. 6698. The processing of personal data, the protection of the

processed data, the legal and penal consequences of illegal data processing are the issues included in Law No. 6698. So what is meant by the processing of personal data? Any operation such as obtaining, recording, storing, preserving, changing, rearranging, disclosing, transferring, taking over, making available, classifying, preventing the use of personal data performed by fully or partially automatic or non-automatic means can be defined as the processing of personal data. This definition is quite broad. The legislator has accepted as the processing of personal data any operation performed on the data for the purpose of protecting personal data and which causes the personal data to be obtained in whole or in part by automatic or non-automatic means.

2) Conditions of Processing Personal Data

a) Principles

The conditions applicable to the processing of personal data are first regulated under the heading of general principles and then the condition of consent (LPPD Article 4 et al.). Accordingly, in the processing of personal data, compliance with Law No. 6698 and the necessary and procedural conditions in other sources of legislation should be ensured. In addition, other principles applicable to the processing of personal data can be listed as follows:

- Compliance with the law and the rule of honesty,

- Ensuring the data to be accurate and up-to-date,

- The necessity of processing data only for specific, explicit and legitimate purposes,

- Processing the data in accordance with the purpose,

- Considering the principles of limitation and proportionality while processing the data [7],

- Letting the data be kept for as long as necessary for the purpose envisaged or taken as a basis in the legislation.

b) Consent of the Relevant Person (with Rules and Exceptions)

While processing personal data, it is obligatory to complete the condition of consent of the relevant person after the preconditions

stipulated in the nature of principle are met [8]. As a rule, the explicit consent of the relevant person is required to process personal data. What is meant by the relevant person is the real person whose personal data is processed [9]. So, is there any exceptional possibility that the personal data can be processed without the explicit consent of a relevant real person? The answer to this question is yes. However, one of the exceptional conditions must be fulfilled for this to happen. These exceptional conditions:

- To be stipulated in the laws,

- To be required for the protection of the life or physical integrity of the person or another person, who is unable to express his consent due to actual impossibility or whose consent is not legally recognized,

- To be necessary to process the personal data of the parties of the contract, provided that it is directly related to the establishment or performance of a contract,

- To be necessary for the data controller to fulfil its legal obligation,

- That the relevant person himself makes data.

- To be necessary for the establishment, exercise or protection of a right.

- To be necessary for the legitimate interests of the data controller, provided that it does not harm the fundamental rights and freedoms of the data subject (LPPD Article 5).

c) Special Conditions Required for the Processing of Special Quality Personal Data

The processing of special categories of personal data is subject to a different and specific legal regime. Special categories of personal data include data related to race, ethnic origin, political opinion, philosophical belief, religion, sect or other beliefs, disguise and clothing, membership to associations, foundations or trade unions, health, sexual life, criminal convictions and security measures, biometric and genetic data. Special categories of personal data cannot be processed without the explicit consent of the relevant person. In cases where the explicit consent of the relevant person is not required, it can only be valid if it is indicated in the laws. Accordingly, in the case a special category of

personal data is related to health and sexual life, it can only be processed to protect public health, preventive medicine, medical diagnosis, treatment and care services, planning and management of health services and financing, without seeking the explicit consent of the relevant person. Only in this condition, this type of data can be processed by persons or authorized institutions and organizations that are under the obligation to keep secrets (LPPD Article 6).

3) Deletion, Obliteration or Anonymisation of Personal Data

Even though personal data are processed in accordance with the legislation, it is deleted, obliterated or anonymized when the reasons for processing disappear. There is no need for the relevant persons to make an explicit request for this. Deletion, obliteration or anonymization is carried out ex officio. However, there is no obstacle for the relevant persons to make a request of their own free will.

4) Transfer of Personal Data

a) Domestic Transfer of Personal Data

As a rule, the permission of the relevant person is sought to transfer personal data, just as in the processing of personal data. Permission must be given explicitly by the person concerned [10]. However, there are exceptional cases where it is possible to transfer personal data without the explicit consent of the relevant person. Accordingly, in cases where the permission of the person concerned is not sought in the processing of personal data, personal data may be transferred without the relevant person's permission (PDDL Article 8).

b) Transfer of Personal Data Abroad

As a rule, the explicit permission of the relevant person is also required for the transfer of personal data abroad. In addition, personal data can be transferred abroad without the consent of the relevant person, under the same conditions as the transfer of personal data in the country without the consent of the relevant person. However, an additional condition is required in order to transfer personal data abroad without the permission of the relevant person. This condition is adequate protection in the foreign country to which the personal data will be transferred [11]. What is meant by sufficient protection is the level of competence in protecting personal data. The Personal Data Protection Board (Board) will determine and announce which countries have

adequate protection mechanisms. To suppose sufficient protection is not available in the foreign country to which the personal data will be transferred, in order for the personal data to be transferred abroad. In that case, the data controllers in Turkey and the foreign country must undertake in writing the protection adequacy and additionally, the Board must give permission in this regard (LPPD Article 9).

IV. PROTECTION OF PERSONAL DATA ACCORDING TO LAW NO. 6698

The rights and obligations of the data controller and the relevant person are regulated explicitly in Law No. 6698. The data controller is the real or legal person who determines the purposes and means of processing personal data and is responsible for establishing and managing the data recording system. On the other hand, the relevant person refers to the real person whose personal data is processed.

A. Obligations of the Data Controller

The primary obligation of the data controller is the obligation to disclose [12]. Accordingly, the data controller or the authorized employee is obliged to inform the relevant individuals about the identity of the data controller and its representative, if any, for what purpose the personal data will be processed, to whom and for what purpose the processed personal data can be transferred, the method and legal basis for collecting personal data and other rights of the relevant person's outlined in Article 11 of LPPD during the acquisition of personal data (LPPD Article 12).

The data controller has obligations regarding also data security. Accordingly, the data controller is obliged to take all necessary technical and administrative measures to ensure the appropriate level of protection to prevent the unlawful processing of personal data, prevent unlawful access to personal data, and provide the preservation of personal data. The data controller is obliged to carry out or have the necessary inspections carried out in his own institution or organization in order to ensure the implementation of the provisions of Law No. 6698. Data controllers and data processors cannot disclose the personal data they learn to others in violation of the provisions of Law No. 6698 and cannot use them for purposes other than processing.

B. Rights of the Relevant Person

As The rights of the relevant person are also determined in a long list in Article 11 of Law No. 6698. Accordingly, every relevant person can apply to the data controller:

- To learn whether personal data has been processed,
- To request information if personal data has been processed,
- To learn the purpose of processing personal data and whether they have been used in accordance with its purpose,
- To learn about the third parties to whom personal data has been transferred in the country or abroad,
- To request for correction in case the personal data is processed incorrect,
- To request for notification to third parties to whom personal data has been transferred (LPPD Article 11).

After the relevant person submits their requests to the data controller in written form or in another way prescribed by the Board, the data controller is obliged to conclude these requests as soon as possible and within thirty days at the latest, free of charge unless otherwise specified by the Board. The data controller may accept the request or reject it by explaining its reason and notify the relevant person in writing or electronic form. In case the demand in the application is confirmed, the data controller fulfils its requirements (LPPD Article 13).

When the data controller rejects the application, in case the answer given is insufficient or the application is not answered in due time, the relevant person holds the application, the relevant person may file a complaint with the Board within thirty days from the date of learning the reply of the data controller and in any case within sixty days from the date of application. It is not possible to make a complaint directly to the Board. Applying to the data controller first is a prerequisite for exercising the right to complain (LPPD Article 14).

V. PUBLIC AUTHORITY APPOINTED AND RESPONSIBLE FOR THE IMPLEMENTATION OF LAW NO. 6698

The Personal Data Protection Authority (Authority) was established in order to ensure the implementation of Law No. 6698 and fulfil the duties assigned by the Law. The Authority has administrative and financial autonomy and, therefore, a public legal personality. There are two bodies in the Authority, which is headquartered in Ankara. These are the Presidency and the Personal Data Protection Board (LPPD Article 19).

The Board is the decision and administrative body of the Authority. It performs and uses its duties and powers given by Law No. 6698 and other legislation independently, under its own responsibility. No organ, authority, institution or person can give orders, instructions, recommendations or suggestions to the Board regarding the subjects falling within its scope of duty (LPPD Article 21).

The Board consists of nine members. Five members of the Board are elected by the Turkish Grand National Assembly, and four members are appointed by the President. One of the conditions sought to be a member of the Board is to have knowledge and experience in the field of duty of the Agency [13]. Not being a party member and having at least four years of undergraduate education is also required to be elected as a member. As can be seen, the election of members is carried out by the TGNA, which has a political aspect, and the President, who is a member of a political party. This approach of election and appointment is a considerable handicap in terms of the impartiality and independence of the Board. Another handicap is that the exact and concrete criteria are not determined in the selection of members. The Law does not include a mechanism that checks or measures whether a person who has a higher education diploma in any field has knowledge and experience in the field of duty of the Authority. This situation raises questions about the objectivity and meritocracy of member elections and appointments.

The duties and powers of the Board can be listed as:

- To ensure that personal data are processed in accordance with fundamental rights and freedoms,

- To decide on the complaints of those who claim that their rights regarding personal data have been violated,

- To examine whether personal data are processed in accordance with the law upon complaint or ex officio in case of learning of the alleged violation, and if necessary, to take temporary measures in this regard,

- To determine the necessary measures for the processing of special categories of personal data,

- To ensure that the Data Controllers Registry is kept,

- To take regulatory action in order to determine the obligations regarding data security.

The Board convenes with at least six members, including the chairman, and takes decisions with the absolute majority of the total number of members. Board members cannot vote to abstain.

VI. CONCLUSION

Codification and legislative efforts to protect personal data in Turkish law had emerged even before Law No. 6698. Unsystematic and scattered institutions in the legislation included mechanisms that prevented the capture, use and distribution of personal data. However, Law No. 6698 on the Protection of Personal Data entered into force in 2016 in order to both validate a codification in EU standards and ensure that the provisions and principles for the protection of personal data are collected as a whole. The Law accepted all kinds of information as personal data in terms of the scope of protection. As the public authority on the protection of personal data, the Personal Data Protection Authority and the Board, which is an organ of this Authority, were formed. However, allowing political influence to be effective, especially in the election of Board members, raised questions about the impartiality and independence of the Authority and the Board. This situation gave rise to suspicions that the Law was put into effect only for the alleged fulfilment of the obligations in the EU candidacy process but that there were no sincere efforts to protect personal data in practice.

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The Legal Aspects of the Artificial Intelligence Systems

Gordana Gasmi[1], Vanja Korać[2], Dragan Prlja[3]

[1,3]Institute for Comparative Law, Belgrade, Serbia
[2]Mathematical Institute SANU, Belgrade, Serbia

[1]gordana.gasmi@gmail.com, [2]vanja@mi.sanu.ac.rs, [3]dprlja@gmail.com

Abstract—**The development of artificial intelligence systems and their daily use have opened up a number of legal issues. These are issues of privacy, data protection, algorithmic transparency, cybersecurity, intellectual property, legal subjectivity of robots, algorithmic discrimination, liability for damages, right to education, employees' rights, right to freedom of expression, right of assembly and association, right to a fair trial, suffrage, all the way to the right to health and the right to life. As a consequence of the operation of an artificial intelligence system, there may be a job loss, lack of social assistance, lack of health care, incorrect determination of creditworthiness, discrimination on various grounds, loss of rights and freedoms, and even loss of life. The high risk posed by individual artificial intelligence systems requires adequate legal regulation and its effective implementation in order to protect the fundamental rights and freedoms guaranteed to all individuals.**

Keywords – artificial intelligence, law, human rights, data protection, algorithmic discrimination

I. INTRODUCTION

The accelerated development of artificial intelligence has enabled products and services based on this technology to be found in mass use today: autonomous vehicles, different types of robots, systems for biometric identification and categorisation of individuals, traffic management systems, systems for water supply, electricity, gas, heating, educational systems intended for marking and grading, systems for determining the credit rating of individuals, artificial intelligence systems for hiring and managing employees, systems intended for competent authorities for the approval of various services and forms of assistance, systems intended for judiciary and criminal prosecution authorities, systems intended for emergency services, systems intended for authorities to control travel documents, visas, asylums, migrants, systems intended for democratic processes (electronic voting et al.), and many other systems.

Everyday use of artificial intelligence in various forms brings a series of positive effects, such as optimisation of operations, better allocation of resources, improved forecasting, personalisation of services provided, positive effects on preserving human lives and health, preservation of the environment, etc. These positive effects will be even more prominent in the future, for example, it is expected that the use of autonomous vehicles controlled by artificial intelligence would almost eliminate the number of traffic incidents and human casualties.

Numerous positive effects brought on by the use of artificial intelligence are also accompanied by many challenges, dangers, and abuse possibilities.

In order to increase the safety level for using artificial intelligence, it is necessary to consider numerous legal aspects of the use of products and services based on the artificial intelligence technology.

II. LEGAL ASPECTS OF ARTIFICIAL INTELLIGENCE

Artificial intelligence systems are changing the way in which different products have been made and various services provided up to now. With the help of artificial intelligence, space satellite are managed and controlled, as well as

autonomous vehicles in road traffic, trains in railway traffic, aircrafts in air traffic, the construction of smart buildings and smart cities is managed and controlled, and also the production, distribution and supply in many areas(electricity, water, gas), robots for home use are managed and controlled, loan approvals by banks are managed and controlled, the health system is managed and controlled, etc. Detailed legal regulations already exist for all these areas, regulating the traffic sector, banking sector, healthcare sector, etc., but they do not include aspects linked to artificial intelligence, hence, they function in a regulatory vacuum today. It is necessary to amend and expand, as soon as possible, the existing regulatory framework and to adopt a completely new legal framework linked to the use of artificial intelligence in all areas of our lives.

A. Autonomous Vehicles with Technology Based on Artificial Intelligence

The launch of autonomous vehicles, cars, buses, trucks et al., announces the need to change the existing and to adopt new legal regulations. These regulations in the field of laws of obligations, indemnity and traffic will include owners of autonomous vehicles, manufacturers and sellers of autonomous vehicles, manufacturers and sellers of artificial intelligence technology built into autonomous vehicles, autonomous vehicles operators, road management institutions, institutions issuing licences to use these vehicles, and institutions in charge of insurance and damage compensation. In terms of the obligation law, it is necessary to change contracts between buyers and sellers of autonomous vehicles, to define new contracts between buyers and operators of autonomous vehicles, it is necessary to change contracts between buyers and insurance companies, it is necessary to define new contracts between producers of artificial intelligence technology and manufacturers of autonomous vehicles, and furthermore between producers of artificial intelligence technology and operators of autonomous vehicles. In terms of the indemnity law, it is necessary to provide all types of responsibilities in all these new contracts. In terms of the traffic law, it is necessary to provide detailed conditions for testing autonomous vehicles, precise requirements for the use of these vehicles in a traffic, obligations and responsibilities of autonomous vehicles operators regarding data security and management, as well as risk prevention, detailed

provisions on the functioning of sensors on roads, on keeping the "black box" with data, and at the international level, it is necessary to make new ISO standards, etc. [1].

The example of autonomous vehicles shows that many legal norms need to be changed or new ones to be adopted in order to insure adequate regulations in this area. A similar situation can be found in other areas as well, where artificial intelligence technology is applied, for example, when it comes to robots used in homes, or artificial intelligence systems implemented in healthcare for diagnosing diseases and treating patients, social assistance systems, educational systems, systems for managing electricity, water, gas supply, etc.

B. Human Rights

The use of products and services based on artificial intelligence leads to the possibility of compromising the fundamental rights of individuals to dignity, respect for private life, data protection, right to non-discrimination, suffrage, freedom of expression and freedom of assembly, right to efficient legal remedy, to a fair trial and presumption of innocence, right to good management, right to fair and just working conditions, consumers rights, children's and persons with disabilities rights, right to environmental protection and right to human health and safety [2].

The right to freedom of expression was drastically compromised when Facebook and Cambridge Analytics distributed semi-accurate or incorrect information and thus endangered the human right to freedom of expression, i.e. citizens' right to freely participate in public affairs management and voting in elections. Those were millions of people who couldn't protect their right to freedom of expression with an adequate legal remedy [3].

The use of artificial intelligence systems in the judiciary can negatively affect the right to a fair trial [4], if the decision was made by using an algorithm, and the judicial staff don't have a sufficiently high level of understanding of artificial intelligence to ensure that decisions made with the use of it are non-discriminatory. Biometric face and voice recognition systems can threaten the right of individuals to privacy. Artificial intelligence systems that collect and analyse a large amount of data about individuals can predict their behaviour, cause changes in their behaviour, compromise their privacy, e.g.

by revealing their facial expressions, emotional state, heartbeat rate, physical location, etc. Biometric face recognition systems can prevent citizens from exercising their right to freedom of expression, assembly and association, and thus have a negative effect on social solidarity and participation in democratic processes. The Chatbot activities and creation of undoubtedly falsified contents (Deep Fake) by a system based on an algorithm and artificial intelligence can affect an individual's capability of forming attitudes on reliable information. This way, individuals are being manipulated and their right to be informed is endangered, which is necessary for them to be able to take part in democratic decision making processes.

Artificial intelligence systems based on biased information can cause algorithmic discrimination.

Artificial intelligence systems which manage sophisticated weapons, such as sniper robots or drones, intended for killing individuals or groups of people, are already in use and they endanger the most important human right, the right to life.

Products and services based on artificial intelligence technology have the potential to endanger human rights, democracy and the rule of law [5]. Predicting human behaviour, identifying disease indicators, risk assessment, unwarranted bias in decision-making are only some of the reasons that require serious consideration of the question of banning some products and services based on artificial intelligence technology, banning some artificial intelligence systems and establishing control over high-risk artificial intelligence systems. Protecting human rights from dangers brought on by the use of technology based on artificial intelligence must be a priority in the activities of international organisations and all countries [6].

C. Artificial Intelligence Regulatory Sandbox

During the development of new artificial intelligence systems it is necessary to use a large amount of personal data in order to test the success of a given system. For example, if an artificial intelligence system is developed for an efficient and reliable analysis of X-rays in order to establish a diagnose for a disease, it is necessary to use a large number of X-rays in the development phase in order to establish whether there are any errors in the algorithm and to remove them. Since there is currently no legal basis for the use of a special legal regime in such cases, and there is public interest in creating such artificial intelligence systems, it is necessary to make changes in legal regulations in order to make this possible. Manufacturers that develop such artificial intelligence systems should have access to suitable data, without which it wouldn't be possible to develop a high-quality artificial intelligence system, but they must have specific obligations to take all protective measures so as to reduce the risk to the security of those data and endangering of fundamental rights of individuals. In every country, it is necessary to have certain state bodies with the competence of controlling data usage by producers of artificial intelligence systems in isolated environments with a special legal regime. If there is a risk to the health, safety and fundamental rights during the development of these artificial intelligence regimes in an isolated environment with a special legal regime, and they cannot be eliminated, the process of development and testing of these artificial intelligence systems must be stopped until those risks are removed. It is necessary for every country to determine in which areas it will be possible to develop artificial intelligence systems of public interest with the use of existing data (discovering and prosecuting perpetrators of criminal activities, protection of public safety, protection of public health, improvement of the quality of the environment, etc.). The processing of personal data, their storage and deletion, as well as obligations linked to the technical documentation during the testing in isolated environments with a special legal regime must be regulated in detail.

An example of how the countries should regulate the use of data in the development of artificial intelligence systems of public interest in an isolated environment with a special legal regime is given in the Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act of the European Union) and Amending Certain Union Legislative Acts.

D. Intellectual Property and Artificial Intelligence

The development of artificial intelligence systems based on machine learning by neural networks has enabled computers to create completely new works (e.g. artistic paintings of musical pieces) without any human participation. These are computer generated works and they must be legally regulated.

Contracting parties that develop and use artificial intelligence systems that can create computer generated works must carefully consider the legal aspects regarding the ownership of those works, the possibilities of assignment and licencing of those works.

The competent state authorities must change the existing regulations and precisely define what constitutes a computer generated work, and jurisprudence must also clarify certain issues regarding the creation and use of computer generated works.

A similar situation with a legal vacuum also exists with patents and inventions originating from the use of artificial intelligence systems.

Data themselves haven't been treated as intellectual property so far, but certain rights and obligations could result from intellectual property existing in an artificial intelligence system in connection with the data. Data are increasingly becoming a commodity and can be monetised, and, on the other hand, can become an object of theft and their use can lead to tort liability. The General Data Protection Regulation of the EU (GDPR) has changed the attitude towards data at the global level, but the use of data within artificial intelligence systems requires additional regulations.

E. Tort Liability and Artificial Intelligence

The legal aspect of liability for the use of autonomous vehicles, robots, and other autonomous artificial intelligence systems are already becoming increasingly actual. Certainly, insurance policies for autonomous vehicles will have to be expanded in regard to the insurance policies for regular vehicles.

Completely new regulations are necessary when it comes to the production and use of robots, and especially sophisticated robots. There are even proponents who believe that sophisticated robots should be given some kind of legal entity status. We are still waiting for a discussion, and possibly new legal regulations, on the legal subjectivity of sophisticated robots and their responsibility.

For the time being, the issue of liability for the use of products with artificial intelligence technology is sought in the expanding of liability for "dangerous things", or expanding the liability which is analogous to the regulation of the issue of liability for damage caused by animals [1].

F. Algorithmic Discrimination

Artificial intelligence systems based on biased information can cause algorithmic discrimination, i.e. discriminatory algorithmic decisions or behaviour. If an artificial intelligence system learns on the basis of preliminary data that are based on discriminatory decisions, then it can also make discriminatory decisions on the basis of "feedback loops", that is to say, it can endanger human rights. For example, if men used to be hired for certain workplaces a lot more often than women in the past, then an artificial intelligence system will discriminate women for those workplaces in the future as well because of the learning based on previous examples. Artificial intelligence systems intended for monitoring behaviour of employees and making decisions by an algorithm can have negative effects on the realisation of social and economic rights of employees. Employees can face errors committed by artificial intelligence systems, the consequence of which can be unjustly lower pay check, unpaid vacation allowance, inadequate reassignment, etc.

The legal aspect of algorithmic discrimination is also covered by data protection regulations regarding the obligation of lawfulness of data processing, the existence of consent or other legal bases for the processing, as well as different obligations regarding providing information and other obligations regarding automatic data processing, but it certainly isn't enough to realise efficient fight against algorithmic discrimination. It is assumed that a good way to obtain compensation on the basis of algorithmic discrimination would be joint lawsuits by a larger number of injured parties [7].

G. European Legal Regulations on the Use of Artificial Intelligence

The Council of Europe and the European Union have been making recommendations, declarations, studies on legal aspects of the use of artificial intelligence for several years already.

Documents adopted by the Council of Europe and the European Union provide a clear indication as to how to regulate the legal aspects of the use of artificial intelligence: Declaration by the Committee of Ministers on the Manipulative Capabilities of Algorithmic Processes, White Paper on Artificial Intelligence – A European approach to excellence and trust, Building Trust in Human–Centric Artificial

Intelligence, Recommendation of the Committee of Ministers Council of Europe to Member States on the Human Rights Impacts of Algorithmic Systems, Fostering a European Approach to Artificial Intelligence, The Risks of Computer-Assisted or Artificial-Intelligence-Enabled Decision Making in the Field of the Social Safety Net, Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts.

The EU's approach to challenges originating from the use of artificial intelligence is based on the special treatment of high-risk artificial intelligence systems compared to those which do not fall into this category. Special rules and mechanisms for enforcing those rules are established for those high-risk systems which pose a high risk to the health, safety and fundamental rights of individuals. Those rules establish legal requirements regarding data and data management, documentation and record keeping, transparency and informing of users, human control, resilience, accuracy and safety regarding manufacturers, importers, distributors, authorised representatives and users.

It is foreseen establishing of the European Committee on Artificial Intelligence at the European Union level, and at the level of individual countries – bodies that would determine compliance with the requirements of the Act and appoint supervisory bodies. The European Committee on Artificial Intelligence will consist of representatives of the Member States and the European Commission. National compliance assessment bodies will designate a competent national body, which will assess compliance with reliable quality management and risk management systems. Besides, artificial intelligence systems will be monitored after reaching the market and certificates on their compliance with the requirements from the Act will be issued. The competent national body will control the application and drastically penalise manufacturers that do not adhere to prescribed provisions, with fines of up to 30 million euros, or up to 6% of the total annual turnover of the given company worldwide for the previous fiscal year. In addition to these binding legal norms, the proposed mechanism of legal regulations also foresees the making of a code of conduct which would be voluntarily adhered to by the manufacturers of high-risk artificial intelligence systems, as well as manufacturers of artificial intelligence systems which are not in the high-risk group.

At the national level, EU Member States will be required to harmonise their legislation to the provisions of the Artificial Intelligence Act once it is adopted. It is expected that this Act will be adopted in the course of the following year, in 2022, and its implementation is expected to start in 2024. Countries aiming to become members of the EU are also expected to harmonise their legislation with the provisions of the Act and to build mechanisms which would enable a safe use of high-risk artificial intelligence systems and legal security.

III.   CONCLUSION

Legal regulations for various aspects of the use of artificial intelligence requires the creation of an extremely complex legal framework, both at the international and the national level. On the one hand, this legal framework must include legally binding norms (the so-called hard law), and on the other, non-binding norms (the so-called soft law).

Within the binding norms, it is necessary, on the one hand, to precisely define the obligations of those who make and use products, services and systems based on artificial intelligence technology, and on the other, to define a rigorous system of sanctions and to ensure its efficient application. The experience with the General Data Protection Regulation of the EU (GDPR) showed that high sanction fees influence on compliance with legal regulations. Aside from making a special law on the use of artificial intelligence systems, which will specifically regulate high-risk artificial intelligence systems, it is necessary to amend a large number of regulations from various areas at the national level, in order to ensure a safe use of artificial intelligence systems.

Within the non-binding norms, it is necessary to create as many recommendations, declarations, guidelines, principles and standards of good practice, as well as codes of conduct which will be implemented by those who produce and also those who use artificial intelligence systems. This way, safety standards for the use of technology based on artificial intelligence would be elevated.

In parallel with the work on making as comprehensive legal framework as possible for the regulation of numerous areas of use of

technology based on artificial intelligence, it is necessary to work on continuous education of producers and users of artificial intelligence systems with numerous legal aspects of using this technology.

ACKNOWLEDGMENT

High-risk artificial intelligence systems must be subject to strict control with the help of applicable legal regulations.

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Accidents in the System of Hazardous Substances

Goran Tepić[1], Milan Kostelac[2]

[1]University of Novi Sad, Faculty of Technical Science, Novi Sad, Serbia
[2]University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia

[1]gtepic@uns.ac.rs, [2]milan.kostelac@fsb.hr

Abstract— **The vital elements of numerous industrial plants include process equipment which, depending on the nature of the technological process, can be exposed to internal pressure in the general case of variable size. Typical examples of process equipment are available at gas stations (distribution centers), fuel tanks, gas boilers, combustion plants, etc. Practical experience and analysis of the cause of accidents has shown that the damage to process equipment is most often followed by explosions of tanks in which the flammable substances, such as LPG, petrol, diesel and jet fuel, oils, etc., are stored. Explosion of the tank cannot occur spontaneously, but only results from external factors. This means that the explosion of process equipment is preceded by primary events whose harmful effects are manifested through the following phenomena: weakening the tank strength, increasing the pressure above the nominal value, or a combination of the two preceding cases.**

Keywords – produsction systems, hazardous substances, accidents, domino effect, BLEVE

I. Introduction

Accidents in the system of hazardous substances, such as chemical release, fire, explosion or BLEVE effect, can cause great catastrophic consequences not only for employees in the workplace, but also for residents and the environment. In addition, financial losses caused by damage on objects (parts of production plants, tanks) are enormous, and rehabilitation and their re-entry into operation require a lot of time. These effects also result in other serious influences, such as, for example, the inability to provide sufficient quantities of raw materials to connected and / or related industries. The development of the oil and chemical industry caused the use of large and complex facilities in their plants, resulting in a large increase in storage space (tanks of different shapes and dimensions). In the meantime, due to the use of land (lack of space) and economic reasons, the distances between installations and warehouses are getting smaller and smaller (Fig. 1). This branch of industry continues to develop in the direction of intensive and deep processing, chemical processes end up mainly through a series of physical and chemical reactions, and their main raw materials and products are in liquid and gaseous states that are toxic, flammable and corrosive [1]. Therefore, the risk for oil and chemical plants has increased dramatically, in particular the risk of explosions and fires.

In the case of an accident (fire or explosion), and bearing in mind all of the foregoing, there may be a chain disaster, and therefore it may endanger human lives, environmental safety, material assets and large environmental
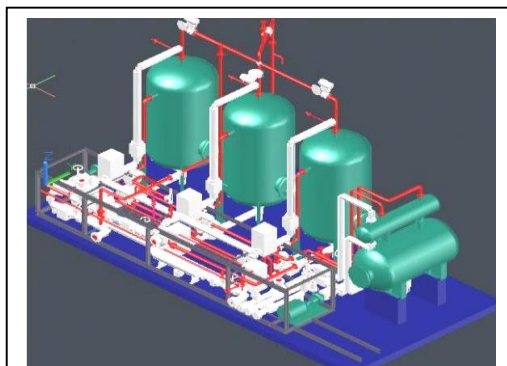

Figure 1.   Illustration of proximity to process equipment and tanks.

pollution, as well as other secondary consequences [2-4].

II. DOMINO EFFECT

In terms of production facilities and in particular refineries, it is necessary to focus (in terms of transport and production processes) on the storage capacities. Storage capacities consisting of tanks of different types, sizes and shapes are used for the permanent or temporary storage of different classes of dangerous substances (oil and oil derivatives, gas, high pressure liquids, various corrosive substances, etc.). When an accident occurs in the production/processing or storage facilities, the physical effects of that particular accident very often lead to damage to other surrounding equipment. With this is taken into account, it can be said that a relatively small incident can escalate into an event that causes damage to a much larger surface and lead to far more severe consequences; in practice it is called a domino effect. Such effects are usually created and caused by the physical effects of primary accidents, such as [5]:

- overpressure,
- fragments (impact fragments)
- thermal radiation and
- heat flux.

According to [6], 225 accidents with consequences of the domino effect were analyzed, in processing, storage and transport plants, in the period from 1961. On this occasion, the following aspects were analyzed: accident scenario, type of accidents, class/type of substance, causes and consequences, as well as the most frequent accidents sequences. The analysis found that the most common causes are: external losses of 31% and mechanical errors of 29%. Even 35% of domino accidents happened in the storage area, while 28% occurred in processing plants. Flammable substances included 89% of accidents, most of which were LPG. In most cases damaged equipment is unable to resist, leading to leakage and loss of hazardous material and additional scenarios:

a. explosion → fire (27,6%),
b. fire → explosion (27,5%) and
c. fire → explosion (17,8%).

Domino effect definitions contain the following three concepts [7-9]:

1. A "primary" event (fire, explosion) that occurs in a certain unit.
2. The propagation of the accident to one or more units or plants, in which "secondary" accidents are triggered as a result of the primary event.
3. An "escalation" effect that leads to a general increase in consequences, with secondary accidents being more severe than the primary one.

III. ACCIDENTS IN PRODUCTION SYSTEMS WAREHOUSES

The oil and chemical industries include many flammable and explosive chemicals for production and storage, and manufacturing processes have high temperatures of high pressures. There are many different pressure equipment in industrial plants, such as, for example, tanks (cylindrical, elliptical and torispherical) containing gas (LPG) or high pressure liquids. When it reaches a critical level of high pressure, overheating or mechanical stress, the tank can suddenly explode and generate many fragments (one or more depending on critical pressure, crack propagation, material type and connection of basic mechanical components) that represent a threat to other equipment or adjacent tanks. So fragments caused by the explosion of the tank have an effect on other tanks, and this effect is reflected in partial or complete breakdown and/or damage to adjacent tanks and equipment. The fragments have different shapes, sizes, initial speeds and initial departure angles (horizontal and vertical). According to expert reports INERIS [9], a typical explosion (BLEVE) of a cylindrical tank creates a limited number of massive fragments, mainly two or three, and very rarely more than four or five.
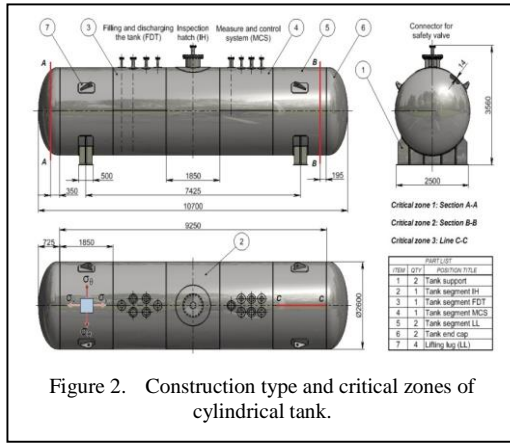
Figure 2. Construction type and critical zones of cylindrical tank.

Figure 3. Software simulation of critical tank zones (pressure 16.7 MPa).

The critical zones of the cylindrical tank are estimated according to (1) and (2), derived from the basis of the substrate in [10]:

$$\sigma_{x,\max} = \sigma_x(x = 0.082n) =$$
$$\left[1 + 0.292685\left(\frac{D}{2h}\right)^2\right] \cdot \frac{D}{4} \cdot \frac{p}{\delta} \approx p \quad \cdot \quad (1)$$

$$\sigma_{\theta,\max} = \sigma_\theta(1 = 0.0195m) =$$
$$\left[1 + 0.031418\left(\frac{D}{2h}\right)^2\right] \cdot \frac{D}{2} \cdot \frac{p}{\delta} \approx 104p \quad \cdot \quad (2)$$

The authorative stress for dimensioning the pressure vessel is given by (2). The permitted stress for the S355J2G3 (tank material) is 195.83 *MPa*. Mechanical and chemical properties of materials are given in Table 1. The maximum operating pressure according to (2) is 1.88 *MPa*, while EN 13445-3 provides 2.12 *MPa*. The operating pressure of the LPG storage tank ranges from 16.4 to 16.9 *bar* (an average of 16.7 *bar*). Rationally designed tank are characterized by a minimum difference $\sigma_{x,max}$ and $\sigma_{\theta,max}$, which is achieved by the ratio $D/2h$.

In the case under consideration, $D/2h = 2$, so it is $\sigma_{\theta,max}/\sigma_{x,max} = 4\%$. The critical zone is conditioned by the criterion $(D/2h) = 2.086$. Critical zone 1 is considered only if the tank head is elliptical. Then it is always $(D/2h) < 2$, so the fragmentation is most often followed by the separation of the end cap from the tank cylinder due to the expansion of the fracture lines by circumference ($\sigma_\theta > \sigma_x$). Critical zone 3

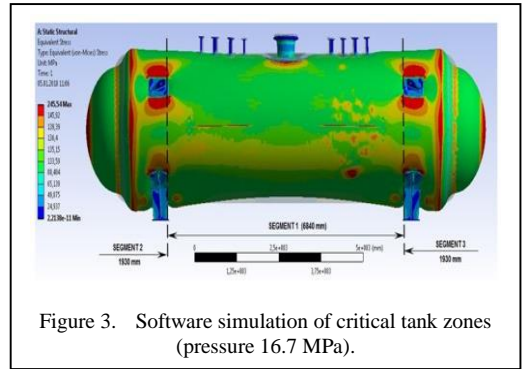dominates when $\sigma_\theta < \sigma_x$ (hemisphere head), otherwise, the B-B cross-section is authorative (Fig. 2). The estimation of critical zones according to (1) and (2) is limited to generating a smaller number of fragments due to the BLEVE effect.

The real stress of the tank varies from (1) and (2) due to axial asymmetry. Therefore, the fragmentation of the tank generally requires the identification of real stress through software structural analysis. On the Fig. 3 are showed critical areas of a cylindrical tank.

When the crack spreads faster than leakage of fluid/liquid, there is an explosion of the tank, where fragments are created, the size and velocity of which depend on the type of cracks, i.e. the brittleness and flexibility of the material. Fragments projected due to tank explosion can affect and damage adjacent objects and tanks in their surroundings. If these affected objects are, for example, pressurized containers, there is a risk that an explosion will occur, which would produce another set of projectiles/fragments. Such fragments can affect other devices and generate next explosions leading to a scenario known as the "domino effect" [10-17].

According to [18-22], when it comes to the reliability of industrial facilities and plants, under possible explosions, it is necessary to observe and include the following development steps:

1. Analysis of conditional sources - identification of potentials of plants/objects in which an explosion can occur, knowledge of conditions that can initiate/lead to explosion, as well as knowledge of geometric dimensions, shapes, speed and frequency of angles of the caused/generated projectiles.

2. Analysis of the influential term – knowledge of conditions that can cause/create
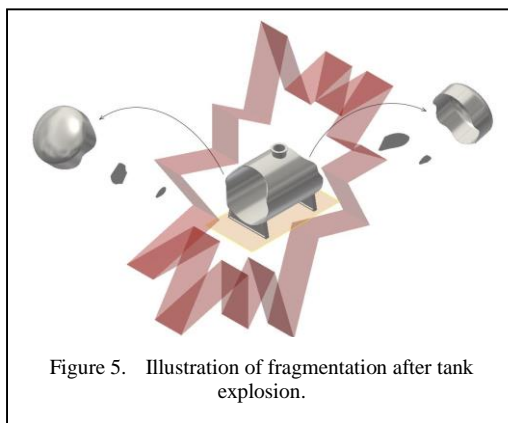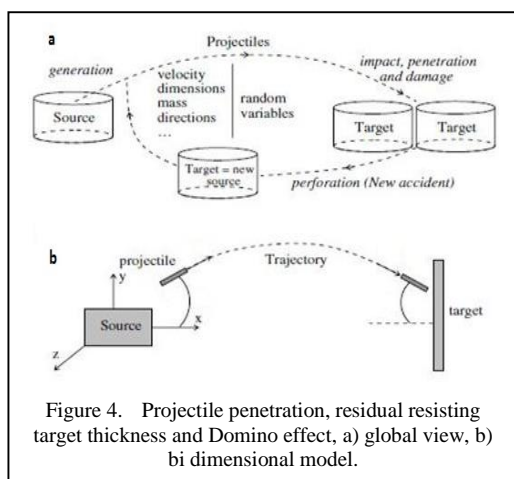
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the influence of other plants/facilities, knowledge of the mechanical and geometric properties of the affected targets, knowledge of impacts such as perforations or partial penetration/break, but also the possible creation of a new set of projectiles, as a result of failure/malfunction or explosion of the affected object/tank.

3. Assessment of the reliability of plants and facilities, and their consequences.

Risk analysis in industrial plants often considers that random explosions generate the given categories and forms of structural fragments (Fig. 4), i.e. standardize projectiles, the speed of which depends on the arbitrary ratio of total energy. In addition, a detailed analysis is needed to assess the risk of impact and mechanical damage that may occur on surrounding facilities and/or tanks.

Fragments can be generated by various characteristics such as: geometric shapes and dimensions, mass, velocity, and angles of projection. If the fragments affect the target (the other tank), they can penetrate completely or partially. The generated fragment penetrates partially or completely the second tank, which can cause an explosion of the adjacent tank (Fig. 4).

Sophisticated mechanical models are necessary or may be required, in order to analyze these dynamic effects and their consequences. Earlier reports [11,12] show that there are generally three forms of generated fragments after industrial accidents or tank explosions: cylindrical, half-sphere or plate (Fig. 5).

Figure 4. Projectile penetration, residual resisting target thickness and Domino effect, a) global view, b) bi dimensional model.

Figure 5. Illustration of fragmentation after tank explosion.

In addition, the valve parts as well as the tubular parts may also be transformed into cylindrical shapes during the explosion. Obviously, the impact of the fragment can occur with any value of the angle between the fragment and the target, i.e. the second tank.

IV. CONCLUSION

Critical infrastructures play a key role in the normal performance of economics and society. Over the past decades, the quantity and diversity of critical infrastructure has grown rapidly and the interdependence between them has steadily increased. Therefore, more and more basic services depend on the continuous performance of one, two or more critical infrastructures, such as electricity and water supply, communications, etc.

Observing and reviewing the extreme events that have taken place over the past two decades reveal that although the interdependence between critical infrastructures is rapidly rising and becomes more complex, there is a huge gap between the increased risk and actual readiness of critical infrastructure to extreme events such as accidents. It is also necessary to note that in addition to mechanical and technical causes there are external causes of accidents, i.e. natural disasters (e.g. earthquakes, tsunami, etc.) that need to be analyzed, as their consequences are not negligible (e.g. Fukushima 2011).

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The Significance and Use of Simulation Software in Evacuation

Radoje Jevtić[1]

[1]Electrotechnical school „Nikola Tesla", Niš, Serbia

[1]milan.jvtc@gmail.com

Abstract—**One of the most important and the most complex tasks in disasters and unexpected events is an evacuation. The more people involved or present in a disaster or crisis situation, the more complex and difficult their evacuation is. The main problems in evacuation are the inability to predict all possible events and the inability to harmonize behavior at humans and animals. So, it is very important to, somehow, predict as many as possible, behavior of humans and animals and time needed for their evacuation. One of very good ways for calculation of time needed for evacuation is the use of simulation software. This paper was written to present the use of Pathfinder simulation software in evacuation through different realized examples.**

Keywords – evacuation, simulation, prevention

I. INTRODUCTION

As a term, evacuation has its origin in Latin language (lat. evacuatio, evacuare) and can purport leaving of military objects that could serve to the enemy, in one sense (military), while in the other sense (medical) can purport cleaning and emptying products [1]. Modern definition of evacuation is that evacuation presents the fastest, the safest, planned and organized moving of humans, animals and material properties from endangered place to the safe place. The reasons for evacuation can be different: fire, explosion or leaking of gas, chemicals, bomb threat, earthquake, terrorism, overflow, civil disorders etc.

History and experience showed that evacuation presents always open task and problem that must be constantly improved. Many tragic events, unfortunately, confirmed that absolute safe evacuation, no matter how planed and organized was, just cannot be realized: Brussels (Heysel playground), September 11th in New York, Chernobyl disaster, Bhopal disaster, earthquake in Indonesia etc.

One of the crucial factors during the evacuation is human's behavior. It is almost impossible to know and predict how someone will behave in the presence of fear, stress and panic. That is particularly characteristic for evacuation of objects with lot of humans inside: schools, hospitals, resident and business buildings, playgrounds, etc. Panic and stress usually produce faster and more chaotic movement on humans and animals, what purports many unexpected and unpredicted events with tragic consequences.

Evacuation in some object can be realized through evacuation routes, primary and secondary. Primary evacuation routes present routes for normal communication in object, such as corridors, hallways, stairs and similar. This routes also can be used by fire units in the case of fire extinguishing. Secondary routes can be different, in dependence of object`s purpose and characteristics. In the most cases, these are roofs, windows, passages etc. Evacuation routes, primary and secondary, must obey different demands, related to the type and purpose of the object, complete number of people in object, their moving speed, necessary time of evacuation etc. [2].

It is obvious that evacuation and its efficiency demand from many factors. For as much as possible successful evacuation, it is important to somehow predict that factors. One of very good ways for effective evacuation is a use of proper simulation software. The use of this software in evacuation has great advantages that are reflected in safety, economy and accuracy.

II. Pathfinder Simulation Software

Pathfinder presents software for simulation of human evacuation. This software enables a graphical user interface for simulation design with possibilities of 2D and 3D visualization tools for results analysis. Realized results can be shown in the form of text, 2D graphic and 3D clip. It is possible to simulate human`s evacuation through object with rooms, floors, stairs, doors, elevators and other objects.

There are two different simulation modes supported in Pathfinder. The first simulation mode is, so called, „steering mode". This mode enables that occupants can preserve normal distance between each other. The other simulation mode is, so called, „SFPE" mode. This mode enables that occupants are allowed to interpenetrate, while density controls flow limit and velocity.

The simulation results comprise information about the imported or drawn simulation geometry, simulation performance, so as information for each room, stairway, and door in simulated object. One of very good properties of this program is the possibility „to import" the simulation model from some other program, such as AutoCAD or Pyrosim. These properties can significantly improve results and accelerate complete time needed for simulation. Evacuation and potential evacuation situations can be calculated for different occupants' speeds and different parameters (dimensions and speeds of elevators, dimensions and number of doors and stairs etc.).

Until today, there were several versions of this program. As every numerical-visualization program, Pathfinder demands very strong hardware configuration for its work [3].

III. Realized Examples

Next several examples show the potentials of Pathfinder software in evacuation and evacuation routes design and calculation.

The first example presents potential evacuation of pupils and staff in Electrotechnical school „Nikola Tesla" in Niš. Schools present objects with lot of humans (pupils) and in some danger situation, such as fire, earthquake, bomb threat or similar, consequences and human victims can be inconceivable. Design of school simulation model purported several months and implied great number of measurements, because school simulation model was in full size. School
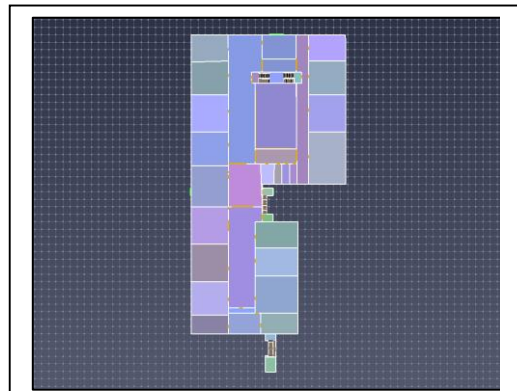
Figure 1.   Simulation model of the Electrotechnical school „Nikola Tesla" in Niš in Pathfinder-above view (figure source: Jevtić, B. R., Blagojević, Đ. M., *Simulation of the school object evacuation*).

simulation model was the same school with real dimensions and all possible parameters and obstacles (stairs, doors, chairs, desks etc.).

Realized results showed evacuation times needed for complete evacuation from the school when 50, 100, 150 and 180 occupants were per floor. Speed of occupants was 1.2 m/s. Simulation was realized for two cases: the first case purported usage of doors for evacuation, the main door and door intended for pupils; the second case purported usage of only fire stairs for evacuation.

Simulation model of the Electrotechnical school „Nikola Tesla" in Niš in Pathfinder (above view) and simulation moment in Pathfinder where 100 occupants were per floor are presented on Figs. 1 and 2.
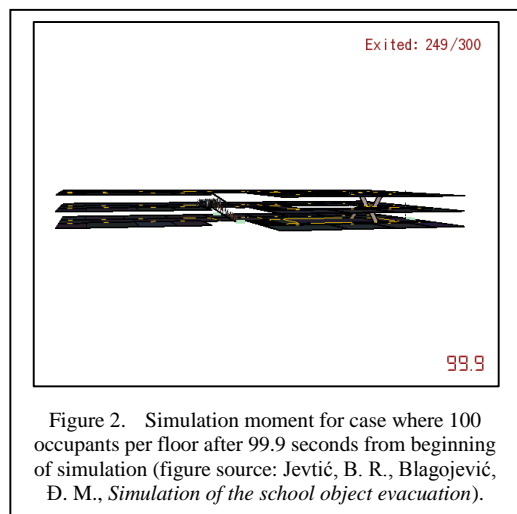
Figure 2.   Simulation moment for case where 100 occupants per floor after 99.9 seconds from beginning of simulation (figure source: Jevtić, B. R., Blagojević, Đ. M., *Simulation of the school object evacuation*).

The second example presents evacuation from shopping center „Zona I" in Niš. Shopping centers were known as objects with lot of humans inside and different kind of stuff and because of that, objects with high risk for evacuation. Simulation was realized for different number of occupants inside the object (240, 300 and 450). Occupants were uniformly arranged per floor (80, 100 and 150 occupants per floor). Speeds of occupants were 1.5 m/s, 2.5 m/s, 3.5 m/s and 4.5 m/s. Different speeds of occupants were used to present occupants calm movement and occupants movement n the presence of hurry and panic.

The simulation model of second floor of shopping center „Zona I" in Niš, in Pathfinder (above view) and simulation moment in
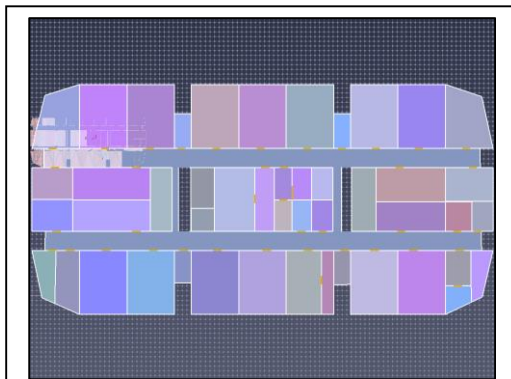

Figure 3.   Simulation model of second floor of shopping center „Zona I" in Niš, in Pathfinder-above view (figure source: Jevtić, B. R., *Simulation of the shopping centre Zona I evacuation*).
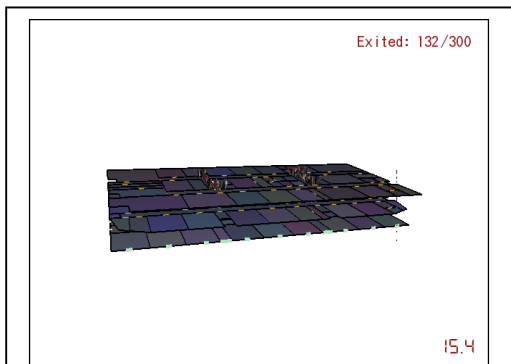

Figure 4.   Simulation moment for the case with 100 occupants per floor after 15,4 seconds from the beginning of the simulation (figure source: Jevtić, B. R., *Simulation of the shopping centre Zona I evacuation*).

Pathfinder where 100 occupants were per floor are presented on Fig. 3 and 4 [5].

The third example presents evacuation from hotel Radon in Niška Banja. This hotel presents special kind of sanitary object. Sanitary objects are particularly interesting of evacuation because many of their occupants are immobile.

The simulation of this object was realized in five scenarios. In the first scenario, occupants on fifth and sixth floor had speed from 0.15 m/s and need help in evacuation. All remain occupants had speed from 1 m/s. In the second scenario, occupants on fifth and sixth floor had speed from 0.15 m/s and need help in evacuation, while remain occupants had speed from 0.75 m/s. In the third scenario, occupants on fifth and sixth floor had speed from 0.15 m/s and need help in evacuation, while remain occupants had speed from 0.6 m/s. In the fourth scenario, occupants on fifth and sixth floor had speed from 0.15 m/s and need help in evacuation, while remain occupants had speed from 0.5 m/s. Finally, in the fifth scenario, occupants on fifth and sixth floor had speed from 0.15 m/s and need help in evacuation, while remain occupants had speed from 0.3 m/s. Related to illness degree, occupants from fifth and sixth floor must use the elevators, while the occupants from higher and lower floors, could use passengers and cargo elevators, stairs, main and fire stairs. Occupants located in the basement didn't have to use the elevators but only doors (swimming pool and wellness center).

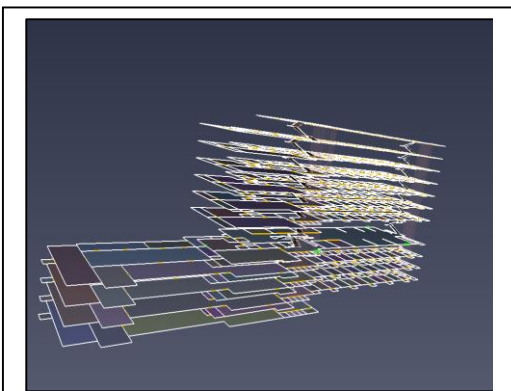Simulation model of hotel Radon in Niška Banja, in Pathfinder and simulation moment for

Figure 5.   Simulation model of hotel Radon in Niška Banja in Pathfinder (figure source: Jevtić, B., *The simulation of sanitary objects evacuation-an example of hotel Radon in Niška Banja*).
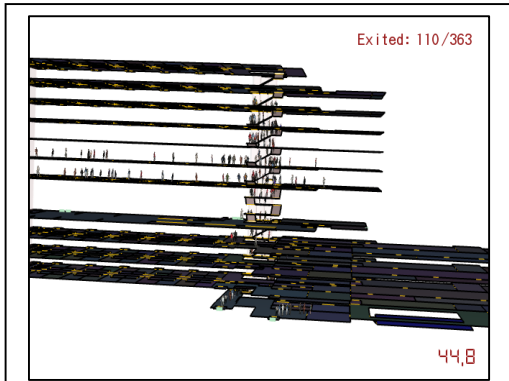
Figure 6. Simulation moment for the first case scenario after 44,8 second from the beginning of the simulation (figure source: Jevtić, B., *The simulation of sanitary objects evacuation-an example of hotel Radon in Niška Banja*).

Figure 7. The simulation model of train in Pathfinder, for the second scenario with marked wagon that was jumped out from railway tracks (figure source: Jevtić, B. R., *Security in metro-an example for simulation of evacuation from subway*).

Figure 8. Simulation moment for the first scenario after 35.6 seconds from the beginning of the simulation (figure source: Jevtić, B. R., *Security in metro-an example for simulation of evacuation from subway*).

the first case scenario are presented on Figs. 5 and 6 [6].

The fourth example presents evacuation from subway. Subways are also very interesting objects for evacuation. In these objects, tens of thousands and even more passengers travel every day, deep into the ground. In the cases of danger or accident, a large number of passengers (occupants) should be evacuated fast and safely, which is often very difficult. Situations that can arise are different (collision, jumping out from railway tracks, earthquake etc.).

For this evacuation example, simulation model was designed as a tunnel with dimensions of 3500 m length, 6 m width and 5 m height. The simulation model of the tunnel purported emergency exits on every 1200 m. The evacuation was realized for two different cases. The first case purported train that stopped in the middle of the subway tunnel, while the second scenario purported train with the wagon that was jumped out from railway tracks also in the middle of the subway tunnel. Because of the presumption that occupants felt fear and panic, for both scenarios, five different speeds for occupant's were realized: 1.25 m/s, 1.75 m/s, 2.5 m/s, 3.5 m/s and 5 m/s. The train had eight wagons with 50 occupants per wagon, what implied 400 occupants complete. All dimensions for train simulation model were the same as in the real train model (wagon dimensions, seat dimensions, wagon`s doors dimensions etc.).

The simulation model of train in Pathfinder, for the second scenario with marked wagon that was jumped out from railway tracks and

simulation moment for the first scenario after 35.6 seconds from the beginning of the simulation are presented on Figs. 7 and 8 [7].

The fifth example presents evacuation from the Terazije tunnel in Belgrade. Traffic tunnels are objects intended to connect two sides of the road, separated with different obstacles. Their dimension can be huge (tunnel length can reach several kilometers). Tunnels can be particularly hard object for evacuation because of the lack of space, the lack of air od similar problems.

The Terazije tunnel presents very important connection in traffic in Belgrade. Its construction was completed in 1973 and it was realized as the tunnel through the building that had already existed in that location. This tunnel has next dimensions: length of 223 m, a width of 13 m and

a height of 5.5 m. It turned out that any kind of jam, accident or similar occurrence in this tunnel could cause huge traffic problems, with blocking of many neighborhood streets.

This tunnel is available only for vehicles. For pedestrians, because of tunnel length and fumes that containing carbon monoxide gas, pass is not allowed. Because of that reason, the evacuation of occupants from the tunnel must be very fast and organized, in the case of any kind of accident.

Simulation of evacuation from this tunnel was realized for two different scenarios. The first simulation scenario purported a tunnel full with cars and buses, without any kind of collision. This scenario simulated a simple and almost every day's jam in the tunnel. The second scenario purported a tunnel full with cars and buses, but with a collision. The collision was between a bus and three cars and it was located at 92 m after the tunnel entrance from the side of Zeleni Venac. The both of simulation scenarios were simulated for occupants' speeds of 0.9 m/s, 1.1 m/s, 1.3 m/s, 1.7 m/s, 2 m/s, 2.5 m/s, 3 m/s, 3.5 m/s, 4 m/s, and 4.5. It was obvious that occupants could reach speeds bigger than 4.5 m/s, but in the tunnel with the presence of other occupants and vehicles as obstacles, it couldn't be possible. The number of cars in tunnel was 161 and the number of busses was 5. The complete number of occupants in the tunnel was 944-it was purported that every car had 4 occupants inside and every buss had 60 occupants inside.

Simulation model of the Terazije tunnel in Pathfinder with the marked position of a collision and simulation moment for the first scenario after
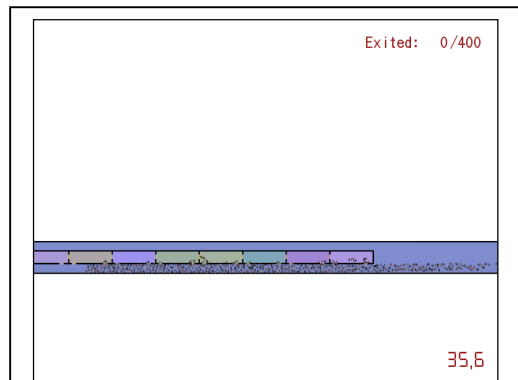

Figure 10. Simulation moment for the first scenario after 39.6 seconds from the beginning of the simulation (figure source: Jevtić, B. R., *Simulation of evacuation from the Terazije Tunnel*).

39.6 seconds from the beginning of the simulation are presented on Figs. 9 and 10 [8].

The sixth example presents evacuation from a parking garage. Parking garages present objects for car accommodation. Nowadays, those objects have several or more floors and huge dimensions and can store a large number of vehicles.

Simulation of the auto parking garage evacuation presumed three different scenarios. The first scenario purported 1680 occupants in auto parking garage. The second scenario purported 840 occupants in auto parking garage. The third scenario presumed 240 occupants in auto parking garage. The speeds of occupants for every of three scenarios were 1.19 m/s, 1.3 m/s, 1.5 m/s and 1.85 m/s.

The simulation model of auto parking garage in Pathfinder and simulation moment of potential
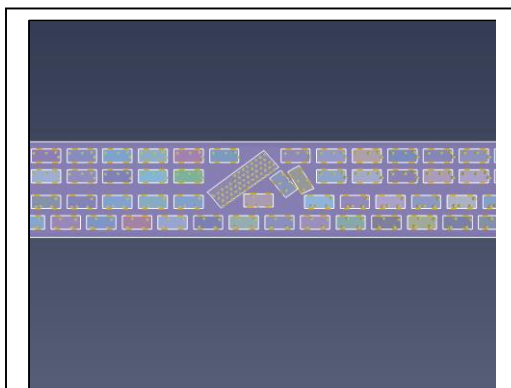

Figure 9. Simulation model of the Terazije tunnel in Pathfinder with the marked position of a collision (figure source: Jevtić, B. R., *Simulation of evacuation from the Terazije Tunnel*).
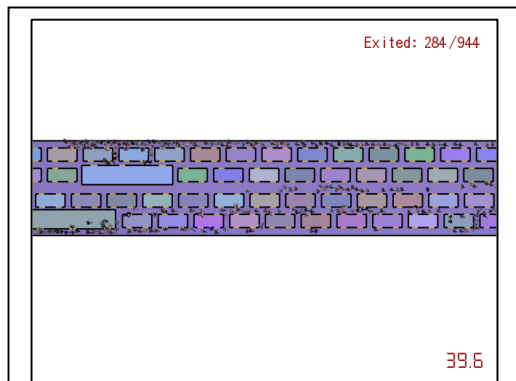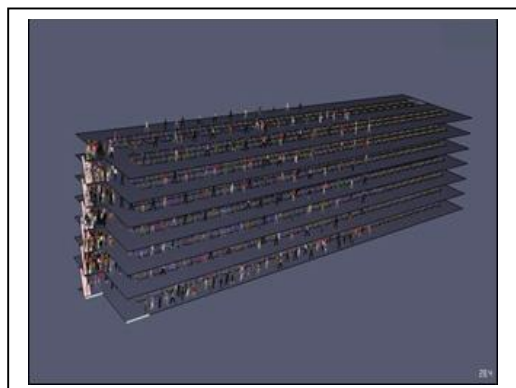

Figure 11. The simulation model of auto parking garage in Pathfinder (figure source: Jevtić, B. R., *Evacuation from a parking garage*).
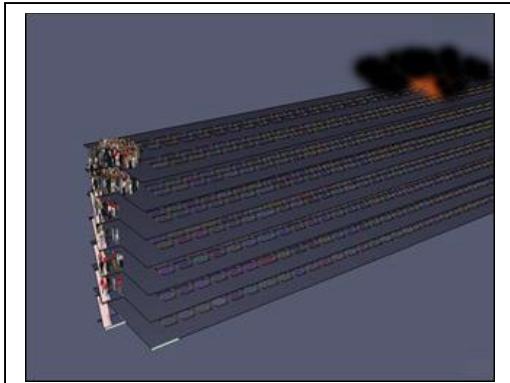
Figure 12. Simulation moment of potential jam situation for the first scenario with fire and smoke presence on vehicles (figure source: Jevtić, B. R., *Evacuation from a parking garage*).

jam situation for the first scenario are presented on Figs. 11 and 12 [9].

The seventh example present evacuation of high residential building. Residential buildings present objects full with occupants. These objects are very complex for evacuation, especially if they are high. Occupants in residential buildings are of different ages, so, related to that fact, their behavior in evacuation can be different and significantly influenced on evacuation time. One of the main problems for these objects is that the number of evacuation routes is limited-the potential evacuation routes are elevators, stairs and fire stairs. But, very often, during evacuation, related to many approaches, elevators shouldn't be used because of many reasons. So, it is very important to carefully analyze residential building and predict potential evacuation routes.

The simulated high residential building realized as two connected smaller buildings with basement and 50 floors. Maximal height of each building was 132.6 m. The complete number of occupants were 1632. There were four scenarios analyzed for evacuation.

The first evacuation scenario from building was realized only by ordinary stairs usage. The second evacuation scenario from building was realized only by emergency stairs usage. The third evacuation scenario from building was realized by ordinary stairs and emergency stairs usage. The fourth evacuation scenario from building was realized by ordinary stairs and elevators usage. For every of four potentials
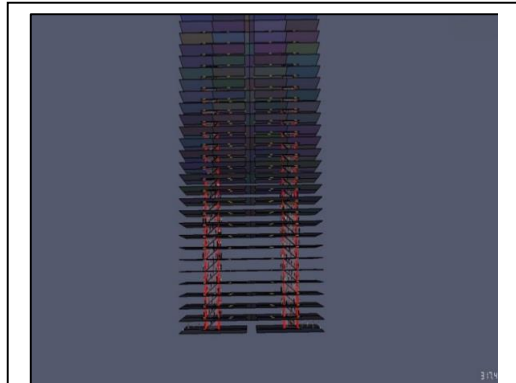
Figure 13. Simulation moment from the third scenario after 317.4 seconds after the beginning of simulation start for occupant`s speed of 1 m/s (figure source: Jevtić, B. R., *Example of evacuation simulation from a high-rise residential building*).
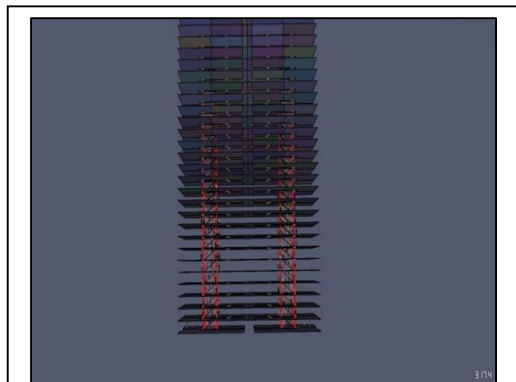
Figure 14. Simulation moment from the second scenario after 321.0 seconds after the beginning of simulation start for occupant`s speed of 1 m/s (figure source: Jevtić, B. R., *Example of evacuation simulation from a high-rise residential building*).

evacuation scenarios, speeds of occupants were 0.8 m/s, 1 m/s, 1.2 m/s, and 1.4 m/s.

Simulation moment from the third scenario after 317.4 seconds after beginning of simulation for occupant`s speed of 1 m/s and simulation moment from the second scenario after 321.0 seconds after the beginning of simulation start for occupant`s speed of 1 m/s are presented on Figs. 13 and 14 [10].

IV. CONCLUSION

Presented examples clearly showed great advantages of simulation software usage. At the first place, it is safety. It is impossible for such huge objects such as schools, auto parking garages, high residential buildings, tunnels and

similar to safety simulate human evacuation on any other way. Evacuation can be very complex and can cause many problems, even and human victims. The other very important advantage is prediction. Using by simulation software, it is possible to check existing evacuation routes in different conditions and find new evacuation routes. Evacuation and reasons for evacuation almost always cause fear and panic, what implies with unpredicted and uncontrolled behavior of occupants. So, any kind of prediction could make a great benefit in the sense of evacuation efficiency. Because of noted facts, simulation software presents unavoidable engineer`s tool.

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The Impact of Covid-19 on Companies: Insights from Serbia and Kuwait

Slobodan Adžić[1], Jarrah Al-Mansour[2]

[1]University Union – Nikola Tesla, Faculty of Management FAM, Sremski Karlovci, Serbia
[2]Arab Open University, Business Faculty, Farwanya, Kuwait

[1]s.adzic@famns.edu.rs, [2]jarrah@aou.edu.kw

Abstract—**The pandemic of the coronavirus known as COVID-19 has spread rapidly across the globe. This is not just a medical crisis; rather, it is a business crisis as well. Therefore, the aim of this paper is to present a research scale that could be used to analyze the impact of COVID-19 on business. The authors adopted a scale variables approach that is generated from topics covered in the papers of leading academic business journals to form the basis of our analysis. The scale was used to investigate the impact of the COVID-19 on businesses in two countries, namely Serbia and Kuwait, to represent two different continents. The results of this research indicate that the influence of this coronavirus is equally devastating in both countries Kuwait with its otherwise good economic conditions and Serbia with relatively poor ones. The findings of the research are beneficial for both academics in producing quality output papers, as well as their support to managers in various business industries in their fight against coronavirus to keep their businesses sustainable.**

Keywords - COVID-19, business analysis, research scale, Serbia, Kuwait.

I. INTRODUCTION

In the first part of this paper we critically evaluated the existing papers from the leading journals on the impact of COVID-19 on business, in order to generate the variables for the quantitative research. From the twenty chosen variables, we constructed a research scale "Impact of COVID-19 on Business". Thereafter, the empirical testing of the variables on the business enterprises in Serbia and Kuwait is presented, and the findings introduced. In conclusion, avenues for future research are identified.

II. RESEARCH PROCEDURES

The aim of this paper is to present a research scale published by the authors in a journal [1], which can be used to analyse the impact of COVID-19 on business. We adopted scale variables approach that is generated from topics covered in the papers of leading academic business journals, which form the basis of our analysis. We exposed the scale to qualitative and quantitative testing and concluded that it is reliable for research on the negative effects of COVID-19 on enterprises. The scale was used to investigate the impact of the COVID-19 on businesses in two countries, namely Serbia and Kuwait, to represent two different continents. We divided the findings into two main categories, namely contemporary academic findings and empirical findings. In the first category, we have identified twenty critical variables from the extant literature in relation to the research scale of the "Impact of COVID-19 on Business", as follows:

1. Working from home [2–4]
2. Declined productivity [4,5]
3. Availability of the Internet and web-based technology [6–8]
4. Modernity of the IT technology [9]
5. Digital innovations [10]
6. Lack of financial resources [11]

7. Governments financial assistance [12]

8. Disturbance of operations [13]

9. Disturbance of the supply network [2,13]

10. Cost cuttings [9]

11. Lay-offs [6,14]

12. Income security [15,16]

13. Revenue enhancement [16]

14. Innovative marketing strategies and tactics [17]

15. New business opportunities [18].

16. Business model innovation [19,20]

17. Corporate social responsibility activities [21,22]

18. Effective leadership [2,9,23–26]

19. Resilience [13,27,28]

20. New forms of collaboration [21].

TABLE I. THE RESULTS OF THE COVID-19 IMPACT IN WHOLE SAMPLE, RESEARCH VARIABLES IN DESCENDING ORDER

	N	Mean	Std. Deviation
We managed to achieve the revenue enhancement during the COVID-19 pandemic	50	3.74	1.352
We introduced the working from home practices during the COVID-19 pandemic	50	3.66	1.533
We managed to achieve the new business opportunities during the COVID-19 pandemic	50	3.56	1.431
We experienced the disturbance of our operations during the COVID-19 pandemic	50	3.52	1.313
We conducted the cost cuttings during the COVID-19 pandemic	50	3.48	1.403
We managed to innovate our business model during the COVID-19 pandemic	50	3.40	1.278
We accomplished the innovative marketing strategies and tactics during the COVID-19 pandemic	50	3.40	1.414
We received the financial help from the Government during the COVID-19 pandemic	50	3.36	1.758
We experienced the disturbance of the supply network during the COVID-19 pandemic	50	3.30	1.488
Our productivity declined during the COVID-19 pandemic	50	3.20	1.400
We experienced the lack of financial resources during the COVID-19 pandemic	50	3.16	1.361
Our organization was involved in the corporate social activities during the COVID-19 pandemic	50	2.98	1.505
We managed to negotiate some new forms of collaborations with the other organizations during the COVID-19 pandemic	50	2.96	1.442
GRAND AVERAGE	50	2.9060	0.56736
We managed to achieve the digital innovations during the COVID-19 pandemic	50	2.54	1.373
Our organization was resilient during the COVID-19 pandemic	50	2.46	1.328
Our IT technology during the COVID-19 pandemic was modern	50	2.00	0.990
The leadership in our organization was effective during the COVID-19 pandemic	50	1.96	1.160
We conducted the lay-offs during the COVID-19 pandemic	50	1.92	1.322
The availability of the Internet and web-based technology during the COVID-19 pandemic was satisfying	50	1.86	0.990
Our workers had income security during the COVID-19 pandemic	50	1.66	1.154
Valid N (listwise)	50		

For the second category, we developed a quantitative survey and collected our data from Serbia and Kuwait in the first half of July 2020. From the twenty variables, we formed twenty Likert-scale questions. We distributed our survey electronically through an online host, Google Docs. It should be noted that our targeted participants were managers from private and public organizations. We adopted a snowball sampling technique to collect the required data. This technique was adopted so as to reach a wider range of managers from both countries, who are believed to possess the correct knowledge for and who would enrich the findings of this research.

As for data analysis, we aimed to establish the reliability of the twenty most critical variables in relation to the research scale of the "Impact of COVID-19 on Business", which was further developed to form the questions of the survey. Therefore, the reliability of our Likert scale was intended to assure that the current themes, which were published in leading journals, indeed cover the topics of critical

TABLE II. The results of the COVID-19 impact in Serbia, variables in descending order

Serbia	N	Mean	Std. Deviation
We managed to achieve the revenue enhancement during the COVID-19 pandemic	32	3.94	1.318
We introduced the working from home practices during the COVID-19 pandemic	32	3.75	1.666
We experienced the disturbance of our operations during the COVID-19 pandemic	32	3.59	1.292
We managed to innovate our business model during the COVID-19 pandemic	32	3.56	1.243
We conducted the cost cuttings during the COVID-19 pandemic	32	3.56	1.523
We managed to achieve the new business opportunities during the COVID-19 pandemic	32	3.53	1.414
We accomplished the innovative marketing strategies and tactics during the COVID-19 pandemic	32	3.47	1.524
Our productivity declined during the COVID-19 pandemic	32	3.22	1.362
We experienced the disturbance of the supply network during the COVID-19 pandemic	32	3.13	1.621
We managed to negotiate some new forms of collaborations with the other organizations during the COVID-19 pandemic	32	3.03	1.470
We experienced the lack of financial resources during the COVID-19 pandemic	32	2.94	1.435
Average Serbia	32	2.8141	0.63452
Our organization was involved in the corporate social activities during the COVID-19 pandemic	32	2.81	1.635
We managed to achieve the digital innovations during the COVID-19 pandemic	32	2.81	1.533
We received the financial help from the Government during the COVID-19 pandemic	32	2.78	1.773
Our organization was resilient during the COVID-19 pandemic	32	2.22	1.184
Our IT technology during the COVID-19 pandemic was modern	32	1.84	1.110
The availability of the Internet and web-based technology during the COVID-19 pandemic was satisfying	32	1.78	1.039
The leadership in our organization was effective during the COVID-19 pandemic	32	1.66	0.902
We conducted the lay-offs during the COVID-19 pandemic	32	1.38	1.008
Our workers had income security during the COVID-19 pandemic	32	1.28	0.851
Valid N (listwise)	32		

interest to the business community in the context of COVID-19. After assuring this reliability, we have then moved to test the statistical differences of the impact of COVID-19 on business enterprises in Serbia and Kuwait. The results should explain if the impact of this pandemic is universal or country specific. To facilitate this purpose, we analysed our data using IBM's SPSS Statistics for Windows, version 25.

III. Empirical Findings

Our data were collected from Serbia and Kuwait during the first half of July 2020. We collected 59 responses of which nine were answered by non-managers. Therefore, we had 50 valid responses ($n = 50$) of which 32 were from Serbia and 18 from Kuwait. The mode of the Serbian sample is a male (78%) aged 30-50 (56%) with a Bachelor's degree (59%) who works as a CEO (53%) in a small (62%) and private (88%) company. The mode of the Kuwaiti sample is a male (89%) aged 30-50

TABLE III. THE RESULTS OF THE COVID-19 IMPACT IN KUWAIT, VARIABLES IN DESCENDING ORDER

| Kuwait	N	Mean	Std. Deviation
We received the financial help from the Government during the COVID-19 pandemic	18	4.39	1.195
We experienced the disturbance of the supply network during the COVID-19 pandemic	18	3.61	1.195
We managed to achieve the new business opportunities during the COVID-19 pandemic	18	3.61	1.501
We experienced the lack of financial resources during the COVID-19 pandemic	18	3.56	1.149
We introduced the working from home practices during the COVID-19 pandemic	18	3.50	1.295
We experienced the disturbance of our operations during the COVID-19 pandemic	18	3.39	1.378
We managed to achieve the revenue enhancement during the COVID-19 pandemic	18	3.39	1.378
We conducted the cost cuttings during the COVID-19 pandemic	18	3.33	1.188
We accomplished the innovative marketing strategies and tactics during the COVID-19 pandemic	18	3.28	1.227
Our organization was involved in the corporate social activities during the COVID-19 pandemic	18	3.28	1.227
Our productivity declined during the COVID-19 pandemic	18	3.17	1.505
We managed to innovate our business model during the COVID-19 pandemic	18	3.11	1.323
Average Kuwait	18	3.0694	0.38659
Our organization was resilient during the COVID-19 pandemic	18	2.89	1.491
We conducted the lay-offs during the COVID-19 pandemic	18	2.89	1.278
We managed to negotiate some new forms of collaborations with the other organizations during the COVID-19 pandemic	18	2.83	1.425
The leadership in our organization was effective during the COVID-19 pandemic	18	2.50	1.383
Our workers had income security during the COVID-19 pandemic	18	2.33	1.328
Our IT technology during the COVID-19 pandemic was modern	18	2.28	0.669
We managed to achieve the digital innovations during the COVID-19 pandemic	18	2.06	0.873
The availability of the Internet and web-based technology during the COVID-19 pandemic was satisfying	18	2.00	0.907
Valid N (listwise)	18		
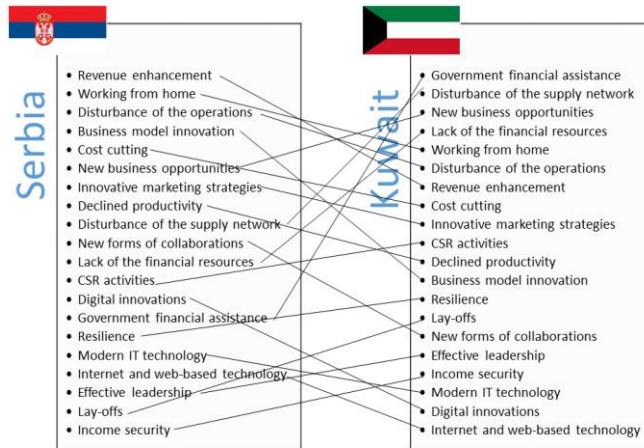
Figure 1.   A complex pattern of COVID-19 effects on business

(78%) with a Bachelor's degree (67%) who works at a senior level (44%) in a small (56%) and private (89%) company.

Our results should evaluate the impact of COVID-19 on businesses and the strongest impact should be rated with the highest grade. Therefore, from our 20 five-point Likert scale questions, 13 questions should be transformed in a reverse order for research purposes, since not all questions indicate the weaknesses in the business enterprises. Further, we conducted the reliability analysis of our scale in SPSS. The calculated Cronbach's Alpha coefficient is 0.75. Therefore, we can conclude that the internal consistency of our scale "Impact of COVID-19" is good, since values above 0.7 are considered acceptable. The particular result not only indicates that the scale "Impact of COVID-19" we developed is suitable for our (and indeed any other) research into the COVID-19 pandemic's impact on business, but also that the current contributions in the leading business journals presented in our literature review are not infodemia, but valid and robust research. However, the total statistical results of our scale showed a negative correlation for the first and seventh questions, i.e., "working from home practices" and "financial help from the Government". When we excluded those two questions from our scale, the Cronbach's Alpha coefficient raised to 0.838. Since values above 0.8 are preferable, the options are to check if a question should be reversed, if a question should be removed, or if a question should be left in. We decided not to remove these two questions, which we found important to leave in our scale

of 20 questions. The "working from home" is one of the most recognizable COVID-19 phenomena. This radical turn in organizing was not chosen by companies; therefore, we refrained from reversing that scale and we left the question as it was. The "financial help from the Government" was a reverse scale question with the logic that financial help improves the liquidity and lowers the impact of the coronavirus. We decided to leave the question as it was, presuming that the negative result is the consequence of divergent Governments politics during the time of coronavirus, which our later results will show.

The average impact of COVID-19 on businesses in both countries (Table I) is rated at 2.91. A grand average grade that is so close to the mid-point of the scale is an indicator that all the possible successful actions of the companies and the positive influences from the environment are effectively countered by the negative ones. The diminished revenues, rated at 3.74, had the strongest and the most devastating impact the on businesses of both countries during this outbreak. The working from home practices and the lack of new business opportunities followed. The fourth and fifth most influential were the disturbance to operations and the cost reduction and elimination. Income insecurity of workers, rated at 1.66, had the weakest impact on the businesses of both countries. Internet and IT technology, as well as job insecurity both had weak impacts. An interesting point is that leadership appears to be graded quite high during the current outbreak. Serbian and Kuwaiti leaders appear then to have managed to cope with the crisis and indeed to

reduce the impact of coronavirus on their organizations.

In order to test the statistical differences in the impact of COVID-19 on businesses in Serbia and Kuwait, we applied an independent samples t-test, a parametric technique to compare the mean scores of the two countries from our sample. There was no significant difference $t(48) = -1.549, p = 0.128$ in the scores for Serbia ($M = 2.81, SD = 0.63$) and Kuwait ($M = 3.07, SD = 0.39$), with a small-sized effect, $r = 0.22$. Although we failed to reject the null hypothesis, the result is entirely expected. The COVID-19 pandemic has had, and is still having, a devastating impact on businesses worldwide. All countries and most businesses are experiencing the negative consequences of this deadly virus. There is no difference in the impact of COVID-19 on businesses in Serbia and Kuwait; both countries are in an equally bad position. However, even without statistical significance between the two countries, we decided to point out some differences in the attitudes of managers in Serbia (Table II) and Kuwait (Table III).

Serbia reported a lower result of 2.81 on the impact of COVID-19 on business compared with the Kuwaiti result of 3.07. However, both results are around 3.0, which indicates that the negative effects of the pandemic on businesses is similar. The strongest impact on businesses in Kuwait during the pandemic, with a value of over 4, was the lack of Government financial support. In Serbia, this variable was graded as being not particularly important since it was in 17th place in descending order of the variables. The Serbian Government paid all interested companies, which was the vast majority, the minimum wage of all workers for the first three months of outbreak from the governmental budget, but with the condition that these companies could not lay any of their workers off during that period. Obviously, the Kuwaiti Government did not intervene or offer financial help to its enterprises. The strongest impact on businesses in Serbia was the problem of revenue enhancement. The more significant issues in Kuwait were the disturbance of the supply network and the failure to achieve new business opportunities, unlike Serbia where the more significant issues were the disturbance to operations and the failure to innovate the business model. Due to the financial support from the Government, income insecurity and fear of lay-offs were the least important issues in Serbia which, unlike Kuwait, were at the bottom

of the table of COVID-19 effects we find Internet and web-based technologies and digital innovations. Moreover, the last two and first three effects by country are not the same. In fact, the impacts of COVID-19 are different in each country as pertaining to economic structure, enterprise strength, government policy, etc. An example of these specific influences would be a complex web of different effects of COVID-19 in Serbia and Kuwait (Fig. 1). Neither for Serbia nor Kuwait, as we can see from Fig. 1, were any of the twenty variables positioned in the same place.

IV. Conclusion

The scale "Impact of COVID-19", which we have developed from selected topics from leading academic journals, has a good internal consistency. The devastating impact of the virus on business is the same in both countries in the sample. For now, COVID-19 cancels out all the good deeds from the internal and external environment.

The extension of this research certainly would be welcomed. As such, including a larger number of countries in the sample is an obvious avenue of exploration. Moreover, the possibility that the businesses have by themselves recognized the critical issues or variables that remain unrecognized in the literature certainly exists. The potentially fruitful research of these in-depth findings is certainly one direction we would like to explore.

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Multiple-Criteria Framework for Cloud Service Selection

Gabrijela Popović[1], Darjan Karabašević[2], Dragiša Stanujkić[3]

[1,2]Faculty of Applied Management, Economics and Finance, Belgrade, Serbia
[3]Technical Faculty in Bor, Bor, Serbia

[1]gabrijela.popovic@mef.edu.rs, [2]darjan.karabasevic@mef.edu.rs, [3]dstanujkic@tfbor.bg.ac.rs

Abstract—**This paper proposes the Multiple-Criteria Decision-Making (MCDM) framework as an aid for the evaluation of the cloud services and selection of an appropriate one regarding the given conditions. The proposed framework is based on the recently proposed *MEthod based on the Removal Effects of Criteria – MEREC* and *The Simple Weighted Sum Product – WISP* method. The MEREC method is used for defining the criteria weights and it represents the objective type of weighting method. The WISP method is used for the final evaluation and ranking of the considered alternatives. The applicability of the proposed framework is demonstrated by using the numerical example borrowed from the literature. Four alternatives are assessed regarding the four evaluation criteria. The final results are adequate and confirm the applicability of the proposed framework.**

Keywords – MCDM, MEREC method, WISP method, cloud service selection.

I. Introduction

Existence of the cloud services, that can very easily replace the IT infrastructure within an organization, has influenced the understanding in which way the computing resources could be solicited. Cloud Service Providers (CSPs) gain an important role because the organizations leave it to them to handle their computer resources, while the organizations can freely perform their crucial business activities [1].

CSPs offer various types of services to their customers, to mention some of them: IaaS, PaaS, and SaaS. The number of different types of cloud services is constantly increasing which makes it more difficult to make a decision about the selection of the appropriate one [2]. The main

task for an organization is to select the optimal service from the appropriate cloud provider at the right period [3]. The mentioned leads to the conclusion that the various criteria impact the final decision. Making the decision about cloud service regarding one or smaller number of criteria is not appropriate approach for an organization. In order to elicit the best possible solution, it is necessary to involve all of the influential criteria important for succeeding in the optimal decision. For that matter, the application of the Multiple-Criteria Decision-Making methods represents an appropriate way to incorporate all the evaluation criteria into the decision-making process.

MCDM is a scientific field which is developing very fast in recent years, and gained significant popularity among scientists. Until now, many different MCDM approaches are proposed for the resolving of different types of problems [4]–[10]. These techniques are used as a decision-making aid in the field of information and communication technologies as well [11]–[17].

In this paper, the MCDM framework based on the *MEthod based on the Removal Effects of Criteria – MEREC* [18] and *The Simple Weighted Sum Product – WISP* [19] is proposed. The MEREC method will be used for defining of the criteria weights, while the WISP method will be applied for the final ranking of the considered alternatives. These two methods are relatively novel and their potential is not completely tested yet. The applicability of this framework will be shown by using numerical example retrieved from the literature [2]. The main aim of this paper is to demonstrate the usefulness of the proposed framework for the application in the field of

cloud service selection and not only that, but the all-necessary computer resources. With that goal the paper is organized as follows: in the second section the proposed framework is explained; the third section contains the numerical example which is followed by the conclusion.

II.   THE PROPOSED FRAMEWORK

A. The MEREC Method

Defining the criteria weights represents a very important part of the application of any multiple-criteria decision-making method. In this case, the recently proposed MEREC method is used [18]. The MEREC method represents the objective weighting method which the computational procedure relies on the input data presented in a decision matrix. Opposite to the other methods, in the process of defining the criteria weights, this method applies the removal effect of each criterion on the aggregate performance of alternatives. If the removal of the criterion causes greater effects on alternatives` aggregate performances, than the criterion has greater importance, which leads to the conclusion that this method is based on the concept of causality. Also, the MEREC method is very flexible because, decision-makers could use different functions to calculate the performance. In this case, the simple logarithmic measure is used for the calculation of the alternatives` performances, while the absolute deviation measure is applied for defining the effects of removing each criterion. Because the MEREC method is relatively novel, until now it is mentioned in a few studies [20-22].

The computational procedure of the MEREC method could be presented by the following series of steps [18].

Step 1. Form a decision matrix. The decision matrix should contain the values of each alternative relative to each criterion. If we have n alternatives and m criteria, the form of the decision matrix will be as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \dots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \dots & x_{nj} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

where x_{ij} denotes the elements of the decision matrix i.e. performance or rating of alternative i in relation to criterion j ($x_{ij} > 0$).

Step 2. Normalize the decision matrix. The normalized ratings are calculated in the following way:

$$n_{ij}^x = \begin{cases} \dfrac{\min_k x_{kj}}{x_{ij}} & if \quad j \in B \\[3mm] \dfrac{x_{ij}}{\max_k x_{kj}} & if \quad j \in C \end{cases}, \quad (2)$$

where n_{ij}^x represents elements of the normalized matrix N, B depicts the set of benefit criteria, and C shows the set of cost criteria.

Step 3. Calculate the overall performance of the alternatives. This is achieved by using (3):

$$S_i = \ln\left(1 + \left(\frac{1}{m}\sum_j \left|\ln(n_{ik}^x)\right| ij\right)\right), \quad (3)$$

where S_i represents the overall performance of the alternatives.

Step 4. Calculate the alternatives` performances by removing each criterion. In this step, the performances of the alternatives are computed based on removing each criterion individually. The equation looks as follows:

$$S_{ij} = \ln\left(1 + \left(\frac{1}{m}\sum_j \left|\ln(n_{ik}^x | ij\right)\right)\right), \quad (4)$$

where S_{ij} denotes the overall performance of alternative i regarding the removal of criterion j.

Step 5. Calculate the summation of the absolute deviations. The removal effect of the criterion j is calculated by using (5):

$$E_j = \sum_i \left|S'_{ij} - S_i\right|, \quad (5)$$

where E_j represents the effect of removing criterion j.

Step 6. Define the overall criteria weights. The final value of the criteria weights is calculated as follows:

$$W_j = \frac{E_j}{\sum_k E_k}, \quad (6)$$

where w_j represents the weight of the criterion j.

B. The WISP Method

The WISP method is proposed by Stanujkic, Popovic, Karabasevic, Meidute-Kavaliauskiene, and Ulutaş [19]. To define a final utility of an alternative, the WISP method incorporates four relationships between benefit and cost criteria. Until now, there is no evidence of application of the WISP method because it has been proposed very recently.

The calculation procedure of this method could be represented by using the following series of steps.

Step 1. Form a normalized decision matrix. The normalized ratings are computed in the following way:

$$r_{ij} = \frac{x_{ij}}{\max_i x_{ij}}, \qquad (7)$$

where r_{ij} denotes a dimensionless number that represents a normalized rating of alternative i regarding the criterion j.

Step 2. Compute the values of four utility measures, by using the following Eqs.:

$$u_i^{wsd} = \sum_{j\in\Omega_{\max}} r_{ij} w_j - \sum_{j\in\Omega_{\min}} r_{ij} w_j, \quad (8)$$

$$u_i^{wpd} = \prod_{j\Omega_{\max}} r_{ij} w_j - \prod_{j\Omega_{\min}} r_{ij} w_j, \quad (9)$$

$$u_i^{wsr} = \frac{\sum_{j\in\Omega_{\max}} r_{ij} w_j}{\sum_{j\in\Omega_{\min}} r_{ij} w_j}, \qquad (10)$$

$$u_i^{wpr} = \frac{\prod_{j\in\Omega_{\max}} r_{ij} w_j}{\prod_{j\in\Omega_{\min}} r_{ij} w_j}, \qquad (11)$$

where: u_i^{wsd} and u_i^{wpd} represent differences between the weighted sum and weighted product of normalized ratings of alternative i, respectively. Analogous to the previous one, u_i^{wsr} and u_i^{wpr} remarks ratios between weighted sum and weighted product of normalized ratings of alternative i, respectively.

Step 3. Recalculate values of four utility measures, in the following way:

$$\bar{u}_i^{wsd} = \frac{1+u_i^{wsd}}{\left(1+u_{\max_i}^{wsd}\right)}, \qquad (12)$$

$$\bar{u}_i^{wsd} = \frac{1+u_i^{wpd}}{\left(1+u_{\max_i}^{wpd}\right)}, \qquad (13)$$

$$\bar{u}_i^{wsd} = \frac{1+u_i^{wsr}}{\left(1+u_{\max_i}^{wsr}\right)}, \qquad (14)$$

$$\bar{u}_i^{wpr} = \frac{1+u_i^{wpr}}{\left(1+u_{\max_i}^{wpr}\right)}, \qquad (15)$$

where: $\bar{u}_i^{wsd}$, $\bar{u}_i^{wpd}$ $\bar{u}_i^{wsr}$ and $\bar{u}_i^{wpr}$ represents recalculated values of u_i^{sd}, u_i^{pd}, u_i^{sr} and u_i^{pr}.

Step 4. Define the overall utility u_i of each alternative by using (16):

$$u_i = \frac{1}{4}\left(\bar{u}_i^{wsd} + \bar{u}_i^{wpd} + \bar{u}_i^{wsr} + \bar{u}_i^{wpr}\right). \quad (16)$$

Step 5. Rank the alternatives and select the most appropriate one. The ranking of alternatives is performed in descending order. The alternative with the highest value of u_i is the best one.

III. NUMERICAL EXAMPLE

The applicability of the proposed model is demonstrated over a numerical example regarding the selection of a suitable cloud service. This example is retrieved from the paper of Nawaz, Asadabadi, Janjua, Hussain, Chang, and Saberi [2]. Four alternative cloud services are evaluated against four criteria. The used criteria are as follows:

- Central processing unit (CPU) represents the main part of any digital computer system, which is generally constituted of the main memory, control unit, and arithmetic-logic unit.

- Memory refers to a possibility to acquire, store, retain, and later restore information.

- Input/output (I/O) is the communication between an information processing system, such as a computer, and the environment, such as a human user or another information processing system.

- Cost means the price which the user or client pays to the CSPs for using the services that they provide.

TABLE I.		INPUT DATA.		
		C_1	C_2	C_3	C_4
unit		CPU	Memory	I/O	Cost
measure		ms	ms	ms	$
optimization		max	max	max	min
A_1	OP_1	2056.19	1455.72	1035.82	0.09
A_2	OP_2	80.77	81.94	260.42	0.02
A_3	OP_3	860.15	126.66	722.40	0.03
A_4	OP_4	2200.70	532.28	4187.19	0.07

Information about the considered alternatives and evaluation criteria are presented in Table I.

First, for defining the weights of criteria the MEREC method is applied. By using Eq. (2) decision-maker calculated normalized performance ratings which are presented in Table II.

Further, it is necessary to obtain the overall performances of alternatives. This is achieved by using (3). The calculated values are presented in Table III.

Table IV shows the overall performances of alternatives gained by removing each criterion (S'_{ij}).

Calculation of the removal effect of each criterion on the alternatives` overall performance is defined by using (5). The obtained results are presented in Table V.

Finally, the weights of criteria are obtained by applying (6) and they are as in Table VI.

TABLE II.   THE NORMALIZED DECISION MATRIX.

	C_1	C_2	C_3	C_4
A_1	0.0393	0.0563	0.2514	1.0000
A_2	1.0000	1.0000	1.0000	0.2260
A_3	0.0939	0.6469	0.3605	0.3051
A_4	0.0367	0.1539	0.0622	0.7345

TABLE III.   THE OVERALL PERFORMANCES OF ALTERNATIVES.

	S_i
A_1	1.06
A_2	0.32
A_3	0.81
A_4	1.12

TABLE IV. S'_{ij} VALUES.

	C_1	C_2	C_3	C_4
A_1	0.72	0.77	0.93	1.06
A_2	0.32	0.32	0.32	0.00
A_3	0.51	0.76	0.69	0.67
A_4	0.81	0.95	0.86	1.09

TABLE V. E_j VALUES.

	E_j
C_1	0.97
C_2	2.35
C_3	1.23
C_4	0.96

TABLE VI.   THE CRITERIA WEIGHTS.

	w_j
C_1	0.18
C_2	0.43
C_3	0.22
C_4	0.17

As Table VI shows, the most significant criterion is $C_2 - Memory$, while the least important is criterion $C_4 - Price$. It should be remarked again that the obtain weights are objective because the computational procedure is based on the input data and not on the standpoint of a decision-maker.

After defining the criteria weights, the final ranking order of the considered alternatives will be determined by using the WISP method.

Recalculated values of four utility measures are computed by using (12) – (15), and they are shown in Table VII.

TABLE VII.   RECALCULATED VALUES OF FOUR UTILITY MEASURES.

	$\overline{u}_i^{wsd}$	$\overline{u}_i^{wpd}$	$\overline{u}_i^{wsr}$	$\overline{u}_i^{wsd}$
A_1	0.33	-0.17	0.70	0.02
A_2	0.00	-0.04	0.21	0.00
A_3	0.06	-0.05	0.51	0.00
A_4	0.29	-0.12	0.82	0.05

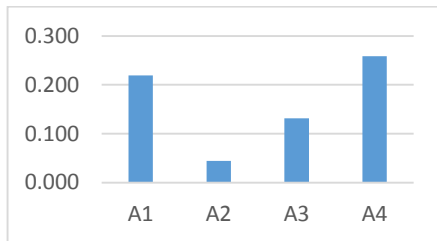|	u_i	Rank
A_1	0.219	2
A_2	0.044	4
A_3	0.131	3
A_4	0.258	1

Figure 1. The ranking order of the alternative cloud services.

By using (16) the final ranking order of the alternative cloud services is calculated. The rank of the alternatives submitted under the evaluation is presented in Table VIII.

As can be seen, the most suitable alternative is $A_4 - OP_4$, while the worst-ranked is alternative $A_2 - OP_2$. The obtained results are presented graphically, as well (Fig. 1).

IV. CONCLUSION

The MCDM framework for the evaluation and selection of the optimal cloud service is proposed in this paper. The mentioned framework relies on the MEREC method, which is used for defining the criteria weights, and the WISP method, which is applied for the final ranking and selection of the optimal alternative cloud service. The numerical example is borrowed from the literature [2], because the main intention is to demonstrate the usefulness of this framework based on the two newly introduced MCDM methods. The final results confirm the adequacy of this novel approach which is supported by the fact that the obtained ranking order of the alternatives matches with that one gained by the other authors [2].

The main limitation of the paper is the involvement of only one decision-maker in the evaluation process. Also, the numerical example is based on the crisp numbers that lead to the neglecting of the vagueness and uncertainty of the environment. Additionally, the results would

be more representative o the greater number of criteria is introduced into decision procedure.

The propositions for future research are directed to the introduction of the adequate extensions of these methods by involving the grey, fuzzy or neutrosophic numbers. Also, it is desirable to perform the decision-making process under the group decision environment. Besides, it would be very interesting to define objective-subjective weights of criteria by introducing some of the subjective weighting methods. But, after all, the proposed framework demonstrated its potential which should be verified in the other business fields, as well.

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Intellectual Capital of Cultural Heritage as a Development Factor of Service Activities

Olja Arsenijević[1], Nenad Perić[2]

[1,2]Institute of Serbian Culture Priština/Leposavić, Serbia

[1]arsenijevicolja@gmail.com, [2]nesaperic@hotmail.com

Abstract—**The cultural wealth of our people represents a very important potential for the development of both the service sector and the entire Serbian economy through the presentation of the original cultural heritage and products derived from it. However, how can we use this huge intellectual capital that we all have and turn it into a value that will provide jobs, a better standard of living and economic growth and development of Serbia? The aim of this paper is to answer this question and it refers not only to the economic justification of projects from our cultural heritage, but also to the preservation and protection of cultural wealth, as well as sustainable cultural development. After the general introduction to the concept and classification of cultural heritage as well as the most important characteristics of cultural heritage in Serbia, the definition of the intellectual capital of cultural heritage follows and the presentation of the model of intellectual capital of cultural heritage by Bratian and Beženar. After that, through the intellectual capital of service activities and its definition and structure, the key creators of the value of intellectual capital in Serbian service companies are presented. The problem of the negative impact of globalization on the preservation and protection of cultural heritage is also addressed, as well as the possibility of preserving and presenting cultural heritage thanks to digitalization. Finally, we herewith present the treatment of one of the most important issues of cultural heritage, and that is the issue of intellectual property, as well as the issue of geographical indications of products, which is perhaps the most important development potential of Serbian companies when it comes to cultural heritage.**

Keywords –cultural heritage, intellectual capital, preservation, protection.

I. INTRODUCTION

In a knowledge-based economy, the terms knowledge economy and knowledge-based economy are distinguished. The knowledge economy refers to the production of knowledge, while the knowledge-based economy uses knowledge and technology to ensure growth and development and higher engagement of the capacities. The most developed economies are also economies that base their business on knowledge, and the most successful countries are also countries that adapt to changes in the environment thanks to innovation. However, the knowledge-based economy implies more efficient use and implementation, but also the development of existing and new knowledge, which is achieved by connecting and cooperating entities from the private and public sectors.

There are four key factors influencing the knowledge-based economy to play a key role in countries' economic development:

1. extremely large number of information and communication technologies;
2. acceleration of scientific and technological progress;
3. global competiton growth;
4. implementation of demand and shifting of consumer attitudes and tastes towards entertainment due to growing incomes and revenues [1].

In order to use knowledge effectively, it is necessary for knowledge to participate more in the service sector, but also for the service sector to grow thanks to knowledge; furthermore it is necessary to increase investment in education and training, view innovation as a key source of economic growth and competitiveness of companies, regions and national economies, to develop and widely use new information and communication technologies.

"The key value of the concept of knowledge economy is that it connects the creative potentials of the human factor, innovation potential and technology, as generators of growth, institutions and economic actors, which is crucial for initiating and sustainability of economic growth and development. The synergetic effect of these key factors has a decisive impact on the productivity and competitiveness of the national economy, which creates realistic preconditions for quality economic growth and sustainable development. This concept is of special importance for developing countries, such as the Republic of Serbia (RS), because the transfer of technological knowledge and skills improves development potentials in the highest quality and long-term sustainable way" [2].

II. THE CONCEPT AND CLASSIFICATION OF CULTURAL HERITAGE

The backbone of the international legal framework for the protection of cultural heritage is under the auspices of UNESCO (United Nations Educational, Scientific and Cultural Organization) [3]. Within the framework of the United Nations, the organization was established in 1945, and for its main goal, the organization adopted the contribution of peace and security by supporting cooperation between nations, of course through education, science and culture."Evolving from its original meaning towards the notion of inheritance, the word heritage has gained an additional deeper meaning. In these extended contexts, the term heritage does not mean every heritage, but values, physical, spiritual, natural, cultural and historical, which were created by ancestors, and which are inherited by descendants (heirs) and which due to their importance must be preserved for posterity. Thus, heritage represents the natural, historical and cultural achievements of a certain area" [4].

Over time, the concept of cultural heritage has received many definitions and interpretations. The International Center for the Study and Restoration of Cultural Heritage provides over 60 definitions of cultural heritage or cultural property.

According to the UNESCO Convention for the Protection of Natural and Cultural Heritage of 1972, "cultural heritage means the following goods: monuments - works of architecture, monumental sculptures or paintings, elements or structures of archaeological character, inscriptions, most of elements of exceptional universal value from artistic or scientific point of view; group sites: groups of isolated or connected buildings, which by their architecture, unity and integration into the landscape represent an exceptional universal value from a historical, artistic or scientific point of view; famous places: works of human hands or combined works of human hands and nature, as well as zones, including archeological sites, that are of exceptional universal importance from a historical, aesthetic and ethnological or anthropological point of view" [5].

At the time when the above mentioned Convention was adopted, the danger of the accelerated disappearance of non-physical aspects of different cultures, ie social customs that emerged during the historical development of the community, was still not recognized [6].

The UNESCO General Conference held in Paris in 1989 recommended the preservation of traditional culture and folklore, where folklore is perceived as part of the general human heritage and as a powerful tool that connects different people and social groups thus affirming their cultural identity [7].

Thereafter, at the UNESCO General Conference held in Paris in 2003, the Convention for the Safeguarding of the Intangible Cultural Heritage was adopted, defining the intangible cultural heritage as follows: 'Intangible cultural heritage' means practices, representations, expressions, knowledge, skills and instruments. objects, artifacts and cultural premises associated with them - which communities, groups and, in some cases, individuals, recognize as part of their cultural heritage. Such an intangible cultural heritage, passed down from generation to generation, communities and groups recreate, depending on their environment, their interactions with nature and their history, giving them a sense of identity and continuity, and thus promoting respect for cultural diversity and human creativity. For the purposes of this

Convention, only the intangible cultural heritage shall be taken into account in accordance with the applicable international legal instruments in the field of human rights, as well as with the need for mutual respect of communities, groups and individuals, and sustainable development [8]. Intangible cultural heritage or, as it is often called, living heritage, includes traditional crafts and food, customs, social practices and rituals, beliefs, ways of oral expression and performance of folk dances and songs, which are still preserved today, and which the communities that inherit them pass down from generation to generation as a feature of their own identity [9].

In order to be included on the UNESCO World Heritage List, a heritage object must meet at least one of the following criteria: it must represent a masterpiece of human creative genius; represent an important interchange of human values during a certain period of time or within a certain cultural region in the world; it must represent the development of architecture or technology, sculptural art, city plans or environmental design; bear the unique or at least exceptional testimony of a cultural tradition or civilization that is alive or extinct; be an outstanding example of a type of building, architectural or technological ensemble or scene depicting exceptional stages in human history. Furthermore, it must be an outstanding example of traditional human life, land cultivation, use of the sea, which represents the culture of human interaction with the environment, especially when it becomes vulnerable under the influence of irreversible changes; it must be directly or materially connected with events or living traditions, with ideas or beliefs, with artistic or literary work of exceptional universal significance; it must contain an unsurpassed natural phenomenon or areas of outstanding natural beauty and aesthetic importance; it must be an outstanding example representing major stages in the historical development of the country, including testimonies of life, significant geological processes that are still ongoing or geomorphological or physiographic features; it must be an outstanding example representing significant ecological or biological processes that take place in the evolution and development of terrain, fresh water, coastal or marine ecosystems and plant and animal communities; it must contain the most important natural habitats that preserve biological diversity, including those that contain endangered species of exceptional

universal value from the point of view of science and conservation [10].

III. INTELLECTUAL CAPITAL OF CULTURAL HERITAGE

Ever since the adoption of the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage in 2003, intangible cultural heritage has become the subject of many interests in the field of heritage studies and related disciplines, and is considered a guarantee of sustainable development. The 2030 Agenda for Sustainable Development consists of an action plan that includes three dimensions - the economic dimension, the social dimension and the environmental dimension, and 17 sustainable development goals, including respect for three principles: human rights, equality and sustainability. Intangible heritage can effectively contribute to sustainable development through these three dimensions with security and peace as prerequisites for sustainable development [11].

The concept of cultural capital in terms of cultural heritage, currently includes both tangible capital - museums, archaeological sites, historic buildings, monuments, etc., and intangible capital, from art production, music, entertainment, to old crafts, traditional food and wine production, as well as traditional cultures that encompass the entire lives and lifestyles of human communities. [...] In this sense, heritage can now be perceived as a source of production and a strategic concept for the development of local economies, using categories of study and approaches that are typical of economic analysis [12].

Intangible heritage literally means those things that we do not see or can touch, but that we can feel. And it certainly involves memory. It is very important how people remember or how they think about the past and the things that currently affect them - things without physical presence. They are mostly related to our knowledge system. There are other categories that cannot be seen but can be heard. These are music, language, dance, performances, beliefs, rituals, various social practices, etc. which are not permanent. The notion of intangible encompasses all of the above.

Intangible cultural heritage as a living heritage can be a major source of innovation and development. Inclusive economic development as a dimension of sustainable development is dependent on stable, equitable and inclusive

economic growth, which is based on sustainable patterns of production and consumption. Local knowledge, skills and practices are maintained and improved through generations, providing livelihoods for many people. Performing arts, ceremonial events and other expressions of intangible cultural heritage also involve community members in economic development, including women and youth. Communities also benefit from tourism activities related to intangible cultural heritage. The discovery of various traditions, holiday events, performing arts, skills related to traditional crafts and other areas of intangible cultural heritage – all this is a powerful lever for attracting tourists at the national, regional and international levels [13].

"From the economic point of view, human creativity is a form of capital. It is a development resource that we call creative capital. According to creative capital theorists, the most important factors driving economic growth are: technology, talent and tolerance" [14]. In order to attract creative people, generate innovations and thus stimulate economic growth, it is necessary that all three factors exist simultaneously in the locality (nation state, region, city) that is the subject of analysis or observation [14].

According to Cecil Duwell, Secretary of the 2003 Convention and Director of the UNESCO Section for the Intangible Heritage, the value of the intangible cultural heritage should be determined in the following way: through a greater focus on the transfer of knowledge and skills than on products; through social and economic value more than commercial value; by applying different protection measures in relation to those applied to the tangible cultural heritage; through collective intellectual property rights or direct recognition of the value of cultural identity through the listing of elements of intangible cultural heritage [15].

According to the same author, the economic value of intangible cultural heritage depends on three elements: direct value that is directly related to products obtained from activities related to cultural heritage and these products can be used for own or other people's use or for commercial purposes; indirect economic value refers to the value of knowledge and skills, the value of transfer of knowledge and skills, then the income earned in other sectors through the activities of intangible cultural heritage, social values and prevention of social conflict; non-intervention costs , if necessary by society, costs

of restitution) and social damage (endangering the dialogue and mutual misunderstanding, respect, the origin of the conflict).

IV. CULTURAL HERITAGE INTELLECTUAL CAPITAL MODEL ACCORDING TO BRATIANU AND BEŽENAR

Bratianu and Beženar study the area of intellectual capital of cultural heritage through ecosystems that contain valuable artifacts that include rational, emotional and spiritual knowledge. These artifacts form a wide range from historical monuments and archeological sites to folklore tradition and religious ceremonies. These are complex systems of interactions and continuous transformations which indicate that intellectual capital is a dynamic entity that evolves from a potential state to an active, operational state. Furthermore, knowledge develops from an "emergent" state to the state that is embedded in cultural artifacts because development and conservation are in constant dynamics [16].

Before presenting this model, it is necessary to explain the terms "embedded" knowledge and "emergent" knowledge. "Embedded" knowledge is collective - tacit knowledge that is found in organizational routines and common norms [17]. "Emergent" knowledge is gained through learning that is more than lifelong learning. It refers to the fact that we create new knowledge constantly while facing different situations and challenges [18].

The authors start from Edwinson's dynamic model which includes time that enables continuous transformation from potential to operational state as a result of linear and nonlinear integrators (integrator is a powerful field of forces that combines two or more elements into a new entity based on independence and synergy). These elements can be physical or spiritual in nature and can have the ability to interact in a controlled way. The property of independence is needed to combine all the elements into a system.The synergy property allows to create extra energy from the work system. This is the feature that distinguishes linear from nonlinear integrators. Potential intellectual capital is the result of the integration of all intangibles in the ecosystem, from the past and the present. "Embedded" knowledge in all forms of cultural heritage and social structure continuously integrates "emergent" knowledge created by social interactions and defines the potential intellectual

capital of ecosystems. This potential is transformed into operational intellectual capital by the linear and nonlinear integrators that exist in the ecosystem. Linear integrators in ecosystems are all technologies and associated processes that bind people to work together, all infrastructure systems and all regulations that function within ecosystems. They are called "linear" because their effect is based on linear mathematical operations. Nonlinear integrators represent management systems of organizations or at higher administrative levels such as villages, cities, regions, cultural organizations, local traditions and various other forms of management. These integrators can produce a synergy that produces a higher level of ecosystem than the combined contribution of its individual components. Any organization may have a higher potential level of intellectual capital, but a lack of efficient integrators can lead to a very low level of operational intellectual capital (human, social, and structural capital) and its poor performance.

As stated earlier, knowledge can be rational, emotional, and spiritual and can be integrated at different levels of organization, network, and ecosystem. It can be embedded in artifacts, structures, legislation, traditions, folklore, natural landscapes and other elements of cultural heritage. Also, knowledge can be the result of human activity and can be integrated with linear and nonlinear integrators. The result is operating capital that transforms itself into value for the community within the ecosystem and for tourists who spend time within the ecosystem. For cultural heritage ecosystems, the economic dimension depends on business service that is directly related to operational intellectual capital. Even when all monuments, art and embedded knowledge contribute to potential intellectual capital, their value can mean to tourists only if the operational intellectual capital is at a high level and if it is supported by the accompanying strong infrastructure. In the ecosystem, the most important nonlinear integrator is the management, on which the transformation of intellectual capital into its operational form depends the most. It integrates rational knowledge. The culture of communities and their tradition, lifestyle and hospitality represent emotional and spiritual knowledge. Transport and communication systems are linear integrators and their contribution is essential for support in living and working conditions. The beauty of the landscape, places of cultural

heritage, monuments of culture and art are emotional and spiritual means for attracting tourists as well as rational drivers of economic development.

The authors of this model believe that it could serve and help various stakeholders to implement knowledge and to arrive at best decisions to increase the value of the operational intellectual capital of a particular ecosystem.

V. THE INTELLECTUAL CAPITAL OF CULTURAL HERITAGE AS A SOURCE OF COMPETITIVENESS OF SERVICE COMPANIES

"Creativity and creative industries underlie all thinking about development in the 21st century. In the past, creativity was treated as a gift from God, then it was considered the work of genius, and today it has already become a democratic heritage. Namely, politicians and managers, athletes and students, artists and engineers, scientists and real estate agents, bankers and lawyers, and everyone else would like to be creative. Therefore, creativity has acquired the status of a basic determinant of the competitive advantages of entrepreneurs, companies and national economies in a turbulent global market. Hence, an economy in which creativity is a source of competitive advantage in the market is a key factor in modern business" [19].

In many developed economies, it is considered that the focus should be shifted from the traditional model of understanding cultural activities that are based not only on entertainment and consumption, but also on production, ie on the creative aspect of the cultural sector.

In cultural heritage research, one of the key issues related to the benefits of cultural heritage and its impact on the development of the local economy is cultural and creative entrepreneurship. Cultural entrepreneurship should be understood as a special type of entrepreneurship, given that it is influenced by the cultural and artistic sector and people - from agents to artists and creators. In the last thirty years, the cultural sector has been recognized as a significant economic sector in many economies, the sector that is is just as important as other segments of the economy [20].

According to Throsby, cultural entrepreneurship can be defined as a management process through which cultural workers seek support in creativity and autonomy

in order to improve their capacity to adapt and create artistic and social value [21].

In business sense, cultural heritage can be understood as a sector of activity consisting of organizations that provide products or services related to the understanding, protection and promotion of objects, sites, monuments and other forms of tangible and intangible cultural heritage. The business side of cultural heritage can be placed among the service and experience economy, as well as in the political context through activities such as tourism, where value can be understood in terms of market position or in terms of a sector that has its own value system [21].

Cultural heritage can be viewed as a combination of goods and services that include the following groups: tangible cultural goods (buildings, books, monuments, works of art, artifacts, landscapes); intangible cultural goods (language and knowledge, folklore, oral history, traditional customs, aesthetic and spiritual beliefs) that are much more difficult to preserve compared to physical cultural goods; cultural natural heritage (rural areas, natural environment, flora and fauna, biological and geographical diversity, cultural landscapes that are an important part of tourism) [22].

The best explanation as to where cultural heritage is located among different activities can be understood from the production cycle of value chain models [23]. Value chain models include the creation, production, distribution and consumption of cultural goods. The value chain can be used by policy makers to identify needs for cultural and creative activities. It can be used as information support for policies and measures, as support for design and to address entrepreneurial needs. The value chain includes five phases: 1. Creation: determining the origin and author of an idea or content (eg sculptors, writers, design companies) and creating an individual product (eg craft products, art paintings); 2. Production: cultural forms that can be reproduced (eg TV programs), as well as specialized tools, infrastructure and processes used in their realization (production of musical instruments, printing of newspapers; 3. Distribution: bringing mass-produced cultural goods to consumers and exhibitors (wholesalers, retailers and renters of recorded music and computer games, film distributors, etc.). In digital distribution some products and services go directly from producers to consumers; 4.

Exposure/Reception/ Transmission: it indicates the place of consumption and commission of cultural experiences either live or in direct transmission to consumers by providing or selling access to consumption, ie participation in cultural activities with a duration (eg festival organizations and productions, opera houses, theaters, museums). Transmission is related to the transfer of knowledge and skills that do not have to involve commercial transactions and that take place in informal circumstances. This includes the transmission of intangible cultural heritage from generation to generation; 5. Consumption/participation: the activities of the audience and participants in the consumption of cultural products and participation in cultural activities and in experiences (eg reading books, participating in carnivals, listening to the radio, visiting galleries) [24].

Entrepreneurship in the field of cultural heritage must be related to the strategic goals and mix of policies implemented by public institutions and private companies in terms of good preservation, maintenance and accessibility of cultural goods and their integration into the existing environment in a productive, educational and efficient manner. The availability of goods and services to the public is a fundamental factor in maintaining community identity, heritage and the possibility of national and international contacts in terms of good practice and sustainable strategic management [25].

Cultural entrepreneurship is performed by cultural companies and the people who are employed in them, and can vary from single-employee enterprises such as authors, writers, architects or musicians, to large enterprises and corporations with a special organization, directors and boards. Their role is to create links between artists and creators on the one hand, and the market for cultural goods and services on the other hand.

In order to better understand the part of the service activities of the public sector that uses cultural heritage as a resource, a transaction matrix from the study of Klamer, Petrova and Minoza can be used, which shows the supply and demand for services related to cultural heritage [26].

Entities that provide financial resources are taxpayers, companies and households. Allocators are the central bodies of government and local self-government that are responsible

for cultural policy. Consumers are government agencies that are responsible for distributing grants to suppliers. The users are service activities. This model could be applied in bureaucratic systems in which service providers are not autonomous in relation to the state [27].

However, at the same time, all these subsidized institutions are very slow to develop business models that can meet the needs, expectations and lifestyles of consumers of cultural goods and services.

Transformation implies overcoming three important challenges: fragmentation of the supply of cultural heritage - it is very important that in addition to offering the main and most famous products and services of cultural heritage of which there is often an overload, there is also a supply of lesser known goods and services. It is also necessary to reconcile the views of entities at different levels such as different institutional structures and stakeholders regarding the preservation, conservation and use of cultural heritage. The problem also arises in terms of the monopoly of information where there is inflexibility of the supply in terms of informal communication, so very often consumers obtain information on their own from the media, literature and other sources; cultural communication - such communication is rich in figurative meanings and interactive contexts. Entities presenting cultural heritage often neglect the intangible dimensions of cultural heritage at the expense of tangible, material heritage. Care must be taken that behind the consumers are people with their perceptual abilities where the presentation evokes in them certain feelings and memories; redefining values - The public sector when it comes to cultural heritage is very slow to develop business models and proposals related to meeting the needs of consumers seeking experience, especially when it comes to digitally literate young generations. In addition, it very often lacks strategies to improve the production mechanisms of intangible cultural heritage, launch new products that will attract demand and create new skills and new jobs.

A. *Entrepreneurship in the Field of Cultural Heritage*

The success of entrepreneurship in the field of cultural heritage depends on several factors on the supply and demand side that are related to: the characteristics of cultural heritage goods and services (physical and digital) and their cultural, aesthetic and authentic values; the level of income of users, education, professional interests, the possibility of intellectual and spiritual perception; economic and social values and environmental values; pricing policy, fees and other service costs; intellectual, emotional and spiritual impact on visitors (tourists), as well as the achieved social prestige and satisfaction, including the reduction of social exclusion [28].

Chang and Vizomirski clasify the components of cultural, ie creative entrepreneurship into five categories. Each entrepreneurship model should contain at least one component from each category in its combination. Therefore, entrepreneurship is constantly recombining components [29].

VI. THE IMPACT OF GLOBALIYATION ON CULTURAL HERITAGE

The process of globalization, in addition to its positive effects, has certainly led to indigenous and small communities adopting a way of life that is detrimental to the preservation of their traditions and local customs.

Old crafts represent a very important part of the intellectual capital of cultural heritage in terms of possession and transfer of skills and knowledge.

Globalization has also led to mass production which is cheaper and suppresses the individual production of traditional crafts.

In addition, global climate change is affecting the lack of key natural materials needed to make old craft products. All this results in young people's lack of interest in old crafts.

Tourism is one of the most developed economic activities in the world and includes the largest international and domestic population movements. As such, it can and does put great pressure on the world's cultural heritage. The negative impacts of tourism on cultural heritage can be different. Inadequate communication between visitors and the local community as well as the lack of adequate presentation of the heritage site can lead to the wider community not understanding and appreciating the site lses which reduces political and institutional support for financing the protection and preservation of the heritage site. Inadequate implementation of laws on the protection and preservation of cultural heritage in cultural and tourism policy at the regional and national levels may, over time,

reduce the application of these laws. In addition, when planning cultural projects, it is necessary to recognize all potential conflicts between cultural projects and the principles of preservation and protection of cultural heritage. Otherwise it leads to the loss of authenticity of cultural heritage and less interest in the tourist site. Poorly planned and uncontrolled tourism activities can destroy physical appearance, biodiversity, the environment, and the infrastructure of the environment in which the local community lives and works. The animosity of the local population also causes disrespect for local customs, religious sites; they can also face attempts to illegally access local practices, knowledge and beliefs, as well as illegal trade in protected or stolen cultural heritage objects.

When it comes to the development of the local economy, it can be endangered by bad promotional programs that do not encourage the arrival of tourists or programs that encourage the arrival of tourists to the most visited places, which leads to uneven visits, so less attractive places fail to relieve the most attractive places. Poor programs can also be caused by a lack of professional staff in terms of planning, design, architecture, interpretation. Even if there is professional staff in the local community, it can happen to hire staff outside the local community, especially in terms of presentation and interpretation of cultural heritage, which leaves the local population without a job opportunity. Poor management of the promotion, distribution and sale of products of local craftsmen leads to negative economic effects on the local population, but also to the degradation of their cultural integrity [30].

In order to prevent the negative impact of globalization, and take advantage of the positive impact, UNESCO in 2001 in Paris proposed an international regulation of a new standardization instrument to preserve traditional culture and folklore that would encourage communities to preserve the rights and capacities to practice their own cultural heritage as well as development of own approaches for its management and maintenance. In that sense, the loss of cultural heritage can be stopped only if the means, conditions and skills that create it are provided, as well as legal regulations and transfer [31].

VII. INTELLECTUAL PROPERTY OF CULTURAL HERITAGE

Intellectual property is a very important issue related to cultural heritage and intangible heritage. Addressing this issue should benefit both rights holders and society as a whole. However, it is very difficult to harmonize national and international legal frameworks governing different forms of cultural creation and traditional knowledge, moreover, an ideal combination of these frameworks cannot be made. International institutions dealing with this issue are the United Nations, UNESCO and WIPO (World Intellectual Property Organization). Intellectual property is a general term used to denote various legal mechanisms that protect the property rights of intangible cultural heritage.

Property rights of intangible cultural heritage can be protected by patents, trademarks and copyright. Patents protect innovation. They give their holders certain rights. Patents can prevent others from making, using, selling or importing these innovations for the duration of the patent. However, traditional knowledge cannot be protected by a patent. They are always the product of some previously published, publicly used or orally established knowledge. Only in a few cases did the patents belong to the autonomous population or local communities for innovations achieved through the use of traditional knowledge, but not for knowledge per se. Innovations were created in these cases in cooperation with patent holders and research institutions, and they relate to the further development of a particular technology or know-how. However, patents are an excellent instrument for the protection of traditional knowledge because they make it impossible to apply for this knowledge as patents and use it as an innovation, and thus abuse it in terms of owning an exclusive right.

A trademark is a suitable way to protect cultural creativity and traditional knowledge because protection does not have to be term-limited, ie it can last forever. On the other hand it is possible to collectively possess this right. Indigenous and local communities can use trademark as a tool for differentiation and branding. With an adequate marketing strategy, this can increase the recognition of traditional cultural creation as well as bring certain benefits to the holders of those rights.

Copyright is a very important tool for the protection of traditional cultural creation. They cover a wide range of literature, artistic and scientific creations, such as novels, poems, plays, films, musical compositions, choreographies, paintings, photographs, sculptures. Furthermore, they protect the expression of ideas, but not the idea itself. In any case, the work does not have to be completely new, but it must pass precisely defined criteria of originality [32].

When it comes to property rights and cultural heritage, a special potential for the development of the Serbian economy is the production of products with protected geographical origin. According to the Law on Geographical Indications, "geographical indications are used to mark natural, agricultural, food and industrial products, handicrafts and services. Designation of origin (IP) is the geographical name of a country, region or locality designating a product originating there, whose quality and special properties are exclusively or essentially conditioned by the geographical environment, including natural and human factors, and whose production, processing and preparation take place as a whole in a certain limited area. A geographical indication (GI) is a designation that identifies a product as originating in the territory of a country, region or locality in that territory, where a particular quality, reputation or other characteristics of the product can be essentially attributed to its geographical origin and whose production and / or processing and / or preparation takes place in a specific limited area" [33].

At the national level, the registration and protection of geographical indications is performed by the "Intellectual Property Office of the Republic of Serbia" and at the international level by the "International Intellectual Property Office", which includes our "Intellectual Property Office", because Serbia is a signatory to the Lisbon Treaty but the registration of the mark itself is done at the request of the Intellectual Property Office of the Republic of Serbia. At EU level, the protection of products of geographical origin is carried out by the European Commission through various regulations.

There is a set of benefits and costs of registering geographical indications and traditional products. Economically, the protection of designations of origin, geographical indications and traditional products differs from other types of intellectual property protection. This is primarily because in the case of a quality scheme, it is not the innovation that is protected, but the geographical area, which contributes to the specificity of the product [34].

The geographical indication is also a very important instrument for the protection of traditional knowledge. It allows traditional knowledge to remain in the public domain, which means that no firm or individual can have a monopoly over this knowledge.

To date, the Institute for the Protection of Intellectual Property has protected more than 60 products with geographical indications, among which the largest number of food products, such as Leskovac homemade ajvar, Leskovac barbecue meat, Rtanj tea, Vrnjci water, but also home-made products such as: Pirot carpet, Bezdan damast and Sirogojno - hand-knitted clothes. In addition, Chigota can be found on this list, as a geographical indication for the provision of health and tourist services in part of the territory of the municipality of Čajetina. Only three products from Serbia have been registered at the international level: Leskovac homemade ajvar, Homolje honey and Bermet.

VIII. CONCLUSION

Serbia has huge potentials when it comes to the intellectual capital of cultural heritage and its participation in creating value at the national level. Tangible and intangible heritage provides space for the operation of service activities in both the private and public sectors, but under the condition of their mutual cooperation.

Tourism is the main activity that has as its subject the promotion of cultural heritage. In order for the business of this activity to come to the fore and take on a serious and sustainable character, it is necessary to meet certain conditions. It is extremely important to preserve and maintain cultural heritage sites in order to create conditions for the arrival of tourists in a particular area. Income from tourism could later be used in further maintenance and development of the tourist site, ie cultural heritage site. However, in order to ensure the interest and arrival of tourists, it is necessary to develop adequate programs that would be particularly attractive and appropriate, and which would entail members of the local community to take an active part in them.

In addition to all the above, it is necessary to have professional staff who could meet and respond to the demands of tourists in terms of providing information. It is also necessary to create interest in language, art, music, gastronomy and other forms of culture of our country, which is achieved by adequate marketing programs.

Products with geographical indications are also an extremely important potential of Serbia. The first steps have been taken when it comes to the protection of original Serbian products, but that is still not enough. It is necessary, first of all, to complete projects of comprehensive mapping of original Serbian products, to identify and protect them. In that way, these products would have a guaranteed quality, gain significant value, attract foreign consumers, and thus encourage the local population to engage in agricultural activities, but it would also activate old crafts that have slowly begun to die out.

In the era of information technologies, it is necessary to use them for the preservation and then promotion of our cultural heritage. It is very important to build an open data infrastructure in Serbia that allows free access to information about various libraries, galleries, museums. This results in increased influence, visibility, new customers, brand value, as well as increasing the number of distribution channels.

ACKNOWLEDGMENT

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Cost-Benefit Analysis of Hens and Broiler Chicken Farms in the Canton of Sarajevo

Muhamed Katica[1], Nedžad Hodžić[2]

[1]University of Sarajevo, Veterinary Faculty, Bosnia and Herzegovina
[2]College "CEPS – Center for Business Studies", Bosnia and Herzegovina

Abstract-**Aim: Aim of this study was to determine the profitability of intensive breeding of broiler chickens and hens using the cost-benefit analysis, on two poultry farms of small capacity in the area of the Sarajevo Canton in Bosnia and Herzegovina.**

Material and methods: A farm of broiler chickens was analyzed within six cycles during one year, and it had a capacity of 8500 chickens. A hens farm of capacity of 2.000 was analyzed as well. Analysis of hens farm was done, because of the didactic reasoning, in two different segments, within breed of broilers up to 4 months of age and the exploitation of hens during the first year. Methods included cost-benefit analysis where the method used was the one of goal-free evaluation. Data which represent input parameters for the analysis were obtained from conversing with the owners of the farms, after what certain numerical values were obtained which were necessary for the further processing of analytical procedures.

Results: In intensive breeding of broiler chickens and hens, using cost-benefit analysis, a number of costs were determined which eventually lower the expected profit. Food, amortization, sawdust, as well as overhead and veterinary expenses make up up to approximately 80% of total expenses, during the one year of breeding. The broiler chicken farm of capacity of 8.500 broilers, during the six cycles produces 122.400 kg of chicken meat a year, which equals to 318.240 BAM[1], while a year long hens exploitation, in terms of placment of consumed eggs on the market, resulted in a profit of 107.320 BAM.

Conclusion: Continental climate, which dominates the region of the Sarajevo Canton, favors the breeding of broiler chickens, as well as the breeding of hens for the production of consumed hen eggs. Obtained results show that an economic profitability exists, if a capital is invested in this segment of poultry production. Quick turnover of capital; a possibility of 6 cycles in a year, a good price of chicken meat and consumed eggs, purchasing habits of the Sarajevo Canton population, as well as the constant increase in the poultry production in bosnia and Herzegovina (B&H). Bare strong economic indicators for the profitability that comes from the investment in the poultry production.

Keywords - cost-benefit analysis, breeding of broiler chickens, breeding of hens, chicken meat, chicken eggs

I. INTRODUCTION

Poultry production in the world in the last two decades has shown a great development. It has a lot of advantages which is why it is now in the first place when it comes to cultivation of animals [1]. Basal metabolism of poultry allows and favors decreased conversion of food, while genetic predispositions enable great reproduction and fast growth. It is possible to apply „industrialization of production" when it comes to poultry in all of the phases of production. Broiler, a young fattened chicken of fast-growing species and hybrids in an enclosed building on the principle of industrial production is the poultry of choice. Meat, as their most representative product, is easily metabolised with amino acid composition of good quality, which does not burden the human organism in the cholesterol diet as well as with other harmful ingredients as some other types of meat. Chicken egg is biologically highly valuable

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[1] Bosnia and Herzegovina convertible mark

food. It is rich with proteins of high quality, mono- and poli- unsaturated fatty acids, vitamins and minerals [2,3]. As it is an important food, chicken egg is far more prevalent when compared to other domestic poultry's eggs [4].

A trend of increased poultry production is evident in B&H as well, and it represents its important part of animal cultivation in terms of agriculture. Poultry in B&H is being bred in multiple ways. The highest number of poultry is still placed in an unspecialized farms where their breeding is extensive. At the same time, there are also some big and highly specialized farms which, for example, have over 20.000 hens or broiler chickens. Technology is used at such intensive breeding, which often works accoring to pre-established programs, that is, it is almost entirely automated. Finally, between these two very different ways of breeding poultry, there are different possibilities of transitional arrangements, depending on whether their use is justified in each case alone.

According to [5] poultry production includes breeding and keeping of hybrid hens of light breads that are able to reproduce, as well as the breeding of chickens for the production of consumed eggs, breeding and keeping of hybrid hens of heavy breeds and the production of a one-day offspring.

II. STATISTICAL PARAMETERS FOR THE NUMBER OF POULTRY IN B&H IN THE PERIOD OF 2010 – 2014

According to data of Agency for Statistics of B&H the number of poultry in B&H in the period 2010. - 2014. varied from 18.7 to 24.73 millions of pieces, while the number of hens since 2010. increased from 3.77 to 5.60 millions. In 2014. the number was somewhat lower when compared to the last year (2013), lower by 16.1%.

A total number of poultry in B&H in 2014. was 20.664 millions pieces, while the number of hens in the same year amounted to 5.602 millions [6]. A share of poultry meat production in the structure of a total fresh meat production in B&H is 59%. On average, around 31.396 pieces of poultry are slaughtered in slaughterhouses a year, and 99% of that are fattened chickens, while the remaining 1% is made up of other poultry, mostly hens [7].

III. FACTORS AFFECTING TREND OF GROWTH OF POULTRY PRODUCTION

Poultry production is specific beacuse of the possibility of quick turnover in business, which in the end results in the lowest meat prices. If we look at the broadest layers of the population, then the meat of poultry, as it is cheaper, becomes the main interest of consumers. With the help of technical and technological achievements in the production of broiler meat, as well as the biological characteristics of poultry, the continuing trend of growth of this production exists, in the world, and in B&H.

By applying the latest knowledge in the field of genetics and selection in a relatively short time, a new hybrid hens were created, whose offsprings - chickens for fattening, today, in only 40 days of fattening can gain the weight of over 2 kg, with food consumption below 2 kg per kg of growth [8].

Many also predict an increase of the production at the word level in the future. Many reasons are in favor of increasing the production of chicken meat:

- The price of chicken meat (is what nowadays determines purchasing habits of consumers more than quality and nutritional value of the food)
- Nutritional composition/value of chicken meat (meat rich with proteins and low on fat)
- Reduced food conversion (lower food consumption per kilogram of growth)
- Maximum utilization of genetic resources (rapid growth and weight gain)
- Usage of space for fattening (production is not closely related to the large rooms / areas)
- The rapid turnover of capital (possibility of up to 6 cycles in a year)
- Lower investments (starting investments in equipment and animals)

Breeding of chicken broilers is enabled to almost all those who wish to engage in this activity, whether for profit or own needs for chicken meat.

IV. OVERVIEW OF THE RESULTS OF PREVIOUS RESEARCH

Cost benefit analysis is a method of economic analysis, used to compare and

evaluate all advantages and disadvantages of some economic venture or project by analyzing costs and benefits. Such analysis is important for making the right decisions, and for the correction of projects for which it is done [9-11].

After consulting the reference data that prejudice issue of cost-benefit analysis, for example, we have chosen an investment model with the basic parameters of the calculation of costs and expenses on the one hand, and the annual income, or profit, on the other hand, (Table I).

Based on the collected relevant data, for the upbuilding of farm and technical and technological process for the fattening of broilers, with prices characteristic for the region

TABLE I. DESCRIPTION OF COSTS AND MARKET VALUE OF PRODUCTION [13].

Description of costs and expenses	BAM cycle	BAM year
Day-old chicks (5.000 x 0.9 BAM)	4.500	24.750
Food for fattening (4.850x4.5 kg x 0.8 BAM)	18.500	99.000
Electricity, water, bedding, medicines	800	4.400
Salaries for 2 months /1 employee x 750 BAM	1.500	9.000
In total	**24.800**	**137.150**
Market value of production		
Chickens (4.850 x 1.90 BAM x 6 BAM/kg)	55.290	304.095
In total	**55.290**	**304.095**
Annual revenues of the production in the system of cooperation		
Gross profits (4.850 chickens x 0.57 BAM/piece)	2.765	15.207
Costs of salaries, electricity, medicine, water, sawdust	2.350	12.925
Profit	**415**	**2.828**

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[2] Independent Turnover Agricultural Activity – Bos. Samostalna obrtnička poljoprivredna djelatnost (SOPD)

of B&H, systematic investment plan updated in the late 2014 on the proposed models from 55 farm looks like this [12].

An example of investment model for the upbuilding of installation/farm of capacity 5.000 broilers.

Parameters: upbuilding of the installation of dimensions cca 330 m2: cca 80.000 BAM, equipment for chicken fattening: cca 20.000 BAM, in total: 100.000 BAM

Hypothetically speaking, it is believed that the intensive rearing of broilers and hens of small capacity is a profitable business.

Aim of this study is to examine two poultry farms using cost-benefit analysis: a farm of fattening broilers and a farm of hens of small capacity on private farms, in order to obtain exact economic data on potential profitability in this specific part of the livestock production.

V. MATERIAL AND METHODS

To make the cost-benefit analysis of the two poultry farms, farms of broiler chickens and laying hens farms of small capacity on private farms on the outskirts of Sarajevo, a method of goal-free evaluation was used. Data included in the analysis were obtained from the interviews with the owners, and we jointly came up with certain numbers that are necessary for the analysis. Two poultry farms were analyzed; broiler chicken and hens ones. Farm of broiler chickens of small capacity is located in the south-western outskirts of Sarajevo, S.P.D. "Chicken". The farm's capacity is 8500 broiler chickens, hybrid COOP 500.

The farm of hens is located in the peripheral northern slopes of Sarajevo, the one of small capacity as well, i.e. Independent Turnover Agricultural Activity SOPD2 "Jaja Prom". Capacity of farm is 2000 pieces of hens - hybrid Issa Brown. Cost benefit analysis of hens farm was analyzed in two segments. First was the breeding of chickens from the first day of their life untill the 18th week (cca 4 months old) and the other period was from the moment chickens carry through eggs and the following 12 months.

For easier monitoring and better visibility of revenues and expenses of the poultry farms, the appropriate tables were made. Income and

expenses are expressed in the B&H currency, i.e. Bosnian convertible mark (BAM/KM)

By the decision of currency board of Central Bank of B&H, every bill is pegged to Euro. Fixed exchange rate of BAM/KM is: 1BAM/KM = 0.51129 € or 1€ = 1.95583 BAM/KM [14].

VI. RESULTS

TABLE II. THE ANNUAL COSTS OF A BROILER CHICKEN FARM.

Description	Amount (BAM)	Percentage (%)
Costs of chickens (8.500sth. x 6 x 0.83 BAM)	42330	14.6
Costs of diet	200000	69.4
Costs of materials, amortization, maintenance	4000	1.4
Overhead expenses (electricity, water, coal, wood)	12000	4.1
Veterinary expenses and medicine	2500	0.8
Costs of disinfection	600	0.2
Salary of one employee	18000	6.2
Sawdust	6000	2.0
Compost	2100	0.7
Accounting services	700	0.2
Total expenses	**288230**	100.0

TABLE III. THE ANNUAL BUDGET OF INCOME OF BROILER CHICKENS' FARM IN THE SYSTEM OF COOPERATION.

Description	Quantity	Unit	Amount (Bam)+Vat	Percentage (%)
Productin of meat	**122400**	**kg**	**318240**	**100**
Production of innards	-	-	-	-
Compost	-	-	-	-
In total	**122400**	**kg**	**318240**	**100**

TABLE IV. THE ANNUAL BUDGET LOSSES: MORTALITY AND WASTE ON THE BROILER CHICKEN FARMS

Description	Quantity	Unit	Amount (Bam)+Vat	Percentage (%)
Mortality	4896	kg	12730	4.0
Waste	750	kg	1250	0.4

TABLE V. BUDGET EXPENDITURES OF BREEDING CHICKENS UP TO 4 MONTHS IN THE HENS FARM.

Description	Amount (Bam)	Percentage (%)
Costs of chickens (2000 x 1,5 BAM)	3000	17.8
Costs of diet	9800	58.4
Costs of materials, amortization, maintenance	960	5.7
Overhead expenses (electricity, water)	520	3.1
Veterinary expenses and medicine	200	1.1
Costs of disinfection	80	0.4
Accounting services	120	0.7
Sawdust	100	0.6
Salaries of employees	2000	11.9
In total	**16780**	**100**

TABLE VI. REVENUES DURING THE BREEDING OF CHICKENS UP TO 4 MONTHS OF AGE IN THE HENS FARM.

Description	Quantity	Unit	Amount (Bam)+Vat	Percentage (%)
Compost	2000	kg	200	100
In total	**2000**	**kg**	**200**	**100**

TABLE VII. THE ANNUAL BUDGET COSTS OF HENS FARM.

Description	Amount (Bam)	Percentage (%)
Accounting services	360	0.4
Costs of diet	56940	71.9
Costs of materials, amortization, maintenance	6830	8.6
Overhead expenses (electricity, water)	1680	2.1
Veterinary expenses, medicine and disinfection	1300	1.6
VS form / veterinary certificate /	3650	4.6
Salary of one employee	8400	10.6
Sawdust	-	
Compost	-	
In total	**79160**	**100**

Description	Quantity	Unit	Amount (Bam)+Vat	Percentage (%)
Production of eggs	657000	sth	105120	97.9
Sellings of used chickens	2000	sth	2000	1.8
Compost (during the breed of chickens that are up to 4 months old)	2000	kg	200	0.1
In total	--	--	107320	100

VII. DISCUSSION

Farm S.P.D. "Chicken" is located on the outskirts of Sarajevo and offers space for fattening of 580 m2, which is physically separated into three equal parts. The approximate value of the farm and associated buildings is approximately 300.000 BAM, along with the cost price of complete construction work. Estimated value of the wages is 60.000 BAM, then zoning, building permits, and veterinary control number (VKB), which amount to 30.000 BAM. In the space for fattening there is an equipment for the power supply, as well as for the feeding and ventilation of chickens, which have an estimated value of 60.000 BAM. The farm is registered, and has a cash register worth 580 BAM.

Farm S.P.D. "Pile" grows fattening poultry of provenance "COBB 500" [15]. Period of intensive farming of fattening chickens (broilers) COBB 500 (5-6 weeks) is up to 42 days (Cobb 500 Broiler Performance & Nutrition Supplement). It is possible to organize six such cycles (8500 X 6) and annually grow 51000 broilers. The purchasing price of a day-old fattening chicken is 0.83 BAM. Table II shows the cost of day-old broiler chicks per year, which amounts to 42.330 BAM, that is 14.6% of the total cost.

Food costs are definitely the biggest costs of broiler chickens farms and they amount to 69.4%. Out of overhead costs on the farm the ones that have to be payed are electricity, water, wood and coal, an annual total of 12.000 BAM or 4.1% of the total cost of the farm. Out of these, the cost of electricity amounted to 4.000 BAM, water costed 3.000 BAM, costs for coal were equal to 4.000 BAM, and the cost of wood was 1000 BAM. The costs associated with maintaining inventory and equipment within the farm were evident, as well as the expenses for the amortization of the cars and the costs of oil. The approximate average cost price of 4.000 BAM was taken, although the amouunt of that cost is unpredictable, since in some cycles of growing broilers it can be minimal or it often can be much higher than listed.

Arrival of the official veterinarian, as well as the costs of medicines (vaccines) that are preventively put in drinking water per year is 4.000 BAM (Table II).

The cost of disinfecting farms in the periods in between the cycles, during which the rooms of the fattening farm "rest" are the smallest, and they amount to 0.2% of the total cost of the farm, 600 BAM. This cost is actually a retail price of disinfectants, because the owner of the farm always personally disinfects. He owns the associated education, which makes him competent to be able to independently carry out this very important part of the work on the farm.

Farm S.P.D. "Pile" is a registered farm and it is a taxpayer. One full-time employee is reported (the owner of the farm), who pays annual contributions: pension and health care insurance in the amount of 2.400 BAM. On an annual basis this is the cost for the farm in amount of 18.000 BAM. The salary of the registered worker is included within this cost. On an annual basis, these costs amount to 6.2% of the total annual costs of the farm.

Sawdust is a necessary detail in the factory farming of chickens. 3.3 m3 of sawdust are needed for a cycle of capacity 8.500 broilers. For one year, or six cycles, the owner of the farm has to set aside a minimum of 5.400 BAM. Very often, the distributors must repurchase the sawdust so the costs of the farm on this basis amounted to approximately 6000 BAM (Table II).

Compost (urine and feces) is permanently evacuated from the collection center (collectors). The poultry farms are one of the few farms in the entire spectrum of livestock farms where compost as a specific good can not be, or is very rarely placed on the market. Farm S.P.D. "Pile", only has costs regarding fertilizers, and the costs of evacuation, transport

and disposal in the city dump. Costs of engaging the workforce (seasonal workers) are equal to 250 BAM, while the transportation costs amount to 300 BAM and the costs of depositing in the city dump amount to 150 BAM. The total costs of the farm in terms of fertilizers is 2.100 BAM, because the evacuation of fertilizers IS performed three times a year, or after two consecutive cycles (Table II). Finally, there are the accounting services costs, the services of independent accountants, and they amount for the whole year to 700 BAM.

In Table III. it can be seen that the annual production of the farm SDP "Pile" is 124 tons and 400 kg of chicken meat, so about 51.000 fattened chickens in a year, within six cycles. The average weight of a farmed chicken is between 2.3 to 2.6 kg. It was hypothetically assumed that every chick was weighing 2.4 kg, after completion of breeding cycles, where the mean value was used. The purchasing price including VAT for 1 kg of live weight was 2.6 BAM. So the annual farm income amounted to 318.240 BAM.

These financial indicators of profit are not diminished, what is essential to certain losses due to mortality of animals. According to Kustura and Goletić 2004, the percentage of mortality is tolerated to a maximum of 5%. Brovis Ltd. company, which redeems the entire production the S.P.D. "Pile", and in accordance with the contract, obliged to financially compensate a percentage of mortality to a maximum of 4%. Therefore, a farmer of S.P.D. "Pile" can have a higher or lower income, when compared to the profit shown in Table III. If, hypothetically, a farmer has a mortality rate of 4%, the losses that arise from it imply a loss of 4 tons and 896 kg of meat, that is a loss of 12.730 BAM annually, within six cycles.

Other financial loss for farmer is so called slaughterhouse confiscates (feathers, intestines, heads, feet) and it ranges from 100 to 150 kg per cycle, by the company Brovis Ltd. In Table IV, hypothetical mean was taken, and it is 125 kg of slaughterhouse confiscates per round The annual income of a farmer is reduced by 1.250 BAM, which is 0.4% of the total earnings. Since Brovis Ltd. fully redeems all fattened chickens, the farmer does not have the opportunity to earn on the chicken innards: liver, lungs, heart (Table III). Also, the farmer does not gain any income from the compost (Table III). On the contrary, there is an annual loss of 2.100 BAM (Table II).

Analyzing Table II and Table III, i.e. comparing the annual profit with the annual expenditures, a total annual profit of 30.010 BAM is obtained, and so the monthly net income amounts to 2.500 BAM. It is important to note that this gain is independent of the monthly salary of a notified worker in the amount of 1.300 BAM, together with paid contributions, a total of 18.000 BAM (Table II), as well as of the cost of salary of engaged seasonal worker (Table II).

In the farm S.P.D. "Pile", as mentioned above, one worker is reported (a farm owner). His family home is located next to the farm, and it has four members. Everyone, without exception, is involved in activities of the farm, and, if necessary, participate in certain segments of work on the farm. The utility bills (electricity, water, coal, wood) in Table II. consumed by family members of the owner of the farm S.P.D. "Pile", in his family home, are calculated in the costs of the farm (Table II). In this sense, the family of the farmer benefits further.

Location of the farm and climate condition (continental climate), which dominates the outskirts of Sarajevo, very well enables the growth of broiler chickens. From an interview with the owner of the farm, and on the basis of his long experience with poultry, poultry farms can with a capacity of more than 20.000 broiler chickens can expect great profits. The different structures of government: municipal, cantonal and federal, had so far shown enough understanding in helping poultry farmers with appropriate motivational incentives, which are also regularly enjoyed by farmers from the other branches of livestock-intensive production in B&H.

Business of a poultry farmer is full of risks and unpredictability. A cost-benefit analysis is done in the Tables II, III and IV, where the optimal parameters are presented. However, the percentage of mortality can be intimidatingly high if any technopathy is encountered, i.e. diseases that occur in intensive farms, where a considerable number of animals are placed on one m2. Then, there is no therapy, but the animals have to be euthanized.

Hens farm of small capacity is located on the peripheral northern slopes of Sarajevo, SOPD "Jaja Prom". The activity of the farm includes raising and breeding of poultry and egg production. The farm capacity is 2000 pieces of hens hybrids Issa Brown.

The plot where the farm of 460 m2 is located is worth 36.800 BAM. Price of converting agricultural land into construction land is 3.000 BAM. Dealing with the government's approval amounts to 15.000 BAM. The main building of a farm with the 150 m2 of space for breeding hens, along with the total cost of construction is worth 100.000 BAM. The constructed object needs feeders, drinkers and ventilation devices that cost 700 BAM. Between 10-15 chickens are placed on one m2. Cage system i.e. the equipment for hens for a farm of the capacity of 2000 pieces, within which there are feeders and drinkers, is 16000 BAM. The ventilation system in the area of breeding hens with the installation costs 7.900 BAM. A mill for grinding and mixing of the food is also necessary, the one with the capacity of 500 kg and its cost price is 3.500 BAM. Equipment for classifying eggs is needed as well, and it costs 1.500 BAM, as well as the automatic device for marking the eggs with VKB number (veterinary control number) which costs 450 BAM, while the purchase price of cash registers is about 580 BAM.

Using cost-benefit analysis of hens farm, we analyzed two separate segments. The first was the breeding chickens from the first day of life untill 18 weeks (approximately 4 months of age) and the second period was from the time the pullets carried through the eggs up until the next 12 months were over.

Price of a one-day chick is 1.5 BAM, and since the farm purchases 2000 pieces, the first cost of the farm is 3000 BAM. Food that is necessary for a four-month feeding of chickens untill they reach the pullets stage where they carried the eggs is 14 tons of food, what is equivalent to 9800 BAM (Table V). The percentage of mortality (mortality) in breeding chickens is low, or satisfactory (on average of 4%). Most often deaths occur shortly after moving day-old chicks to the building. We took the average mortality rate to be 4%. This means negligible losses of about 12 BAM. Hypothetically, if the losses occur in the fourth month of fattening, but it rarely happens on the farm SOPD "Jaja Prom", then the losses amount to approximately 50 BAM. Practice has shown that one chicken during th breeding time of 4 months eats 7 kg of food. The price of 1 kg of food is 0.7 BAM.

The cost of materials, amortization and maintenance within the four month period of breeding chickens is 960 BAM. In this kind of

costs we include the cost of oil, the cash register costs and the accounting services. Utility bills (electricity, water) amount to 520 BAM. Veterinary expenses and medicine, as well as disinfection costs amount to 280 BAM. Sawdust (bedding) for a period of 4 months costs 100 BAM, and it is needed approximately 400 kg of it. Accounting services cost 120 BAM for this period, and salary of the workers is 2000 BAM, for four-month period (Table V). Total expenses for a 4-month period, the expenses of growing day-old chicks untill they are pullets which lay eggs amounts to 16.780 BAM. Within this period, dominated by expenditures, a symbolic gain is evident, and it is the one that comes from selling the compost. For a period of four months, 2 tons of fertilizer are deposited which farmers then manage to place on the market and make a profit of 200 BAM (Table VI and VIII). The value of one pullet aged 4 months, which is in the stage of carring eggs costs 11 BAM. Farmer of SOPD "Jaja Prom" does not sell pullets, but he moves them to another part of the building that is designed to exploit the hens. In this part of the farm this type of poultry is being exploited for 12 months continuously. The biggest cost of the exploitation is the food. Daily 2.000 hens eat 240 kg of food. One kg of food costs 0.65 BAM, and on an annual basis the cost is 56.940 BAM (Table VII). Veterinary expenses, medicines and disinfection of the facility is 1300 BAM. These costs include preventive vitamin and mineral food supplements which annually cost 144 BAM. Disinfection then costs 80 BAM. Laboratory analysis of the quality of the eggs, which is obligatory every month, at the annual level costs 840 BAM. Stool examination of faeces is done four times a year, and it is the cost of the farm in amount of 240 BAM. Utility bills (electricity, water) is 1680 BAM, 480 BAM for water and 1200 BAM for the electricity annually. The cost of materials, amortization, facility maintenance and equipment per year is 6.830 BAM. Of these, the cost of oil, as well as the registration and maintenance of cars and cash registers cost 3850 BAM. Packaging the eggs (cardboard packaging, packets, foil, rubber fasteners, adhesives) annually amounts to 2.980 BAM. The costs of the veterinary certificate (VS form), daily costs 10 BAM, so the annual cost is equal to 3.650 BAM. The salary of a single worker annually costs the farm 8.400 BAM (Table VII). This amount includes a monthly salary, then social and health care contributions. The percentage of mortality in the parts of the farms where the hens are exploited is minimal,

and it is on average 1%. As the costs regarding mortality are minimum,Vwe didn't record them in the tables of expenditures (Table V and Table VII). Sawdust in the cage system of keeping hens is not used, as there is a floor with the appropriate perforations through which feces smoothly circulate through drains. As regards to fertilizers, the farmer decided for the best option and that is to use part of the compost for personal purposes, suppurating his estate, and the rest of fertilizer is donated to agricultural entrepreneurs, provided that they organize the transport and loading of fertilizers. If the farmer deposited fertilizer to the city dump, that would have, on an annual basis, cost him 750 BAM. Accounting services per month cost 30 BAM, what makes it an annual cost of 360 BAM (Table VII).

Experiences of the SOPD "Jaja Prom" in terms of load capacity is 87%. This means that 2.000 hens on average produce 1.800 eggs a day. In one year hens produce 657.000 eggs. At the Sarajevo market one egg has an average price of 0.16 BAM. The annual value produced on the farm SOPD "Jaja Prom" is 105.120 BAM. In addition to this gain, there is a possibility of the sale of "worn out" hens after completion of the 12-month cycle for the price of 1 BAM a piece. Thus, the gain is 2000 BAM. In breeding of pullets of up to 4 months of age, there are profits from the sale of fertilizer in the amount of 200 BAM. The total income is 107.320 BAM. When we subtract the cost from the first part of growing chickens up to 4 months of age in amount of 16.780 BAM and expenses during the one-year exploitation of hens in amount of 79.160 BAM, the total profits obtained result in a surplus of 11.380 BAM.

The farm SOPD "Jaja Prom" has a family of four involved, where the wage of a farm owner, along with the paid contributions is calculated within the costs. The owner of SOPD "Jaja Prom" is not in the system of cooperation, so he himself finds investing opportunities of his own products on the market.

Many years of experience of the owner in this part of livestock production, states that poultry farms with the capacity between 6500-8000 of hens would provide significant financial returns, taking into account a number of problems of an unregulated market economy in B&H, in terms of an unfair competition and the risk of an efficient placement of proucts on the market.

VIII. CONCLUSIONS

Cost benefit analysis of the poultry farms of small capacity established the profitability of farmed breeding of broiler chickens and hens in the Sarajevo Canton.

Low purchasing power of B&H citizens, purchasing habits, the continuing trend of increased poultry farming in B&H, as well as favorable climatic conditions in the Sarajevo Canaton are solid economic indicators of profitability of investments in the poultry production in B&H.

A more complex economic analysis is required in order to evaluate the type of poultry farming and the scope of intensive farming for achieving a more optimal economic results.

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Knowledge Management - The Route of Tourism Development in the Post-Covid Period

Snežana Štetić[1], Igor Trišić[2]

[1]College of Tourism, Belgrade, Serbia; Balkan Network of Tourism Experts, Belgrade, Serbia
[2] Faculty of Geography, University of Belgrade, Belgrade, Serbia

[1]stetic.snezana@gmail.com, [2]trisici@hotmail.com

Abstract—**Risks for the development of tourism have been present since its creation. This activity reacts strongly to all negative occurrences at the global level. Observing and resolving the arising issues is vitally significant for the further development of the entire economic activity. People who work in tourism play the most valuable role in that. Therefore, the quality of their knowledge and knowledge of the management is a crucial factor for further tourism development, especially in this period of the global Covid 19 virus pandemic. That is precisely the cause why the authors decided to point out the importance of human resources (HR) and knowledge management in tourism after pandemic. Risks in tourism result in uncertainty and side effects such as insecurities, non-fulfillment of the tourist program, and inadequate quality of consumed services. Consideration of various risks (medical risks, economic crises, natural disasters, terrorism) by HR at all levels are a condition for the realization of services and further tourism development. Knowledge management and program innovation in tourism are the basis for its future development.**

Keywords - tourism, human resources, COVID 19, knowledge management, risks

I. INTRODUCTION

Tourism is a very vulnerable economic activity. Studying the development of tourism at a global level, we are witnessing the emergence of an increasing number of risks that this activity faces. Social development, economic crises, war destruction, terrorism, natural disasters, as well as medical risks are irregularities that leave strongly negative consequences on tourism development.

Most often, any unforeseen events have a negative impact on tourism through a reduction in the number of tourists. That means that there is less consumption of services like traffic, catering, and others. Various issues arise, not only in these activities but also in the entire economy, given that tourism generates many different jobs. Lower attendance at destinations influenced by different types of risk leads to a reduction in the number of employees, a reduced foreign exchange inflow, and a weakening of the local community economy.

As this is a matter of more severe disturbances, it is reflected not only on the tourist destination but also on wider regions, the whole country, and even certain parts of the world. It is this scenario tourism experienced globally in 2020 with the spread of the Covid-19 virus [1].

Increased risks in tourism in the second half of the 20th and the early 21st century affect the significance of safety during travels and the growing need to protect tourists. First, natural risks were studied, then socio-economic issues that have been replaced by growing terrorism, especially in the 21st century. Throughout that period, the medical risk did not receive much attention because it was, for the most part, under

control. Unfortunately, Covid-19 spiraled out of control and spread globally, leading to approximately 241 million infected and about 5 million deaths worldwide in October 2021.

The quality of risk management by tourism economies also influences consumer decisions about travelling. Tourist countries are starting their campaigns more and more often with the convictions that tourists' stay is safe, without risk. Therefore, risk management has become an extremely significant activity in planning the development of tourism [2]. As the feeling of insecurity grows, the quality and possibility of placing that destination on the tourist market are in suffer.

The spread of the epidemic on a global level led to the closure of state borders for two reasons: to prevent domestic residents from traveling abroad and not allow foreign tourists to enter it. That is the way the world tries to protect itself from the spread of the virus, but at the same time, it prevents not only the development but also the survival of tourism [3].

As tourism is a labor-intensive economic activity, it also reflects in employment in tourism. In all countries of the world, employees in tourism feel the consequences of the crisis [4]. Obviously, we must consider all the elements of this issue to rehabilitate tourism activity at a global level.

If we accept the statement that tourism is a phenomenon that knows no borders, then we must be aware that education for tourism must not have limitations [5,6]. That not only gives us a wide range of jobs but also puts considerable constraints on the actual and potential opportunities of institutions and people involved in education in tourism. The training of staff to provide services in tourism is the basis for the quality as ninety percent of wrong decisions are made due to lack of knowledge, not lack of intelligence or talent!

II. HUMAN RESOURCES AND EDUCATION AS THE BASIS FOR KNOWLEDGE MANAGEMENT IN TOURISM

Realizing that tourism has almost unlimited possibilities in creating a tourist product, this certainly is the basis for the education of personnel engaged in this activity. Tourism frequently becomes a victim of various risks that occur on a global level.

During the travel, tourists want to enjoy and get to know the local community, population, cultural and historical monuments, folklore, and gastronomy and feel free. That is why today's basis for good business in tourism must notice the dangers to tourism and prevent them. We can do that, first of all, through adequate education.

Tourism is an activity that requires trained and qualified staff to provide services in all segments of a tourism product. As for a constant change in tourist demand, the needs for staff education are persistent. The specificities of the tourist market reflected in the heterogeneity of tourist demand, condition the introduction of new occupations and professions into this activity [4,7].

Planning the needs of education in tourism is neither easy nor uncomplicated. Adequate education for tourism needs can only be the one that presupposes the wishes of tourists, harmonizes them, and monitors their realization. The staff training to provide tourism services is the basis for their quality [8]. Knowing that tourism has almost unlimited possibilities as refers enriching the offer, education of staff according to the needs of tourists represents a new quality for the tourist presentation of a country and enrichment of already existing stereotypical tourism offer. We have to know that the most important thing for the development of tourism is knowledge.

Employment is immensely significant for the development of economic activities, which also applies to tourism involve a wide range of different activities, facilities, and employments. The focus on employment is justified by the fact that tourism is a large consumer market characterized by an increased global market, turbulence, and changes in consumer demands [9]. That deserves attention, not only to understand the quality of tourism products and services but also to highlight the quality and importance of human resources that are one of the main conditions for the success of this sector. According to the World Travel and Tourism Council (WTTC), tourism generates about 319 million jobs, including complementary activities, which was 10% of world employment (2019) [1].

Tourism is a labor-intensive activity, and the actions in providing services are characterized by the process simultaneousness of creating and consuming services, i.e., the necessity of the presence of consumers during the service

provision. Thus, interpersonal contacts as an integral part of the services are established, which means that the influence of the human factor is crucial for achieving consumer satisfaction.

Numerous essential and additional services are implemented in the tourist destination as an expression of different tourists' needs [10]. Heterogeneity of services in tourism requires different professional profiles. Here, the specialized knowledge and skills of the staff come to light. This knowledge and skills directly affect the quality of services provided and should be understood as dynamic categories subject to constant testing and innovation.

Employees' competence implies some characteristics, skills, and abilities that they should possess [11]. Depending on the job and the position of the employee in the organization, these competencies vary. The selection of employees with appropriate capability enables us to plan and develop human resources, manage employee training efficiently, and design job positions that will possibly open in the future [8].

The specificities reflected in the direct contact between providers and users indicate the extreme complexity of the staff competence and the need for a wide range of knowledge, skills, and abilities. The capability of human resources also depends on socio-cultural and psychological factors, character, and personality traits, which also include talents, inclinations, and personal interests [12,13].

That is why education for the needs of tourism is vital, and why this issue must be approached very carefully.

III. THE SIGNIFICANCE OF HUMAN RESOURCES EDUCATION FOR BUSINESS SUCCESS IN TOURISM

It often happens that the domicile population and staff who provide services to tourists are not sufficiently familiar with the wishes and needs of guests. In that case, despite the kindness and quality of the provided services, if the guest has not completely satisfied his tourist need, he will not be pleased. It can cause his resistance to the local environment, and perhaps to the destination and that type of tourism in general. One way to forestall and even prevent this is to educate the local population and all those who provide services to participants in tourist movements.

Employees must know how to anticipate, recognize and offer what guests want and expect. That is the key to the business success of all providers at the level of a tourist destination.

Business success and competitiveness of tourist destinations rely, among other things, on the competence and satisfaction of human resources, so we must pay special attention to this business segment. Employees' satisfaction refers to their job satisfaction, earnings, work environment, atmosphere, interpersonal relationships, and personal contribution to achieving success.

A sense of identification with the company is a necessary factor in staff satisfaction. According to the earlier mentioned research, it varies depending on whether it is a private, public, non-governmental sector, or self-employment [14]. The fewest employees have a sense of identification with the company in the private sector, and the most in the public sector. In most cases, younger employees consider the jobs they do as a springboard in their careers.

Employees' loyalty can be defined as commitment and devotion to the company and is a consequence of increasing the level of job satisfaction. As a result, employee loyalty develops into a generalized emotional relationship with the company. However, the changes influencing the business environment in the modern age also affect the nature of the relationship between employers and employees [15]. It is becoming more and more common that employees not only do not expect to work in the same place for decades, but also do not want to, so the very idea of loyalty seems repulsive to them. On the other hand, knowing the cost of hiring new workers, special attention must be paid to employee satisfaction programs and encouraging their loyalty.

In the business world, the rule is that a loyal employee will do his job in the best possible way [7]. However, an employee who wants to build his career, prove himself and improve his knowledge, will also do the job in the best possible way Human resources in tourism should be encouraged to acquire new skills that will contribute to their professional advancement because that is exactly how they become committed to the company and promote loyalty [9,16].

Without the devotion of employees, there is no sustainable consumer loyalty especially

pronounced in service activities such as tourism. The internal quality of service is determined by the quality of human resources, job design, the possibility of advancement, reward systems, available tools for customer service, which determines the internal quality of service.

The collective attitudes and behavior of human resources in tourism seriously influence the satisfaction of guests due to the direct contact with tourists [17]. Employees are responsible for creating a competitive advantage by directly influencing the loyalty and behavior of tourists.

Therefore, to create satisfied guests, it is necessary to have satisfied employees because they express their satisfaction or dissatisfaction through their behavior with customers [18]. Thus, it is crucial to understand the contribution of human resource management practices in creating positive interactions between employees and tourists. It is necessary that both employees and management are involved in creating value for clients. Thus, a complete orientation of personnel to customers can be achieved, which contributes to better business results at the tourism destination level. In order to achieve this, knowledge management has an exceptional role.

IV. COVID-19 AND KNOWLEDGE MANAGEMENT IN TOURISM

The estimates and plans for the development of tourism at the global level, given by the World Tourism Organization (UNWTO) for 2030, have become "a dead letter". The global pandemic caused by the Covid-19 virus in 2020 affected the stagnation and collapse of the tourism industry. According to official UNWTO data, the number of foreign tourists in 2020 decreased by over 70%, and foreign exchange inflows by 1 billion US$ (Fig. 1).

Tourism is the most massive migration of the human population since its inception [14] which can be seen from the previous chart. When we envisage the number of international tourists in 2019 and add the number of domestic tourists, which is at least five times more, we come to the data that "all the humanity travels." The effects of individual crises in few periods, are evident, but none has affected foreign tourism as drastically as the pandemic Covid-19. As the impact of the pandemic on tourism development is obvious, the question of the pandemic impact on workforce in tourism arises. It is evident that human resources, in addition to natural and

Figure 1. Foreign tourist traffic in the world in the period from 1989 to 2020. Source: UNWTO (2020), UNWTO briefing note – Tourism and COVID-19, Issue 2, Madrid

anthropogenic resources, are the basis of tourism development. To consider this problem is extremely significant because the tourism industry is among the most severely affected economic activities at the global level during the pandemic. The impact of the COVID-19 pandemic on world tourism continued in 2021, additionally influencing the reduction of the number of jobs on the market.

Knowledge management (KM) in tourism is becoming the key to its further development because turbulent changes in the tourism market will often require cardinal solutions [15]. The fact is that the global tourism market has changed. The decrease in foreign tourist movements evolves due to the changing demand. There have been significant changes in consumer behavior due to the closed borders, the suspension of flights of certain airlines, restrictive measures when traveling, and passengers' awareness of travel safety. The restructuring of tourist demand occurs because of that.

By the middle of 2020, the number of trips was drastically decreasing. Most tourists do not travel, and those who travel direct to closer destinations, most often in their own country. In Serbia, domestic tourist traffic started in the middle of the year on a smaller scale, and it increased during the summer months.

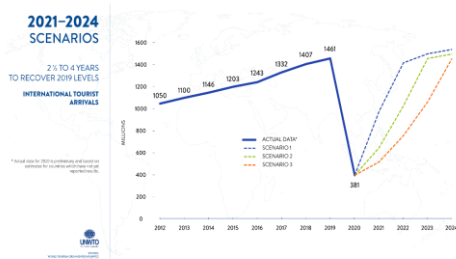The same happened in other parts of the world as well.

Figure 2. The scenario of tourism development in the period from 2021 to 2024, according to the UNWTO. Source: UNWTO (2020), UNWTO briefing note – Tourism and COVID-19, Issue 2, Madrid

However, many countries have a very strict policy of closed borders, quarantine, etc. It is a specific topic that the authors will write about in some other paper.

Due to all these changes in the tourism market, knowledge management is becoming the basis for further tourism recovery [17]. Business globalization is key to achieving knowledge management as a strategy to build sustainability and improve customer services in tourism [8], all the more so because new knowledge is needed for HR to become involved in the new reality. Many countries have taken various measures to recover tourism and to enable the survival of tourism professions. The UNWTO, therefore, calls for greater coordination on travel protocols between countries to ensure the re-development of tourism. According to the World Tourism Organization, there are several scenarios for further tourism development [13] (Fig. 2).

Obviously, these are optimistic scenarios, the realization of which requires people who need to take out all the burden of different jobs. Unfortunately, many employees in tourism are no longer part of the industry because there was no possibility of their job survival due to the pandemic. Although many countries have invested heavily in organizations and individuals to survive, many employees have to change their preferences and seek employment in other industries, if any.

V.   THE BEGINNING OR END OF KNOWLEDGE MANAGEMENT IN TOURISM

The drastic changes that have occurred on the world market due to the Covid19 pandemic have strongly affected the tourism economy, as well as human resources in tourism. The year 2019,

which was the rise of tourism development, even more indicated its downfall in 2020. Tourists felt it through the impossibility of traveling and employees through the elimination of jobs.

When it comes to education in tourism, this was reflected in the interest of young people when enrolling in schools. There is a significant reduction in the number of students enrolled in the school year 2020/2021 in secondary vocational schools and faculties of tourism. On the other hand, there is an evident decrease in the number of employees and jobs in all segments of tourism. Due to that, many countries are facing a serious problem of human resources in tourism.

In the middle of 2020, it was obvious that the tourist market was not functioning and that the problems of the pandemic were worldwide, but no one could have predicted how long it would last. That is why important issues for tourism and education have crystallized:

- What will be the decline in tourist traffic, and how will Covid 19 affect air and bus travel;

- Will long-haul or short haul travel survive and will cars be used more when traveling;

- How will the number of indoor visitors and their social distance be controlled;

- How endangered the destination is and which ones will survive;

- Is there enough work for all employees;

- Will facilities be closed and the workforce reduced;

- Are the existing HR educated for the new situation and do they have enough knowledge to deal with it.

These were all open questions at the beginning of the pandemic that were only speculated about, but no one knew the right answers.

If we look at research conducted in the field of human behavior and their response to major and sudden stresses and shocks in life [19], we may be able to see the impact on KM and HR in Tourism.

It is obvious that the tourist economy must think about survival while respecting the new situation. Tourism should take into account all the shortcomings of business that have appeared
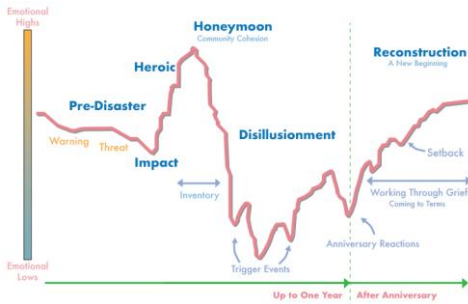
Figure 3. The scenario of tourism development in the period from 2021 to 2024, according to the UNWTO. Source: Deborah J. DeWolfe (2000), Training Manual for Mental Health and Human Service Workers in Major Disasters, Second edition, Department of health and Human Services, USA

in this crisis, and make a plan to get out of it. This refers, above all, to HR and the return of jobs in tourism. Prerequisites are one thing and reality is often something else. Therefore, the problems related to HR and KM must be understood. It is certain that the current way of education must undergo changes with regard to the new situation. Tourists are faced with restrictions and rules of conduct that did not exist before. Employees must understand this and be trained for the new reality that has become the basis in the development of tourism. Therefore, it is extremely important that there are adequate initiatives in changes in education, which will offer new knowledge for the needs of the new reality in tourism.

Only in that way will we be able to get out of the crisis and continue the development of tourism. New knowledge is needed by everyone, not only employees but also the teaching staff who need to train employees for a new reality in tourism and globally.

VI. INSTEAD OF A CONCLUSION

The problems that appeared before the tourism industry are huge, and the possibility of job survival during the pandemic is minimal. There are numerous issues for the return of this economic activity to the domestic and global tourism market. Lack of human resources will be one of the limiting factors for further development. Therefore, it is particularly significant that knowledge management is understood as a very important segment of the future of tourism.

Knowledge is a resource that drives activities and creates new products competitive in the market. It is an activity based on people who design tourist services and guests who consume them. The complexity of this sector requires professionals with specialized knowledge. The fact is that tourism employs a staff of various profiles, degrees, and levels of knowledge from different fields. The employment in this activity makes it very complex and highly flexible. That is why the expertise and training of human resource is the basis of their work. The flexibility of knowledge, which employees in tourism should possess, is a challenge for knowledge management in tourism.

The knowledge not acquired during schooling is a serious challenge for all those who plan to hire staff and take care of their additional education. Therefore, tourism must implement knowledge management as an appropriate means for achieving new knowledge, training for different levels of communication depending on profession, and creating new jobs concerning the development of technologies and their impact on tourism.

Human resources in tourism are basic materials that need to be shaped according to the needs of different economic entities in tourism and the needs of the tourism market. Therefore, those who manage their knowledge should influence the creation of staff for specific jobs and services in tourism. In this way, they will be able to affect the design of adequate tourism products, the quality of services provided, reduction of costs, sales and income increase, and the competitiveness of their products and services in the market.

Creating efficient knowledge management tools in the service sector enables the solution of various problems and often the retention of a quality workforce [17]. That is very important for achieving a competitive advantage in the tourism market. It affects the decision-making process. The exchange of experience influences the increased knowledge that causes better results both in theory and in practice.

Considering the pandemic, the reduction of employment, the inclusion of the new labor force, and the understanding of new processes in tourism industry, education is the key to its further development. The process of trust, motivation, knowledge sharing, and vision of the future should always be present in the

knowledge management system in tourism. Today, more than ever, because only the right people can restore the importance of tourism and pave the way for this economic activity towards the future.

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Towards Society 5.0 Era: Organisational Empowerment of the Sustainable Future

Vesna Tornjanski[1], Mladen Čudanov[2]

[1,2]Faculty of Organizational Sciences, University of Belgrade, Belgrade, Serbia

[1]vtornjanski@gmail.com, [2]mladenc@fon.bg.ac.rs

Abstract—**This study is conceptualised to enlighten the perspective of organisational empowerment of the sustainable future by moving forward towards Society 5.0. The paper opted for a secondary research method. Research results reveal an innovative approach to sustainable organisation viewed from two perspectives. One perspective shed more light on a sustainable organisation as an entity by putting the organisation in the context of Society 5.0. Another perspective reflects organisational contribution to the collective intelligent ecosystem. The paper proposes key research directions for the future organisation that fit into the Society 5.0 paradigm. A new aspect of a smart, human-centric and noble future is outlined to strengthen the long-term well-being and prosperity of organisations, economies, and societies.**

Keywords - Society 5.0, organisational empowerment, sustainable and noble future, collective intelligent ecosystem, human-centricity.

I. INTRODUCTION

A wave of rapid technological development and global changes accelerated the birth of a new industrial revolution - Industry 4.0. The era of the 4th industrial revolution has introduced a disruption of stable business models across various industries, reflecting the phenomenon characterised by power to lower down organisational, industry's, country's, and regional boundaries, creating simultaneous opportunities and challenges for organisations. As a result, the era of Industry 4.0 drew the outlines of a new business landscape, signifying a design of new business models, changes in organisational capabilities and a shift of strategic competitive dynamics [1-4].

Industry 4.0 is characterised by emerging technologies development such as artificial intelligence (hereafter: AI), Internet of things (hereafter: IoT), cloud computing, big data, augmented reality, cyber-physical system (hereafter: CPS), adaptive robotics, enterprise architecture (hereafter: EA), and enterprise integration (hereafter: EI) [3,5-7]. Besides the digital disruption, many organisations face numerous challenges due to various external forces driven by uncertainty, volatility, strong competition, and a fast-changing business environment. These trends have fostered a wide variety of organisational changes in all industries, resulting in a very low success rate [1,7,8-10,37].

Despite many opportunities that Industry 4.0 may bring to businesses, organisations do not achieve expected real business achievements and return rates mainly due to limitations recognised at both strategic and operational layers. Existing literature points out that lack of vision, leadership quality, organisational culture, IT systems and unclear roles represent main constraints for organisations [7,11].

On the other hand, according to the research results depicted by Accenture (2010), a large majority of included CEOs in the study believe that sustainability represents a fundamental issue to future business success [10].

With that in mind, the aim of this paper is twofold. The paper sets out to find a sustainable solution for "future organisation" and enlighten

an organisational contribution to the collective intelligent ecosystem, using a research method based on secondary data collection.

II. LITERATURE REVIEW

The past century has promised a well-recognised future characterised by significant changes in societies that result in reciprocity with organisations, too. Drucker (1992) [12] has pointed out the new society of organisations drafted by changes in civilisation. History has shown that a sharp transformation occurs every couple of hundred years in societies. The transformation implies rearrangement of society in the context of its fundamental values, perspective on the world, social and other structures, key institutions, and culture. "*Our age is such a period of transformation. Only this time the transformation is not confined to Western society and Western history. Indeed, one of the fundamental changes is that there is no longer a "Western" history or a "Western" civilisation. There is only world history and world civilisation*" [12].

A. The Art of Organisation in Contemporary Society

Contemporary society is coloured by a vast variety of changes, creating both opportunities and challenges for organisations at an accelerated pace. Drucker (1992) [12] has recognised that a knowledge-based society is a future society in which organised long-life learning is the norm for sustainability, while knowledge is recognised as the primary resource for individuals, organisations and an economy overall. Knowledge-based economy evolution has transformed the way of how organisations perceive and value the competencies of human resources. For example, Drucker (1992) [12] believes that the strengths of a contemporary's organisation lie in well-qualified and knowledgeable people, while the dynamics of knowledge implies the building of change management into its very structure.

Numerous scholars and practitioners have supported Drucker's (1992) [12] view by recognising knowledge management and dynamic capabilities as a foundation for the development and achievement of an organisation's competitive advantage. For example, Santoro et al. (2021) [13] noted that an organisation's orientation to knowledge management indicates the development of ambidextrous entrepreneurial intensity and

performance. The intensity comes to the fore when an organisation pursues substantial dynamic capabilities [13].

According to Fjelstad & Snow (2018) [14], a complementary relationship is present between dynamic capabilities, organisation design and business models [14]. Dynamic capabilities represent the power of an organisation to effectively respond to changing environment by the strong ability to simultaneously integrate, build and reconfigure both internal and external required competencies in a way to create a healthy foundation for achieving competitive advantage [15,16]. On the other hand, the role of organisation design is to conceptualise an effective organisation that is composed of components that involve: strategy, structure, people, processes, management philosophy - the values, assumptions and beliefs as a basis for decision-making approach and leadership [15,17-19]. Finally, in a variety of definitions, a business model can be simply explained as a conceptual tool that emphasises a holistic view on how organisations do business with the overall goal to show the logic of an organisation, its strategic choice, value creation and value capturing within a value network [15,20].

To gain competitive advantage and sustainability, organisations increasingly recognised sustainable business model innovation (hereafter: SBMI) as a key driver that in perfect equilibrium with dynamic capabilities to innovate and appropriate organisational design can produce simultaneous values for multi-stakeholders [15]. Having a basic view on an organisation in contemporary society, the key question is how to achieve perfect equilibrium to create a more sustainable future for societies and organisations?

B. Going beyond Industry 4.0: Society 5.0 Overview

Society 5.0 is a core concept, vision and growth strategy of a sustainable future viewed as a "super-smart society" for the world. Society 5.0 is developed in Japan, presented by Keidanren, and adopted by the Japanese Government in 2016. Society 5.0 was introduced as a response to numerous challenges that the world is faced with and thus strongly promoted outside the country's boundaries. The purpose of the concept is to contribute to sustainability by integrating innovations characterised by Industry 4.0 into

businesses and societies aiming at flourishing well-being and prosperity to stakeholders [7,21-23,72].

According to Keidanren (2016), Society 5.0 is defined as: "*A human-centred society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space*" [7,23-25].

Similarly, a sustainable future in the context of Society 5.0 can be defined as: *"an innovative approach that encompasses and encourages simultaneous development and growth of both, economies and societies by introducing a concept of deep integration of humans' and smart machines' cognitive and emotional intelligence and open innovation, thus by empowering collective intelligence for the long-term well-being and prosperity of different stakeholder groups in the ecosystem"* [23].

The concept of collective intelligence introduced by [23] represents a set of integrated principles, building blocks and domains founded on new operating models and management practices with core power of knowledge, innovation, flexibility, agility, adaptability and dynamic capabilities to effectively shift intangible values into tangible assets. The concept of a sustainable future goes beyond the traditional postulation of value creation by shifting focus from shareholder to stakeholder value [23,26,27].

Collective intelligence viewed from the eye of Society 5.0 vision simultaneously shapes a strong foundation for organisational sustainability and designs a fashionable framework for prosperity and growth of economies and societies [23].

III. RESEARCH METHODS

The research method introduced in this paper is based on secondary data collection.

TABLE I. TABLE 1. RESEARCH METHOD BASED ON A FIVE-STAGE MODEL (SOURCE: [3,28])

No.	Research method process	
	Stage description	*Sub-stage description*
1	Definition of research criteria	Relevant sources based approach
2	Literature collection	Literature collection from reliable sources
3	Literature refinement	Filtering and sorting by subject relevancy
4	Analysis	Selection of appropriate content
5	Presentation of key research results	Conclusion making

The research method consists of a five-stage model showing the systematic literature review process that is depicted in Table I.

IV. RESEARCH RESULTS

The sustainable organisation understood from a sustainable future perspective, i.e. in the context of Society 5.0 is analysed from different perspectives in the existing theoretical fund.

A. Early Thoughts on a Sustainable Organisation: Towards Society 5.0 Context

Early thoughts on a sustainable organisation towards Society 5.0 context shed light on a perspective that focuses on an organisational design by suggesting a more sophisticated concept to effectively fit into the digital transformation journey and thus to enable smooth strategic orientation towards the future-ready enterprise. The effectiveness of the organisational design that supports future-ready organisation is primarily founded on two perspectives [29-36]:

- Ambidextrous organisation,
- Strategic IT alignment.

Digital transformation equals radical change that implies significant adaption of various components including [1]:

- Structural reorganisation,
- Digital leadership,
- Technology revamp,
- Process redesign,
- Incentive realignment,
- Cultural renewal.

Besides a more sophisticated organisational design, a future-ready organisation is grounded on dynamic capabilities and a business model that is innovative-based, agile-ready and fast-adaptable to all external forces that are coloured by dynamism, volatility and uncertainty [1,7,34,37-39]. This implies a stronger explorative aspect of the organisation, compared to the exploitative one in the paradigm of ambidextrous organisation.

Translating these compositions into practical imperatives for an organisation that is capable to create a competitive advantage in contemporary society, McKinsey & Company (2021) drew key takeaways for real-life practice purposes [40]:

- Taking a stance on purpose,

- Sharpening value agenda,
- Using culture as a secret sauce,
- Treating talents as scarcer than capital,
- Fast decision making,
- Taking an ecosystem perspective,
- Building data-reach tech platforms,
- Accelerating organisational learning
- Radically flatten the structure.

A future-ready organisation calls for the development of soft-based skills and effective leadership approaches. McKinsey & Company (2019) [41] have shaped the leadership approach for 21st-century organisations that is based on four new roles:

- Visionary,
- Architect,
- Coach,
- Catalyst.

Integrated roles of leadership approach make a difference that creates a powerful kind of shared and servant leadership style that energises and reveals people's potentials and passions to bring the best value to stakeholders [41].

B. A Sustainable Organisation in the Context of Society 5.0

The purpose of a sustainable organisation in the context of Society 5.0 is to provide an opportunity for all. A sustainable organisation represents a vision of an innovative organisation that simultaneously [7,22,23,42]:

- Harmonises operational efficiency with strategic effectiveness,
- Satisfies tangible and intangible organisation's and stakeholders' needs,
- Sustains human-centricity by:
  - Creating a noble environment,
  - Strongly enabling and supporting work-health-personal life balance.

A sustainable organisation in the context of Society 5.0 highlights a promising operating model for the future that is based on the synergetic effects of deeply integrated collaboration between smart machines and humans. Smart machines in this paper represent machines with incorporated cognitive and emotional intelligence [7,23]. The perspective is based on the human-centricity paradigm in which knowledge economy and humans' needs come to the fore.

To create sustainable value for an organisation and stakeholders, a fundamental transformation that implies changes in both the hard and soft components of an organisation are required [7]. Key transformation's aspects lie in:

- Perfect harmonisation between [15,23]:
  - Effective sustainable business model innovation,
  - Strong dynamic capabilities to innovate,
  - Organisational design that easily fits into the vision of contemporary organisation and society viewed in the context of Society 5.0.
- The development and adoption of new leadership approaches and a set of new managerial knowledge and skills [43,44]. In particular [7,23,34,45,46,48]:
  - Innovation management,
  - Capability to empower people,
  - Developed emotional intelligence,
  - Leading by heart paradigm,
  - Fusion skills,
  - Creativity,
  - Talents recognition and valuation as the most valuable asset
- Soft-based skills development and empowerment through the entire organization [23].

The sustainable organisation observed from the perspective of collaboration between humans and smart machines outlined the challenges in particular aspects that needed to

be shifted into opportunities. Key challenges lie in the following areas [7,23,46,47]:

- Organisational maturity level,
- Organisational culture,
- Management practices:
    - Leadership style,
    - Management knowledge and skills,
- Unclear AI strategies,
- Technical knowledge for implementation,
- Adequate implementation of AI.

C. Organisational Contribution to the Collective Intelligent Ecosystem

The collective intelligence ecosystem in this paper follows the understanding of the context introduced by Tornjanski et al. (2020a) [23], and consists of three main components:

- Humans' cognitive and emotional intelligence,
- Artificial cognitive and emotional intelligence,
- Open innovation.

A collective intelligence ecosystem is an innovative approach to a sustainable future viewed in the context of Society 5.0 that is conceptualised to enlighten and empower long-term prosperity and well-being to organisations, economies and societies [23].

The existing theoretical fund suggests that economic results cannot ensure sustainable value creation if limited at an organisational level. Rather, creating a sustainable value requires satisfying and empowering the needs of stakeholders beyond "classical" customers. In other words, sustainable value creation by an organisation comes to the fore when applied in an ecosystem manner, i.e. when applied to internal and external multi-level stakeholders [73]. The thought can be strongly supported by the understanding of an organisation as an entity. According to Adizes (1979) [74], Dulanović & Jaško (2009) [38], Janićijević (2011) [39], an organisation is both:

- An open system that continuously evolves,

- Subsystem in a business ecosystem.

With that in mind, numerous scholars have recognised that innovative businesses cannot survive, develop and grow in a vacuum. Instead, to achieve long-term well-being and prosperity for all stakeholders, an extended collaborative network that exceeds the organisation's boundaries indicates a model of sustainability in contemporary society [3].

Organisational contribution to the sustainable future viewed in the context of Society 5.0 implies:

- Development the purpose of a sustainable organisation in the context of Society 5.0 at a collective level,
- Development of sustainable organisation in the context of Society 5.0 at a collective level,
- Shifting focus on ecosystem instead of an organisation as an entity,
- Integration of technologies that constitute Industry 5.0 into an ecosystem,
- Shifting focus from shareholder value to stakeholder value,
- Development and integration of key components that build collective intelligence ecosystem at all levels.

Organisational contribution to collective intelligence ecosystem - conceptualised for sustainable future, implies new aspects of a smart and noble future that aims to strengthen the long-term well-being and prosperity of economies and societies by designing and empowering a sustainable organisation in the context of Society 5.0 and its further development and translation at a collective level.

To effectively transform all challenges into opportunities, and to maximise value for all stakeholders, the following aspects should be holistically approached [3]:

- Multidisciplinary knowledge continuous development,
- Strategic change leadership knowledge and skills,
- A culture that can effectively support Society 5.0 concept and context,

- Strong security and privacy approach,

- Pull-based security ecosystem development and integration into collective intelligent ecosystem.

D. Future Organisational Forms that Fit the Society 5.0

Further development of organisational theory can be grounded on, at least, five key directions that Society 5.0 context allows to researchers.

The research study of this article is founded on the interpolation and extrapolation of trends observed and partially elaborated in the previous chapters. The interpolation part shows that there is much overlap between those directions. While risking being redundant due to that overlap, key organisational research directions for Society 5.0 can be categorized as follows:

- Networked organisation,

- Self-management teams and organisation,

- Digitally transformed organisation,

- IT transformed organisation,

- Agile organisation.

The first branch of research is aimed at meta-organisational design. While the organisations can be designed one at a time, at a particular level, relations they form between themselves are too complicated to be left alone to the market and contractual relations. Pioneer research of Miles & Snow (1986) [49], Powell (1990) [50] and Moore (1993) [51] directs us towards a flexible, network form that is structurally fitter to the prerequisites mentioned in the text above, given by McKinsey & Company (2021) [40]. An interesting view is a branch of research related to an ecosystem, initiated by Powell (1990) [50], which treats the inter-organisational design less like an intentional, exact engineering approach and more like a systematic action. Society 5.0 will need more specialised organisations. What was earlier value creation chain will be transformed into a value creation network or even a self-sustainable ecosystem. Hence, the study of these structures will contribute to defining organisations appropriate for Society 5.0.

The second line of research refers to a self-management stream of research initiated by the early nineteen-century philosopher John Stuart Mill. This approach started as a mainly political and economic topic but was elaborated in the theory of management by Adizes (1971) [52] and recognised as the important influence on job design by Hackman & Oldham (1976) [53]. Further, Cohen et al. (1996) [54] added the predictors for the functioning of the self-management team. Always balancing on the edge of political ideas, the concept was utilised as the important factor of the business process reengineering popularised by Hammer & Champy (1993) [55] used in organisations like Larsen (2002) famous spaghetti organisation example in the Oticon corporation [56]. Today it is mainly flag shipped by Laloux (2014) and his theory of teal organisation [57]. The importance of self-management for Society 5.0 was foreseen by the eighth internal hypothesis of Mintzberg (1993): "*The automation of the operating core transforms a bureaucratic administrative structure into an organic one*" [58]. As artificial intelligence is more and more involved in value creation in all fields of human endeavour, Society 5.0 cannot rely on the organisational structures, processes and ideas recycled from earlier industrial revolutions.

Digital organisational transformation can be seen as the technical aspect of adapting current organisations to Society 5.0. Introduced by the Andal-Ancion et al. (2003) [59], contemporary studies are mainly led by Berman (2012) [60], as well as Matt et al. (2015) [61]. Kane et al. (2015) [62] emphasise the importance of organisational instead of technological aspects in the digital transformation. As the citizens of Society 5.0 use digital technology in all aspects of life, organisations need to adapt the way they create, promote and disseminate value from the analogue, classical approaches towards digital ones. That is not a one-dimensional endeavour but a significant organisational change that requires detached research analysis.

The next dimension of research can be pioneered by the ground-breaking, although partially neglected, research of Groth (1999) in future organisational design [63]. While the other approaches use existing paradigms of the organisation, Groth (1999) [63] elaborates on how information technology is changing the very essence of the organisation, and its dimensions of specialisation, centralisation, formalisation, control and coordination. Mainly

grounded on the works of Mintzberg (1993) [58], Groth's research is implemented chiefly in the practical research of information and communication technology application [63-66]. Thus, it can be seen as the philosophical milestone for the transformation of organisations as entities and the whole paradigms of organisations for Society 5.0.

Finally, the popular application of agile organisation can be viewed as the eclectic mix of the previous approaches. Initially developed by a team of seventeen professionals in information technologies [67], it used four principles to define a novel approach to software development. Organisationally, it transformed the process of team value creation, flattened the organisational structure and favoured small increments in the development of the solution rather than major ones. Scrum, extreme programming and lean programming are popular techniques derived from the concept. However, agile became more than the organisational approach in software development, and process, structure and strategy changes of the agile organisation are currently applied in creative industries [68], the financial industry [69], aviation industry [70] or generally in large organisational projects [71]. The significance of this direction for the development of Society 5.0 organisations is that the agile organisation's core is the continuous and fast-increment adaptation to the changing environment, which fits the traits of the Society 5.0 described in the text above.

V. Conclusions

This study is conceptualised to shed more light on the perspective of organisational empowerment of the sustainable future by moving forward towards Society 5.0.

The paper opted for a secondary research method that is based on secondary data collection.

Research results introduced in this paper depicted an innovative approach to sustainable organisation viewed from two perspectives, i.e.:

- One perspective outlined a view on a sustainable organisation as an entity by putting the organisation in the context of Society 5.0.,

- Another perspective reflects organisational contribution to the collective intelligent ecosystem.

The paper proposes a new aspect of a smart, human-centric and noble future that aims to strengthen the long-term well-being and prosperity of organisations, economies and societies. Based on the literature review, we propose main directions of research for the Society 5.0 organisation as Networked organisation, Self-management teams and organisation, Digitally transformed organisation, IT transformed organisation and Agile organisation.

The paper may contribute to academics in the area of organisation management, change management, innovation management, and human resource management. Also, the paper can be useful to organisations that are interested in further implementing the concept of a sustainable organisation that is introduced in this article.

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Ethics in Digitalization

Can Adam Albayrak[1], Ortwin Renn[2], Karl Teille[3]

[1]Harz University of Applied Sciences, Wernigerode, Germany
[2]Institute for Advanced Sustainability Studies, Potsdam, Germany
[3]Volkswagen AG, Wolfsburg, Germany

calbayrak@hs-harz.de

Abstract— **Technical innovations of the digitization lead to significant changes in society. From the point of view of computer science, the main focus is at the technical side of innovations or at the clear economical aspects for the clients. Not very often they see the consequences of the created "digital ecosystems" for the people and their living together. The remarks enlighten these topics and propose ethical guidelines for human actions and interactions with the technical innovations.**

Keywords - acceptance, personal data, digitization, computer ethics, innovations, ethical guidelines, technology impact assessment

I. INTRODUCTION

More and more frequently and with increasing speed, technical innovations, especially in the field of computer science, lead to changes in society. The computer scientists who develop these innovations are often concerned with the technical side of the innovations or the possibilities of implementation in the market, but less often with the impact of these innovations on our everyday life and on our coexistence. Current trends such as Big Data, cloud computing, machine learning and artificial intelligence, global and ubiquitous networking, the Internet of Things and Services, as well as entirely new application possibilities when combining these technical innovations are leading to changes in the world of work and everyday life in society.

This paper therefore focuses on the question of how digitization and the resulting technical possibilities are changing the way people live together and what guidelines should be applied to human actions.

II. TECHNICAL INNOVATIONS AND THEIR EFFECTS

A. Selected Previous Work

According to [1], in a first step, all listed techniques and concepts of the digital world can be reduced to the questions: Who provides what data intentionally or unintentionally? What information is obtained by whom for what purpose? Who bears the risks, if any, resulting from this?

Even though there are more and more of them, comparatively few IT experts and scientists, such as [2,3], deal with the effects of technical innovations on society. As a counterpart to business ethics, which first addressed social and responsible corporate governance in the 1970s and 1980s [4], information ethics deals with ethical issues in the handling of information.

B. Accepted and Tolerated Technical Innovations

In the history of mankind, there have always been technical innovations that were accepted by individuals or by the respective societies to a greater or lesser extent, i.e., approvingly (accepted innovations) or only approvingly (tolerated innovations), or rejected completely or predominantly. Even if the concept of innovation is defined differently in the literature, most definitions have in common that an innovation is a novelty at least for the system under consideration and that it is accompanied by a change or a transformation in the system (authors' collective 1988).

Before an individual can accept, tolerate or reject an innovation, that individual must first

become aware of the innovation and form an opinion about it.

Acceptance for new digital services, such as smart urban cities, or technical systems, such as self-driving vehicles, does not necessarily require a positive attitude or advocacy [5].

Many infrastructure projects, including those in the digital innovation sector, are not received with enthusiasm, at least initially. For the political implementation of innovations, it is usually sufficient if the people affected by them tolerate the associated measures and conversions in their living environment. In order for a drastic change in one's own living environment to gain acceptance in this sense, four prerequisites must be met. A similar compilation can be found in Susan T. Fiske (cf. 2010, 89-92) [6]. Susan T. Fiske names the following basic motives: understanding (corresponds to orientation), controlling (comes close to the concept of self-efficacy) and self-enhancing (identity development). However, she does not mention utility, which is undoubtedly an important motive. For collective action, see [7].

Self-efficacy: people tend to reject interventions in their lifeworld if they associate with them the idea that their scope of freedom and their sovereignty over their lifestyles could be negatively affected.
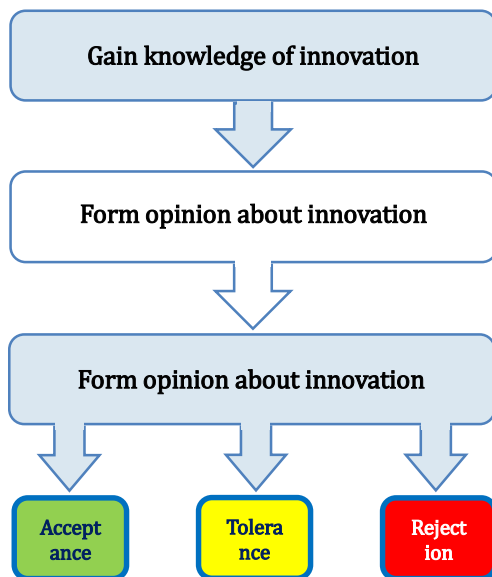
Positive risk-benefit balance: Acceptance is more likely the more the planned digital innovations benefit oneself or the groups and individuals one particularly values.

Identity: The more one can identify emotionally with a measure, the greater the willingness to accept it. When innovations are introduced, it is important to provide information that helps potential users to understand the significance of the project for their individual development and to check whether the project fits in with their own self-image and their own environment.

However, the effectiveness of communication in influencing acceptance is limited. Particularly when it comes to projects where the individual himself has little experience and where the general benefit is socially disputed, it is almost impossible to achieve a change in acceptance through information and communication alone, even if they are offered in the form of a dialog. In addition, a digital innovation is often perceived as an invasion of privacy and a latent threat to one's own sovereignty. Here, the communicator has bad cards.

In addition to an understanding of the necessity of participatory approaches in the implementation of innovative digital services, however, there is still a need for the concrete design of participation processes. There are no general recipes for this (see, for example [8-10]. However, it has been shown that the central key points must be made transparent for all participants, especially at the beginning of the participation process.

The factors that influence the opinion-forming process include in particular

- the value system, i.e., the characteristics that are highly regarded in a society or by an individual,

- the prevailing (public) opinion in a society,

- the level of education in a society and even more so the level of education of the individual himself,

- the quality of the information about the technical innovation, i.e. the degree to which the information corresponds to the actual facts

Figure 1. Process of forming opinión.

424

- the possibility or the effort to obtain information at a high quality level,

- the degree of freedom of the individual to form an opinion,

- and, especially in the case of technical innovations, certain technology-driven trends, which, however, interact with the previously mentioned factors.

III. Norms and Ethical Foundations

Norbert Wiener wrote: "We have modified our environment so radically that we must now modify ourselves in order to exist in this new environment. We can no longer live in the old one. Progress imposes not only new possibilities for the future but new restrictions" (Wiener 1954).

Authors in [1] have already made suggestions for guidelines, which we take up again here, supplement and group. We need new moral guides for life in the digital world that answer specific questions. We now distinguish between three different areas:

(1) Guidelines relating to personal data,

(2) Guidelines relating to communication

(3) and other guidelines relating to social interaction.

These guidelines, whether in the professional or private sphere, are intended to provide all people and associations of people with a kind of foundation on which to base accepted technological innovations. Ideally, technological innovations outside this foundation are neither tolerated nor accepted.

We first formulate the guidelines and then go into more detail on the research questions.

A. Guidelines in Relation to Personal Data

(D1) Everyone's data is their property. Their collection, storage and processing requires the explicit consent of the individual on a recurring basis. Everyone has the right to know at any time who is storing which of their data.

(D2) Everyone has the right to know what information is generated from their own data and the procedures used by algorithms to generate information from their data.

(D3) Everyone has the right to request (where justified) the correction and (where appropriate) the deletion of their data.

(D4) All stored data must be deleted after a specified period of time, unless this is explicitly excluded by law, e.g. for criminal prosecution. In this context, intelligence services are also subject to legal regulations. Even the latter must not operate in a legal vacuum, whether national or international.

(D5) Everyone has an obligation to protect the privacy of his or her data and the data to which he or she has access.

(D6) The possibility of switching sensors and automatic data deliveries on and off must be provided for in all devices (PCs, notebooks, wearables and private vehicles, insofar as it does not restrict traffic safety) in a user-controlled manner.

(D7) Providers of Internet portals and social media, data traders, financial service providers and, in particular, states and reporting authorities are to be required to exercise particular care in handling personal data. In the event of changes to the GTCs, these must be explicitly pointed out.

B. Guidelines with Regard to Communication

(K1) The forms of respectful and dignified communication are to be observed and enforced (anonymously or not) also on the Net.

(K2) Non-participation or refusal to participate in digital offerings must not lead to sanctions against the individual. Offers to customers must be checked to ensure that deliberate non-participation does not result in serious disadvantages for the individual, so that he or she cannot really escape the obligation to accept the offer.

(K3) Sending data that has not been ordered (spam) is subject to a charge (e.g., micropayment). Additional information or services require explicit consent.

(K4) Advertising as well as individualized information must be marked as such.

(K5) Avatars and social bots must be identified as such. The communication partner should always know whether he is dealing with a human being or an avatar.

(K6) In the spirit of the existing press law, sources and mediators of information must also be named in the digital world of global networks.

C. Other Guidelines

(S1) The distinction between the real and virtual worlds is becoming increasingly blurred.

Actions are to be evaluated in terms of their effects in both the real and virtual worlds.

(S2) Monopolies in the area of social media, search engines and Internet portals must be specifically prevented (by the state or supranationally) or at least monitored. (Note: The postal and railroad systems were once organized by the state for good reason).

(S3) Education in the use of digital media to acquire appropriate media competence in the curricula of schools and other educational institutions should be considered.

(S4) The possibility of equal access to digital information must be ensured regardless of income, social status or ethnicity. Preferential treatment of paying customers is rejected.

(S5) Censorship of available information on the Internet, especially by state institutions, is not acceptable (see D3, S6).

(S6) Where private providers (e.g. Facebook) are required by law to delete discriminatory content for reasons of personal rights or to protect minorities, proportionality must be maintained and an ethics council (analogous to the German Advertising Council, for example) must be set up to monitor this. (see D3, S5).

(S7) Electronic elections and electronic vote counting must be rejected because of their inherent lack of transparency and the fact that they can in principle be manipulated in democratic decision-making.

D. Research Questions on the Guidelines

The implementation and practical application of the guidelines encounter at least three challenges. Firstly, the proposed guidelines are often only vaguely definable in terms of their moral claim and are thus not consistently free of contradictions. Secondly, new challenges arise from expected technical developments, and thirdly, economic considerations and commercial interests seem to stand in the way of practical implementation, at least in the business sense. Insofar as value is placed on the practical implementation of the guidelines, a wide field opens up for interdisciplinary research.

Regarding D1:

Where are the limits of what is reasonable for the individual, but also for society?

Regarding K3:

What is "everyone's data" and to what extent can compiled data also be someone else's data?

Where does the limit of this requirement begin with regard to derived or aggregated data?

How and with what reasonable effort can control be enabled and misuse be limited?

Regarding D2:

In the age of digital services and with the non-patentability of programs and algorithms, the "algorithms with which service providers generate information from data" represent a significant value of the service providers using the data (Google, Amazon,...). Nevertheless, how can companies' investments in these algorithms be protected?

Regarding D3:

Who defines what is "legitimate" and what is "appropriate", and according to which criteria?

Regarding D4:

What about data whose preservation is in community or contemporary interest, and where does the delineation take place?

Regarding D5:

What is the obligation of individuals for data they never asked for or would incur significant costs to securely store?

Regarding D6:

To what extent is this even possible given technological innovations (Internet of Things, smart dust, etc.)?

Regarding K1:

Where does the boundary of free expression begin? Cultural idiosyncrasies and different aspects of what is understood by "good education" make this guideline appear fuzzy in principle.

Regarding K2:

Even if discrimination is to be avoided, individuals will experience restrictions if, for example, they refuse digital accounts or have to accept disadvantages due to their inaccessibility.

Given the extensive autonomy of the Internet, how can such commercialization of digital communication be enforced worldwide or at least in significant areas? Moreover, the relevance of

this point seems obsolete if artificial intelligence methods were to enable effective spam filters.

Regarding K4:

Where does the boundary of advertising begin when taking over prefabricated articles, reports, films from "independent" third parties?

Regarding K5:

It is possible that mixed forms of communication are conceivable in which social bots or avatars act in a human-assisted manner. The question here would be what still appears here as a natural (human) interlocutor.

The question of passing a Turing test will raise the question of the capabilities of an artificial intelligence here, but can no longer serve as proof of "humanity".

Regarding K6:

How can standards use digital innovations such as blockchain technology to enforce this claim globally?

Regarding S1:

The extent to which the concept of "reality" needs to be recast needs to be investigated.

Regarding S2:

How can this control be democratically legitimized without degenerating into censorship measures and arbitrariness?

Are public digital media, in addition to Twitter, Facebook, etc., analogous to a public broadcaster necessary?

Regarding S3:

The ministers of education and cultural affairs must mandate appropriate courses.

Regarding S4:

What media and technical aids (devices) are necessary, and who bears the costs?

Regarding S5:

A delimitation of this requirement at least to the guidelines K1, K3, D3 and S2 seems necessary.

Regarding S6:

The ethical conflict arising here between the individual's freedom of expression and the protection of others against discrimination, or the need for a rapid response in the digital world

based on clear guidelines, appears to be a difficult and major social challenge.

Regarding S7:

How could manipulation of election results be possible and at what expense, and where have initial suspicions already arisen (cf. American presidential election 2016)?

IV. CONCLUSION

Most computer scientists are good at developing technology, but often poor at deducing what can happen with technology in society. The authors state that digitization changes the rules of living together in a community and that digitization offers both opportunities and risks.

From the authors' point of view, the possibilities of digitization can only be used ethically and without major social upheaval in the long term if there are rules and laws whose application explicitly regulates use and restricts misuse. It is up to us to make the change transparent and to strengthen the individual's sense of responsibility for himself and his fellow man. It is important to make appropriate rules known and to establish them in our lives together.

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Risk Management in SMEs in COVID-19 Crisis Conditions

Ivana Marinović Matović[1]

[1]PUC Parking Service, Niš, Serbia

ivana.m.matovic@gmail.com

Abstract—**This paper describes the influence of COVID-19 pandemic on small and medium enterprises (SMEs), focusing on SMEs operating in the Republic of Serbia. In order to investigate the impact of COVID-19 crisis, a questionnaire was conducted, and the responses were collected from Serbian SMEs. The questionnaire was conducted with the aim of examining a pandemic impact on the continuity of SME businesses, and the reasons that led to the eventual business suspension. The paper features a significance of risk management and crisis management for survival and business sustainability in unforeseen conditions.**

Keywords – SME, small business, COVID-19, crisis management, risk management

I. INTRODUCTION

Many authors have pointed out that small and medium enterprises (SMEs) have a very important role for the development of national economies [1,2], because they represent the main support and a key resource of economic growth, dynamics and flexibility [3]. The contribution of SMEs, in terms of job creation, and high innovativeness is particularly significant in transition economies [4]. The innovativeness of SMEs, as well as their significant role in the development of new technologies and digitalization, contributes to reducing unemployment and encouraging new investments, which is an important factor in the development of transition countries [5,6].

SMEs are the backbone of the global economy, employing over two-thirds of employees globally, or up to 90% of the working population in developing countries [7]. The COVID-19 crisis, and the measures taken by national economies to combat the spread of infection, affected the operations of all companies, but the most vulnerable were SMEs, which had limited financial and other resources [8].

The aim of this paper is to sublimate the knowledge about the effects of COVID-19 pandemic on the small businesses. First of all, the crisis impact on the business continuity of SMEs in the Republic of Serbia is analyzed, and then the basic determinants of risk management and crisis management were considered, that contribute to maintaining the business of these companies in the COVID-19 pandemic.

II. EFFECTS OF COVID-19 ON SMALL BUSINESS

The COVID-19 crisis is characterized by a high degree of unpredictability, with the impossibility of organizational planning of preventive activities, which endangers the survival and sustainable operations of companies, endangers their goals, and requires quick reactions [9].

SMEs are vulnerable to the crisis caused by COVID-19 pandemic for several reasons, primarily due to resource constraints and weaker market positioning [10]. The pandemic has changed the business environment and in most cases reduced the demand for their products and services. The sectors most affected by restraint measures are those in which a large number of SMEs operate, and these are the sectors characterized by human contact and interaction, such as culture and arts, fashion, tourism and the aviation industry [11].

The crisis caused by COVID-19 pandemic has a strong impact on companies, employees and the way they do business, which requires

radical measures by governments to reduce business losses and to secure the survival of companies [12]. Working from home, almost completely canceling business trips, holding virtual meetings using various applications, work engagement on digital platforms, have become part of everyday business life [13]. To manage the crisis, many companies have digitized their business processes, which at the same time provided a safe working environment for their employees [13].

The survival and sustainable business of SMEs, in the conditions of COVID-19 pandemic, depends on the crisis duration, the applied measures of movement restrictions, business incentive programs, as well as the resources available to the company. The availability of liquid assets is of great importance during the crisis period, especially in a situation of untimely state support [14].

According to a UNCTAD study [15], SMEs are significantly more affected by declining demand for products or services, lack of necessary raw materials, reduced liquidity and availability of liquid assets, as a result of the crisis caused by COVID-19 pandemic. Anti-virus measures, such as locks and quarantines, have had devastating consequences for the

businesses of these companies. Although most companies are affected by the COVID-19 crisis, the depth and nature of its impact vary depending on their size.

III. COVID-19 CRISIS AND BUSINESS CONTINUITY OF SERBIAN SMEs

In order to analyze the impact of COVID-19 on SMEs in the Republic of Serbia, a survey was conducted in a two-month period, April to May 2021, and the number of respondents was 392. Within the questions that included the attitudes of SMEs regarding the impact of crisis on their business, applied measures and expectations from the state, the questionnaire also included questions concerning the continuity of business activities of SMEs.

In a selected sample of SMEs, the study examined the impact of COVID-19 pandemic on the business continuity of these organizations, as well as the reason for the suspension of business activities in those SMEs that have stopped operations. It was also analyzed whether the COVID-19 pandemic has a different impact on the business continuity of SMEs, depending on their affiliation to a particular industrial sector. The results are shown in Table I and Table II.

TABLE I.   IMPACT OF COVID-19 PANDEMIC ON SME BUSINESS CONTINUITY.

Industrial sector	Business continuity	Total	Total (%)	Cumulative (%)
Manufacturing and construction	Currently open	83	89.2	89.2
	Temporarily closed	10	10.8	100.0
	Total	93	100.0	
Trade	Currently open	63	94.0	94.0
	Temporarily closed	2	3.0	97.0
	Permanently closed	2	3.0	100.0
	Total	67	100.0	
ICT and finance	Currently open	49	100.0	100.0
	Total	49	100.0	
Other services	Currently open	129	86.6	86.6
	Temporarily closed	18	12.1	98.7
	Permanently closed	2	1.3	100.0
	Total	149	100.0	
Other	Currently open	33	97.1	97.1
	Temporarily closed	1	2.9	100.0
	Total	34	100.0	
Total	Currently open	357	91.1	91.1
	Temporarily closed	31	7.9	99.0
	Permanently closed	4	1.0	100.0
	Total	392	100.0	

TABLE II.   REASONS FOR CLOSING SME.

Industrial sector	Reason	Total	Total (%)	Cumulative (%)
Manufacturing and construction	COVID-19	6	6.5	6.5
	Not COVID-19	4	4.3	10.8
	Currently open	83	89.2	100.0
	Total	93	100.0	
Trade	COVID-19	3	4.5	4.5
	Not COVID-19	1	1.4	5.9
	Currently open	63	94.1	100.0
	Total	67	100.0	
ICT and finance	Currently open	49	100.0	100.0
	Total	49	100.0	
Other services	COVID-19	17	11.4	11.4
	Not COVID-19	3	2.0	13.4
	Currently open	129	86.6	100.0
	Total	149	100.0	
Other	COVID-19	1	2.9	2.9
	Currently open	33	97.1	100.0
	Total	34	100.0	
Total	COVID-19	28	7.1	7.1
	Not COVID-19	7	1.8	8.9
	Currently open	357	91.1	100.0
	Total	392	100.0	

Observed on a sample of 392 SMEs, the survey found that 91.1% of companies still operate, while in the period after the outbreak of COVID-19 pandemic, 8.9% of companies suspended business activities. 7.9% of the observed sample temporarily suspended operations, while 1% of respondents confirmed that they had permanently closed their companies. SMEs that have suspended their operations, temporarily or permanently, have mostly done so under the influence of COVID-19 crisis, as confirmed by 80% of respondents. Only 7 observed companies, or 1.8% of the total sample, stopped operations for reasons unrelated to the COVID-19 pandemic. The results of the research confirmed that the COVID-19 pandemic did not have a negative impact on the business continuity of SMEs belonging to the sectors of ICT and finance, because 100% of the observed companies continued to operate even in crisis conditions. Companies that perform other service activities are most affected by the pandemic. Due to the negative impact of the COVID-19 crisis, 13.4% of other service SMEs confirmed that their companies had stopped operations, with 12.1% temporarily and 1.3% permanently. The reason for the business suspension in other service activities is mostly the COVID-19 pandemic, as confirmed by 11.4% of companies (85% of SMEs that stopped operations, either temporarily or permanently).

IV. RISK MANAGEMENT IN COVID-19 CONDITIONS AND SMALL BUSINESS CONTINUITY

Crisis management is a challenge for SMEs, where managers bring strategic decisions in the most difficult circumstances [16]. Reference [16] emphasizes the importance of crisis management for the company, in the form of reducing the harmful effects of the crisis on business. The crisis management is the process of identifying and predicting the potential crisis, and the reduction of its negative effects on business [17]. This process should be seen not only as a reactive response to the crisis effects, but a proactive style of management, which includes protective actions, prevention, readiness and recovery of company [18].

If there is a preventive activity, according to [19], the crisis management is more efficient, because the organizational culture of the crisis response is already established in the company. The crisis management should include the learning process, and adaptation of the organizational structure and managers, which makes it easier to notice potential chances in crisis conditions [20]. According to [21], the learning process is a key factor for efficient confrontation with future problems in the crisis management process.

If SMEs adequately manage crises, and perform timely crisis planning, they will preserve profitable business in crisis conditions [22,23]. The role of managers in crisis conditions is crucial for the company [24].

Professional management and quality of human capital are crucial for SMEs in crisis conditions [25]. References [26] confirmed in their studies that the effective risk and crisis management is of great importance for the appropriate business reaction and overcoming the crisis challenges. This achieves a timely reaction of SME, and the application of adequate risk and crisis management [27], which leads to sustainable business, new chances and directions of development [28]. The crisis requires a timely response and reorganization [27], which can lead to a new business development opportunities and directions [28].

V. CONCLUSION

Many SMEs were affected by the COVID-19 crisis, which led to reviewing of their approach to risk management, in the unpredictable crisis conditions of the macro-environment. COVID-19 pandemic affects SMEs, their employees and their business models. This crisis caused by the pandemic has led to a depth market changes in the region and globally. With general measures to prevent the spread of pandemic, different industrial sectors are affected, to a greater or lesser extent.

During the period of uncertainty, SMEs should consider the potential influences of this crisis on employees, customers and suppliers. Companies that ignore possible risks, that do not undertake any necessary measures, or do not create adequate business solutions, will be deeply affected by the negative effects of the crisis. Especially managers should predict all potential impacts of pandemic, and take a series of measures to make their SME overcome the crisis as soon as possible.

The business in crisis conditions involves different solutions, very specific to each organization, which SMEs should apply. In addition to technical and technological improvements, it also includes the depth process of the risk management. Risk management implies strengthening of business risks, through strategic and operational risks, business process and decision-making, all the way to early crisis identification, and developing adequate concept

of crisis management to maintain business continuity.

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Innovations in Transport: Gender Perspective

Milica Stanković[1], Gordana Mrdak[2], Suzana Stojanović[3]

[1,2,3]The Academy of Applied Technical and Preschool Studies – Vranje Department, Serbia

[1] milica.stankovic@akademjanis.edu.rs,
[2]gordana.mrdak@akademijanis.edu.rs,[3]suzana.stojanovic@akademijanis.edu.rs

Abstract—**The goal of the innovation is to efficiently meet existing needs as well as to create new needs that will arise from customer requirements. Gender equality is a core value of the European Union, a fundamental right and a key principle of the European Pillar of Social Rights. The main reasons for the underrepresentation of women in the labor force in the transport sector are the stereotypes that transport is a male-only sector, difficult working conditions and safety problems, as well as work-family balance challenges. The inclusion of women in the transport sector is an economic imperative that is crucial for the growth of the sector and long-term sustainability. The aim of the paper is to point out the importance of innovations in transport, while considering the gender dimension of transport innovations. The first part of the paper analyzes innovations in the transport sector, while the second part of the paper analyzes innovative transport policy. The third part of the paper is dedicated to the gender gap in transport innovations. In the third part of the paper, the emphasis is on the gender gap in the European transport sector. After a comprehensive analysis, relevant conclusions are drawn.**

Keywords – transport, gender gap, economics, innovation

I.   INTRODUCTION

The goal of the innovation is to efficiently meet existing needs as well as to create new needs that will arise from customer requirements. In transport, technical, technological and production innovations can become a means to outperform competitors. In other words, better and more efficient transport services should be offered to the market. Innovation means the ability of a business to create and implement ideas that have not been used in practice so far. Innovations most often refer to the offer of a new generation of services and innovations such as the most modern means of transport, new infrastructure, and modern traffic control techniques, new means to improve safety, new ways to mitigate environmentally harmful consequences. The inclusion of women in the transport sector is an economic imperative that is crucial for the growth of the sector and long-term sustainability. However, women remain underrepresented in the transport sector. The aim of the paper is to point out the importance of innovations in transport, while considering the gender dimension of transport innovations. The first part of the paper analyzes innovations in the transport sector, while the second part of the paper analyzes innovative transport policy. The third part of the paper is dedicated to the gender gap in transport innovations. In the third part of the paper, the emphasis is on the gender gap in the European transport sector. After a comprehensive analysis, relevant conclusions are presented.

II.   INOVATIONS IN TRANSPORT SECTOR

Innovation can be interpreted as an instrument for the exploitation of financial resources in order to realize certain ideas for increasing profit. Innovation could also be understood as a change in companies offers, a change in a business model or service, which should significantly improve the satisfaction of the needs of service users. Reference [1] defines innovation as an idea, product or technological element that is developed and offered to customers who perceive it as new or innovative. There is only one reliable way to introduce innovation - to properly interpret the market and

customer needs. The innovation could also be represented by a new product line, a simplified sales system or a more efficient management staff [2].

The need for transport is a derivative need and is expressed by the demand for transport service. Innovations include a variety of activities related to market novelties, such as streamlining existing transport services or designing new transport offers. According to [3], innovation is a specific tool for an entrepreneur to get the opportunity to start a new business or provide services. Innovation means the ability of a business to create and implement ideas that have not been used in practice so far. Innovations most often refer to the offer of a new generation of services and innovations such as the most modern means of transport, new infrastructure, modern traffic control techniques, new means to improve safety, new ways to mitigate environmentally harmful consequences [2].

There are proposals for innovations in the field of transport that attract attention. These are transport solutions within logistics supply chains, e.g. intelligent container terminals, ultramodern bimodal systems or underground systems for the transportation of freight across cities. The Strategy for Transport Development by 2020 features innovative projects of technical and pro-ecological character. The most vital ones forecast redevelopment and assurance of inner interoperability of telematic systems which serve particular transport branches, such as ITS - road transport, ERTMS - rail transport, SESAR - air transport, VTMS – sea transport, and RIS - river transport [2].

III. INNOVATIVE TRANSPORT POLICY

Incentives for innovation in transport should come from transport policy. Given the fact that transport policy aims to achieve a well-balanced transport system (in technical, spatial, economic and environmental terms) with cooperation in creating a single transport market across Europe, transport policy should certainly encourage transport innovation. Innovative transport policy, obviously, contributes to a well-balanced development of transport through proper stimulation and financing of transport investments. In logistic terms, logistic innovations for transport were presented in the action plan of the European Union Commission for the logistics of freight transportation. They are, for instance, electronic freight transportation (e-Freight) and intelligent transportation systems

(ITS). This has been confirmed by the White Paper of 2011 "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system". The White Paper focuses on technological innovation, safer and more reliable transport networks with the use of information technology and communication systems [2]:

• Formation of stable platforms and mechanisms for co-operation between public and private sectors, research and scientific units. These platforms may be in the forms of clusters which effect in synergy in establishing competitive edge. Clusters may constitute the strength of a region or a country;

• More efficient and effective exploitation of the European funds within the programme "Intelligent development". EU funds will constitute the primary financial source for transport projects;

• Co-operation between private and public sectors within public-private partnership;

• Comprehensive information activities which will support innovative behavior.

The European Commission attaches great importance to innovation in transport. In the planning and budget perspective for 2014-2020, the essential goal was to develop cooperation between science and business (Fig. 1). Center for Transportation Innovations Foundation, in December 2012, organized I Forum for Transportation Innovations where 36 innovative projects were presented. The innovativeness of the project consists in the full coordination of the implemented processes in order to achieve a balanced exploitation of all available transport resources. For example, one of the rewarded logistic innovations in transport was DEGAmix - Dual Fuel System installation which consisted in the provision of two types of fuel for the DERVs, i.e. diesel oil ON and LPG. Such installation enables exploitation costs cut down to 10-15% [2].

IV. GENDER GAP IN TRANSPORT INNOVATIONS

Innovations are transforming the transport sector at an unprecedented pace. It removes obstacles to the movement of people and goods and changes the whole way of life and work of people, as well as the planet itself. Innovation can

Effective and ecologically balanced mobility	Improved mobility
- improved efficiency of vehicles – new generation - alternative fuel - intelligent transportation systems - optimized management of demand	- less traffic congestion - easier availability - integrated door-to-door transposrt and logistics - enhanced intermodality and transport planning - fewer roads accidents - better securtiy for passengers and freight along the whole supply chain
Competitiveness of European transport systems	Support for policy-making
- new generation of equipement and transportation concepts - smarter steering systems - more efficient production prosesses - shorter development time	- better understanding of socio-economic trends and perspectives - supply of evidence-based data and analyses

Figure 1. Goals in key areas of research and innovation in transport by 2020 [2].

have a positive impact on women both as transport users and as professional drivers. Women as transport users can benefit from a variety of services using innovative technology, new business models and other innovations to tailor mobility options to their needs. Innovation can also open up new employment opportunities for women in transport. It is necessary to encourage innovation in the transport sector in order to promote gender equality and more inclusive and sustainable transport [4].

Women more than men prefer flexible modes of transport that facilitate travel with children and other dependents, which is often not taken into account when designing transport infrastructure. Women also feel less safe in public places, which discourages them from choosing public transportation, taxis, sharing transportation or cycling and hiking. After all, this restricts women's and girls' access to schools, jobs, health and other public services [4].

New technologies and business models in transportation are creating new opportunities for women. Accessibility of transport often depends on the income, educational and digital competence of transport service users. These aspects must be taken into account when designing the framework for the development of innovative transport services so that they are inclusive for all users. The inclusion of women in the transport sector is an economic imperative that is crucial for the growth of the sector and long-term sustainability. However, women remain underrepresented in the transport sector. For decades, decision-making and transport planning have been done almost exclusively by men. Women make up more than half of the global population, and society simply would not function without them [5].

There is evidence that teams of people made up of both men and women are more innovative. For companies that build such teams, this means more sustainability and resilience in times of change. Research shows that companies with a balanced workforce and an inclusive culture are six times more likely to be innovative. Research has shown that women are more environmentally conscious than men. Automation is threat to gender balance, as many jobs that women work in are expected to be automated. Nevertheless, many actors in transport are optimistic, because future jobs will require less physical skills and more interaction. The possibility of teleworking will also improve the work-life balance and make transport occupations more attractive to women [6].

One of the most important challenges facing workers everywhere is the introduction of new technologies that have the potential to transform the world of work - with the potential benefits and risks of employment. In 2019, the International Transport Workers 'Federation launched a major report on The Impact of the Future of Work for Women in Public Transport. The report highlights the important role of women in the public transport workforce and reveals how the development of new transport systems and technological change have the potential to benefit public transport employees - for example by opening up new employment opportunities and improving working conditions and vehicle safety [7].

An example of women's entrepreneurship in the transport sector is the Wher platform, a

service designed by women for women. The women's community - "Wherriors" - provides maps with safety indicators, which are easy to understand and which provide feedback, including text comments that provide information on routes to be careful or not, at different times of the day and night [8]. Statistics show that a very low percentage of women are active as workers in the transport sector. But the jobs that are taken into account are in most cases only those related to professional drivers. The modern concept of mobility is enormously expanding the range of jobs related to the transport sector: changes in mobility strategy and related technologies offer new attractive jobs aimed at improving public transport and mobility management. New jobs include the establishment of mobility centers, the promotion of user-friendly intermodal mobility systems and ad hoc designed platforms (such as Wher), the promotion of innovation in mobility services and transport technologies. This new labor market can offer opportunities for women to be more equal to men compared to the traditional transport services market [9].

The governments of many countries aim for an inclusive and sustainable transport system that requires changes in thinking and a new set of skills, to which more women in decision-making positions can contribute. There is an urgent need to collect not only quantitative but also qualitative data for a better understanding of women's mobility patterns. But it is also necessary to develop appropriate capacities for data analysis and transformation of results into concrete integration measures. The presence of more women employed in the field of transport can contribute to the improvement of dialogue on the problems that women have in transport, and thus can help to find solutions that are inclusive and socially sustainable, including relevant innovative business models that will benefit financially disadvantaged users [10].

The unequal position of women in the economy requires gender-based public policies aimed at finding the root causes of discrimination and ensuring women's right to paid work, safety, dignity and respect at work. For example, it is important that there are laws that allow women in the transport sector to earn equal pay for work of equal value, to be protected from discrimination during pregnancy, to have access to paid childcare, and to have access to a safe and secure work environment. [7]. At the global level, the international social partners - the International Transport Workers 'Federation and the International Association of Public Transport - signed a joint agreement in March 2019 to strengthen women's employment in public transport. The practical recommendations cover nine core areas: working culture and gender stereotypes, recruitment, work environment and design, facilities (including sanitation), health and safety at work, work/life balance, training, pay equality, and corporate policy [11].

In today's dynamic business environment, achieving gender equality is considered a determinant of the competitiveness of any organization. The main reasons for the underrepresentation of women in the labor force in the transport sector are the stereotypes that transport is a male-only sector, difficult working conditions and safety problems, as well as work-family balance challenges. To address these barriers and foster gender equality in the workplace, some simple but key measures need to be implemented, including [12]:

• Adopting hiring practices to increase diversity and promoting gender equality

• Fostering opportunities for leadership roles for both men and women: according to the World Economic Forum's Global Gender Gap Report [13], women represent fewer than 50% of leaders in every industry analysed, although there has been a slow but positive progress in this regard.

• Adopting equal pay practices: compensation should always be reliant on the job roles, and an appropriate payment system needs to be introduced to improve transparency and eliminate any discrimination in payment rates.

• Introducing strict policies and precautionary measures against any type of workplace harassment.

• Facilitating work-life balance

V. EU TRANSPORT SECTOR: GENDER GAP

Among the employees in the transport sector, men dominate. The share of women working in the transport sector in the European Union (EU) is only 22%, while the total share of women in the labor force in the entire European Union is 46%. The percentage of employed women ranges from 10% in land transport (including road and rail), to over 20% in the maritime sector and 40% in the aviation sector. Women make up only 17.5% of the EU workforce in urban public

transport and perform less than 10% of technical and operational work [14].

Fourteen member states of the European Union (EU) are among the 20 best countries in the world in terms of gender equality. However, none of these Member States has achieved full gender equality, and progress in this area has been slow. With women occupying only 22% of jobs, the transport sector is among the male-dominated sectors of the EU economy, presumably due to persistent stereotypes and sometimes difficult working conditions. In Europe, although women transport users are more likely to choose more sustainable modes of transport, their needs are less likely to be taken into account when designing transport systems and they are more likely to be affected by transport poverty. Given that gender equality is a prerequisite for innovation and sustainability, it is essential to take strong, coordinated action to address gender imbalances. This will ensure that we can meet the challenges of the 21st century, which include climate change, population aging, digital transformation and the socio-economic and health impacts of the Covid-19 pandemic [6].

Creativity and innovation are key to improving the European economy's ability to compete internationally. In this regard, all citizens should be given the opportunity to acquire key competences such as digital competences, learning to learn, a sense of initiative and entrepreneurship and cultural awareness. The synergy between education, research and innovation also needs to be improved. In order for such innovative measures to be widely accepted, it is necessary to take action at several levels, covering various aspects of education and employment, including [12]:

•   building necessary skills and focusing on more under-represented groups of workers (e.g. women)

•   promoting stakeholders' co-operation, including the interaction and co-operation of social partners, such as labor unions, company representatives and governmental bodies

•   Fostering measures relevant to legislative or organizational issues at European, national, local or sectoral level

Gender equality is a core value of the European Union, a fundamental right and a key principle of the European Pillar of Social Rights. In its 2020-2025 Gender Equality Strategy, the European Commission commits to systematically including a gender perspective in all stages of policy design in all policy areas. The strategy contains targeted measures to address the digital divide. It recalls that today 90% of jobs require basic digital skills, but women represent only 17% of those in information and communication technology (ICT) studies and careers in the European Union, and only 36% of science, technology, engineering and mathematics (STEM) graduates, despite the fact that girls outperform boys in digital literacy [6].

There are a number of initiatives taken by the European Commission to increase gender equality in transport, including:

•   Data collection and research: Gender is a relatively new topic in transport research, but two EU-funded research and innovation projects - DIAMOND and TInnGO - are already analyzing the current situation in this area. Both projects assess gender differences in the adoption of digital products and services in transport, identifying the skills and strategies needed by women to fully benefit from this technological advancement and thus avoid being excluded from the transport sector [15, 16]. The European Institute for Gender Equality (EIGE) is working on disaggregating data on women and men in decision-making with a focus on the transport sector. There has been some progress on the amount of funds earmarked for increasing gender equality in recent years, in order to address the gender gap in the EU through more efficient research and innovation programs. However, it is necessary to pay full attention to the problem of the gender gap in the future and to increase the scope of research on gender in transport and further data collection [14]:

•   Combating stereotypes from an early age: One of the main reasons for gender imbalance within the transport sector is strong gender stereotypes. As children begin to form their career aspirations from an early age, the European Commission is developing educational toolkits, for both primary and secondary school, to support teachers across the European Union as they organize class discussions addressing gender stereotypes. The toolkits include concrete examples from the transport sector.

•   Tools to increase the share of female transport workers: EU stakeholders can join forces to increase female employment in transport through the action-oriented initiative Women in Transport – EU Platform for Change. This platform, put in place by the European

Commission, has also published a list of measures that companies can take to increase their gender balance.

• Towards a better inclusion of female transport users: For EU urban mobility policy, a new guidance document on inclusive mobility was published in 2020 as an annex (i.e. topic guide) to the Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan.

• Raising awareness: In September 2020, the European Commission called for volunteers to join a European Network of Ambassadors for Diversity in Transport. These efforts are necessary now more than ever as the transport sector needs to be able to rely on the biggest pool possible of diverse and innovative resources as it seeks to rebuild after Covid-19. Some inclusion and diversity initiatives have been put on hold because of the pandemic, while we should be doing the exact opposite [6].

CONCLUSION

Innovative transport policy contributes to a well-balanced development of transport through proper stimulation and financing of transport investments. Gender equality is a core value of the European Union, a fundamental right and a key principle of the European Pillar of Social Rights. Fourteen member states of the European Union (EU) are among the 20 best countries in the world in terms of gender equality. However, none of these Member States has achieved full gender equality, and progress in this area has been slow. The unequal position of women in the economy requires gender-based public policies. In today's dynamic business environment, achieving gender equality is considered a determinant of the competitiveness of any organization.

The main reasons for the underrepresentation of women in the labor force in the transport sector are the stereotypes that transport is a male-only sector, difficult working conditions and safety problems, as well as work-family balance challenges. To address these barriers and foster gender equality in the workplace, some simple but key measures need to be implemented, including: adopting hiring practices to increase diversity and promoting gender equality, fostering opportunities for leadership roles for both men and women, adopting equal pay practices, introducing strict policies and

precautionary measures against any type of workplace harassment and facilitating work-life balance. The inclusion of women in the transport sector is an economic imperative that is crucial for the growth of the sector and long-term sustainability.

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Organisational Measures for Emergency Prevention in Smart Cities

Karovic Samed[1], Rankov Aleksandra[2], Domazet Sinisa[3], Jesic Jelena[4]

[1,3]University Educons, Faculty of Security Studies, Sremska Kamenica, Serbia
[2]University Educons, Faculty for Information Technology, Sremska Kamenica, Serbia
[4]University Educons, Faculty for Business Economy, Sremska Kamenica, Serbia

[1]karovic.samed@gmail.com, [2]aleksandra.rankov@gmail.com,
[3]sdomazetns@gmail.com, [4]jelena.jessic@gmail.com

Abstract— **The functioning of smart cities is conditioned by various influences from the environment. Such impacts are not always predictable and cause emergencies. Preventing and mitigating consequences of emergencies is a key issue for security challenges of smart cities. The paper deals with elements of emergencies of natural character, with a focus on identifying possible preventive solutions to reduce the consequences of natural hazards. This is illustrated through existence of the smart city platform that would integrate the city information and correlate it with emergency related historical knowledge to provide early warning preventive measures. The most necessary legal aspects of protecting of cyberspace of smart cities in terms of emergencies are considered, which are the basis for defining the concept of prevention measures.**

Keywords – *smart cities, risk assessment, emergency prevention, privacy, law, knowledge management*

I. INTRODUCTION

Smart cities fulfill their function by organizing the most important life processes for the development and existence of the population within the smart urban area. Finding the best solutions is a challenge for the conceptual approach of a smart city and organizational processes for the functioning of possible solutions.

An important premise of such action is the security aspect, which includes the preventive form of emergencies that may occur as a result of various events. Events that are predictable in nature are embedded in the concept of the functioning of smart cities, while the other part, which is unpredictable, has serious consequences, often destructive.

The concept of a smart city needs to understand that the other part is of such proportions that organizational measures of prevention should have a dominant place, so that smart cities are to some extent protected or organized to be able to withstand such events.

II. THE CONCEPT OF SMART CITIES

A. Challenges of Smart Cities in the Future

The difficulty of unpredictability of emergencies leaves great challenges for the development and maintenance of smart cities. The main challenges lie firstly in the interaction between technological infrastructures through combination of technological innovation and collaboration between public organizations and private enterprises.

Important milestone in building secure smart city lies in Political Differences which can be a roadblock to smart city deployments. The intricate dynamics and continuous cycle of politics is another ongoing challenge that could impede smart city initiatives. Large-scale smart city projects are often challenging to fund, as they require buy-in from multiple stakeholders involved in a public-private funding mechanism which blends interests from national, state and local levels with private enterprises. Public and private sector organizations need to coordinate collaboration and cooperation between key stakeholders in municipalities and the private sector can be another hurdle for smart cities.

Government agencies and private sector organizations are often reluctant to share sensitive data or standardize on common networks, tools and infrastructure. This "need-to-know" data-sharing policy can prevent the kind of cross-collaboration that can help cities prevent terrorist attacks, improve drinking water and garbage collection and reduce noise and light pollution. In emergencies, all systems in smart cities become even more challenging and difficult to manage.

B. Modern Technologies in Achieving the Sustainability of Smart Cities

The steep growth in urban population and the subsequent increase in resource consumption will inevitably create numerous challenges for cities. This fact highlights the importance of shifting paradigms in the way cities work in terms of sustainability. For the purposes of the present study, it is important to establish a working definition of sustainability. Allen and Hoekstra [1] highlight the importance of establishing the scale on which a system is being assessed in terms of sustainability. Achieving sustainability on a global scale requires different type of actions than on an urban scale. There is no single best-established definition in terms of sustainability in the urban scale nevertheless there is a commonly used set of characteristics of urban sustainability. These include intergenerational equity, intra-generational equity (social, geographical, and governance equity), conservation of the natural environment, significant reduction of the use of non-renewable resources, economic vitality and diversity, autonomy in communities, citizen well-being, and gratification of fundamental human needs [2].

These characteristics incorporate the three dimensions of sustainability: the environmental, the economic and the social dimension [2] where the environmental regards the ecological aspect and includes the conservation of the natural environment (flora and fauna) and natural resources and an energy production-based economy. The social dimension includes equity, community autonomy, citizen well-being, and gratification of fundamental human needs, while the economic one consists of the economic vitality and diversity of urban areas. For the context of this research an urban environment can be sustainable when social equity, conservation of the natural environment and its

resources, economic vitality and quality of life are achieved [3].

Despite the suspicions that have erupted, the crisis of the epidemic continues, the concern for the natural environment and the further preservation of natural resources or their harmless use remains. Natural disasters and emergencies can be prevented by a more balanced nature and a fairer distribution of resources. The current energy crisis is proving the harmful impact of political and economic disagreements and the spillover of damage to already weakened social systems and communities around the world.

Other challenges concern the legal aspects of smart city implementation and functioning, emergency situations in smart cities, natural hazards endangering the functioning of smart cities, technical and technological hazards endangering smart cities and oorganizational measures for preventing threats from natural hazards, which will be elaborated in the paper.

III. Legal Assumptions in Functioning of Smart Cities

In the last decade cities around the world have been investing considerable effort into transformation towards the so called smart or intelligent cities, i.e., cities that are self-sustainable and understand the importance of its physical and digital infrastructure [4]. The most critical characteristics of this service relate to the following eight characteristics: a) Lawful interception: in many countries national legislation requires the possibility of data traffic interception which thus also applies to IoT traffic; b) Service dependability: ability to avoid service failures that are more frequent and more severe than acceptable; c) Personal data protection: one of the fundamental human rights which stipulates that citizens have the right to protect their personal data; d) Security: concepts and solutions preventing cyber-attacks at the device and service level; e) Operator switch (number portability): ability to change an IoT operator, i.e., any stakeholder from the IoT value chain; f) Roaming: relevant to regulated services where foreign numbers are used outside of their domestic network, i.e., IoT devices registered in one network are used in visited networks; g) Interoperability and open access to data and services: we believe this is not only a technical, but also regulatory requirement, primarily for all publicly funded Smart City services. It is highly related to operator switch [4].

Of these characteristics, special attention should be paid to the protection of personal data. For example, the General Data Protection Regulation (GDPR) was put into effect in the European Union in 2018. In accordance with Article 4 of the GDPR Regulation, "personal data" means all data relating to a natural person whose identity has been or can be determined (hereinafter: the data subject); an identifiable natural person is a person who can be identified directly or indirectly, in particular by means of identifiers such as name, identification number, location data, network identifier or by one or more factors specific to physical, physiological, genetic, mental, economic, cultural or social identity of that individual. According to the same article, "processing" is any procedure or set of procedures performed on personal data or on personal data sets, automatically or non-automatically, such as collection, recording, organization, structuring, storage, adaptation or modification, retrieval, inspecting, using, disclosing, transmitting, disseminating or otherwise making available, harmonizing or combining, restricting, deleting or destroying.

The Regulation stipulates that the "controller" is a natural or legal person, authority, agency or other body which alone or together with other bodies determines the purposes and means of processing personal data; where the purposes and means of such processing are determined by Union law or by the law of a Member State, the controller or the specific criteria for his appointment may be prescribed by Union law or by the law of a Member State. "Processor" is a natural or legal person, authority, agency or other body that processes personal data on behalf of the controller. Finally, a "user" is a natural or legal person, authority, agency or other body to whom personal data are disclosed, regardless of whether it is a third party or not. However, authorities which may receive personal data in the context of a particular investigation in accordance with Union or Member State law shall not be considered as beneficiaries; the processing of such data by those authorities must comply with the applicable data protection rules according to the purposes of the processing.

Having in mind these definitions, it is clear that one of the main problems in smart cities will be related to privacy and mechanisms for its protection. This is logical since the collection of data occurs in everyday city operations, from paying a utility bill, to browsing a web page, and increasingly walking down a city street, riding public transit, or driving on a city-maintained road. The use of smart city technologies — such as sensors, connected devices, and always-on data flows that manage transportation systems, support real-time infrastructure maintenance, automatically administer public services, enable transparent governance and open data, and support emergency services in public areas — can provide real benefits to governments and communities [5].

Given such a wide scope of use of modern technologies, there is a clear and immediate danger of violating the right to privacy of citizens, or unauthorized collection and processing of personal data. Therefore, it is necessary to strike a balance between the need for personal data of citizens to be used and processed for the efficient functioning of smart cities, and the need to protect personal data of citizens, in accordance with applicable legislation (GDPR regulation or some other national legal act). The way out of this situation is to develop an appropriate model - Privacy impact assessment, based on which the risks related to privacy and personal data of citizens would be resolved. In this regard, the legal regulations in the field of cyber security are of great importance.

A particular problem for smart cities is related to emergency situations. With regard to emergencies, national legislation will be applied depending on the country where the smart city is located, with special attention to disaster risk assessment, organization and civil protection measures, early warning, notification and alert measures, as well as the development of appropriate planning documentation.

IV. EMERGENCY SITUATIONS AND SMART CITIES

Emergencies are declared as a consequence of various events that are of such magnitude that the consequences cannot be resolved by normal activities in the area where the consequences of such events are manifested. This is the reason that legally defined activities and measures should be taken, which include the engagement of additional resources or potentials (human and material) in order to mitigate the consequences of such a situation.

In Article 2, paragraph 7, of the Law on Risk and Disaster Reduction and Emergency Management (hereinafter: DREM), an

emergency situation is defined as a situation that arises with declaration of the competent authority when risks, threats or consequences for the population, the environment and material and cultural goods are of such scope and intensity that their occurrence or consequences cannot be prevented or eliminated by regular action of competent bodies and services, which is why it is necessary to use special measures, forces and means for their mitigation and elimination with an enhanced mode of operation [6].

It should be borne in mind that the emergency situation can turn into a crisis, which puts the management of emergency situations into the sphere of crisis management. Crisis management refers directly to the lives of citizens and the well-being of societies. When vulnerabilities and threats appear, then the situation must be adequately assessed and the consequences of such situation resolved. Of course, a misunderstanding of events and the negligence of those who make decisions and manage social processes can lead to a crisis [7]."

The topicality of emergency situations induces the constant need of the social community to find an adequate response to the manifested security threats. By declaring a state of emergency, the social community creates a specific legal framework that enables engagement and use of all necessary available resources of the society in protection and rescue [8]

Organizational work processes at the smart city level are managerial jobs. In the process of organizing work in organizational systems, it is necessary to unite and coordinate the work of a large number of people in order to perform the set task or successfully implement an operation of any kind. In the stated statement, one should keep in mind two manifestations of such a process: organization as a structure and organizing as a process management function or management.

The organizing process includes a large volume of work, starting with discovering the regularity of organizational activities and ending with the implementation of recommendations given by science and best practice. Work processes at the level of smart cities are conditioned by the degree of technical equipment of smart cities, the specifics of work in emergency situations and the nature and size of the smart city itself.

The organization of work at the level of smart cities covers various fields, including sociology, economics, physiology and psychology, etc. They reflect different aspects of working in smart cities in emergency situations. The success of work in such conditions is measured by different parameters and criteria, therefore in the process of work and good organization of different work processes, it is necessary to identify those criteria and parameters, in order to measure the efficiency and effectiveness of a certain process or task. This is the basic condition without which it is impossible to act in an efficient way in modern and complex conditions.

The purpose of the question related to the relationship between smart cities and events with devastating consequences and preventing the functioning of life and work is based on the fact that one of the elements of the way to restrain a situation (regardless of the cause, it can be a pandemic) is to declare a state of emergency. Frequent natural disasters in recent years, with the consequences they cause, significantly endanger the social community, human lives, material goods and the environment.

The topicality of emergency situations induces the constant need of the social community to find an adequate response to the manifested security threats. By declaring a state of emergency, the social community creates a specific legal framework that enables the engagement and use of all available resources of the society in protection and rescue [8].

Identifying natural hazards that can threaten the functioning of smart cities is a key issue. It should be borne in mind that there is a wide range of such hazards that have not been manifested in a particular area for many years, perhaps centuries, but are not excluded as a risky event. All this shows that climate change causes catastrophic consequences for the environment, people and, ultimately, the functioning of smart cities, which in a short time can be endangered and dysfunctional for human life.

There is a whole range of theoretical considerations for emergency situations. The essence of the legislation does not show the essence that refers to risks of different nature with possible significant consequences. The emergency situation is characterized by absence of planning, disruption of normal life and work of people, material and financial damage and engagement of capacities from the wider area of the state in order to repair or mitigate the damage.

If the "smart city" is observed to have a completely regulated system of functioning of all elements, then the issue of security and protection should be a presumption, and not a subsequent action after an event that has the consequences of dysfunction of such an organized city.

Emergencies are caused by a certain development scenario, with the impact on man and the environment, and the scale and effect of the phenomenon. With this in mind, emergencies are most often classified using the following criteria [9]: (1) the cause of the emergency situation; (2) the speed of development of the emergency situation, and (3) the scale of the effects of the emergency.

What has practical applicability and what is most often used, refers to the classification according to the cause. Following the above criteria, emergencies can be classified as: (1) emergencies of technogenic character; (2) emergencies of natural character and (3) emergency situations of anthropogenic character

Emergency situations of a natural character are especially characteristic, which include: geophysical phenomena (earthquakes, volcanic eruptions); geological phenomena (landslides, torrents, landslides, avalanches, slope washing, abrasion, erosion); meteorological and agrometeorological phenomena (storms, hurricanes, stormy winds, heavy rain, heavy snow, high heat, drought); marine hydrological phenomena (tropical cyclones - typhoons, tsunamis, strong waves, strong thrust in ports, ice pressure); hydrological phenomena (floods, rain torrents, lower water level, early freezing and the appearance of ice on navigable rivers and reservoirs, increase in groundwater levels); natural fires (forest fires, peat fires, underground fires of combustible excavations); infectious diseases of humans (group cases of dangerous infectious diseases, epidemics, pandemics, infectious diseases of unknown etiology); infectious diseases of domestic animals (individual cases of exotic and extremely dangerous infectious diseases, enzotia, episotia, panzotia, infectious diseases of domestic animals of unknown etiology); destruction of agricultural plants by diseases and pests (progressive epiphytosis, panfitotia, disease of agricultural plants of unknown etiology, mass spread of plant pests).

Bearing in mind that the elements of emergency management are also oriented towards forms of prevention, the authors Đorđević D. and Karović S. agree and point out that: "Many analyzes of previous years indicate that the field of prevention is the weakest link in the system of emergency management. Also, a special problem is the creation of an integrated emergency management system and, within that, the creation of effective prevention mechanisms that would be an integral part of that system [10] "Also, the authors Bajrami S., Karović S. and Radić G., point out: "Prevention would include measures and activities to monitor and update water levels and hydrometeorological forecasts, risk mapping, planning of forces and means, as well as the period of activation of forces, constant training and practice of personnel in accordance with applicable standard operating procedures inherent in the various forms of threat in the event of a declaration of an emergency [10].

In addition to natural disasters, technical and technological disasters are also characteristic, which can endanger smart cities, but are not the subject of this paper.

V. SYBER SPACE AND SMART CITIES

Connection of devices onto internet that can identify themselves to other devices and use embedded technology to send and receive data without human involvement represents the concept of internet of things which is the core technology of any smart city. The concept relies on cyber physical interconnected systems which can monitor and manipulate real objects and processes [11] and connect devices and systems. Since the intelligent devices collect data that are geographically determined we can see it as a geographic information system of things establishing in such a way citizen-community-technology relationship.

Smart cities' critical infrastructures (CI) (energy, water, transportation etc) need to provide essential services to citizens without disruption. They rely on availability of data coming from different systems essential for their
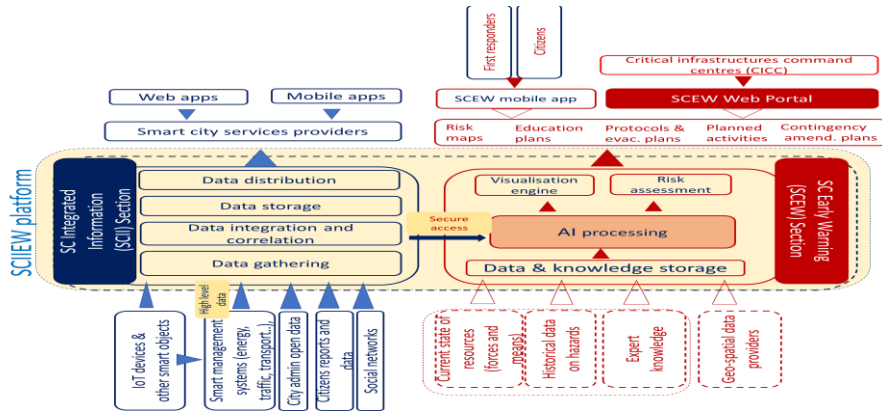
Figure 1. Smart City Integrated Information and Early Warning Platform SCIIEW platform

normal operation and a possibility to remotely control the city's infrastructures. Often, failing of one critical infrastructure will cause cascading events affecting others since there are interdependences between some of them [12].

In addition to multiple benefits they offer, the implemented smart city technologies introduce new forms of cyber and physical security threats and attacks that can jeopardize the city infrastructure and reduce the initial gains. Five forms of major vulnerabilities related to smart city technologies are [13]: (1) Weak software security and data encryption; (2) Use of insecure legacy systems and poor ongoing maintenance; (3) Large, complex and diverse smart city systems with many interdependencies; (4) Interdependences between the smart city technologies and systems creating cascade effects; (5) Human error and deliberate wrongdoing.

A systematic proactive and preventive approach to building strong security and privacy measures into systems is an introduction of security-by-design and the privacy-by-design concept. Security by design refers to integrating security measures into every step of the system development lifecycle which would require a security risk assessment as a basis of the design process. Privacy by design approach presumes not only the secure access to data but also the personal control over their personally identifiable information with respect to its collection, use and disclosure [14]. All this becomes even more important in emergencies when a short-term disruption of a system can be both financially costly and affect human lives. Adoption of 5G technology in future smart cities will highly improve responsiveness of the

wireless network and practical implementation of physical security due to capability for ultra-fast communication between different services and almost real-time reactions to events. Huge amount of generated data coming from additionally included endpoints and IoT devices required by 5G will further increase vulnerabilities requiring upgrade of cybersecurity systems and measures.

VI. PREVENTION OF EMERGENCY SITUATIONS IN SMART CITIES

In order to ensure a reliable and timely emergency management of smart cities it is necessary to: (1) collect and integrate all necessary information about the city from various existing sources and systems linking in such a way interconnected critical infrastructures, correlating collected information and providing a better insight into SC operation [12,15] and (2) monitor actively the city operation in relation to its specific vulnerabilities and provide early warnings for any possible issues that can arise into emergencies.

This is illustrated in Figure 1 with a top-level view of a possible Smart City Integrated Information and Early Warning platform (SCIIEW). The core backend cloud infrastructure includes two interconnected platform sections:

SCII section: Smart **C**ity **I**ntegrated **I**nformation section gathers inputs from heterogeneous smart objects/devices responsible for data collection as well as from deployed smart management systems operating in the city. To make the whole city operating better it is necessary to integrate city information, process it and provide it back to all interested parties

ensuring end-to-end security and trust in shared information and at the same time respecting the GDPR regulations regarding the privacy requirements of data owners [15]. Information originally deployed for one specific application could be reused in other city services and improve the city operation. Better correlation of information could be provided and thus the better service and faster reaction to any problem. For example, information on traffic operation could be relevant for various providers and users of different services. Some traffic congesstion problems could be caused by different factors so the information coming from the platform would be relevant and helpful for better adressing the problem.

Citizens should also be involved in a platform to report accidents and share incident data from their smart devices on a voluntary basis. Inclusion of incentivisation and reputation mechanisms would further ensure their full engagement in emergencies. Acquired, stored, processed, correlated information should be used as an important input to the early warning system which is realised through the second platform section.

SCEW section: **S**mart **C**ity **E**arly **W**arning section gets access to real time data from the SCII section of the platform as well as to the specific data required for the assessment of the city's level of preparation and readiness in case of emergency. This refers to the current status of emergancy resources (forces and means), historical data and knowledge on hazards (reports from relevant sources), the expert knowledge on different hazards and models for managing different types of hazards or crises situation (e.g. air polution, flooding, desease transmission). This information together with real time city data is fed into an AI processing unit that outputs early warning information and prevention measures including the risk assessment report as well as appropriate geo-spatial visualisation of information indicating vulnerable city areas and presenting them with a higher degree of granularity. Additional outputs of this platform are risk maps, protocols, and evacuation plans, education plans of personel and citizens, planned activities and contigency amendment plans. This all is available through the SCEW Web portal that provides this information to command centres of critical infrastructures including access to recommendations on prevention measures. SCEW mobile apps would be suitable for first

responders and citizens but the informations and notifications would be filtered based on their defined role in preventing emergency situation (e.g. first responders) as well as the location (e.g. notifying citizens about the emergency status and sending recommendations based on their location).

The platform relies on interoperability between organizations, exchange of geospatial data and information on any incidents, communication between services to increase efficiency of processing the information and thus improve coordination.

Efficient and reliable operation of the proposed SCIIEW platform requires mechanisms for access control (role-based authentication and authorisation), users' privacy protection (data anonymisation), context dependent access policy (access to high level data), secure comunication and data exchange.
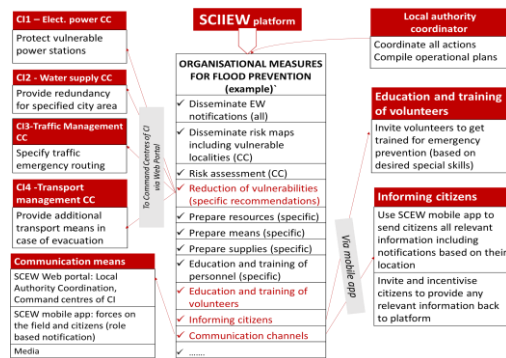

Figure 2. Organizational measures for prevention of possible flood in the city (platform output example)

Possible organizational measures for preventing threats from natural hazards are illustrated in Figure 2.

In cities with the risks from flooding, prevention requires activities to monitor water levels, soil saturation and hydrometeorological forecasts and collect such data with the SCIIEW platform where combined with the related city historical data and existing knowledge provides specific organizational measures for flood prevention that can be further distributed to all relevant command centers and citizens.

VII. CONCLUSIONS

The paper points out that the concept of smart cities is based on technology which allows city officials to interact directly with both community and city infrastructure and to monitor what is happening in the city and how the city is evolving

and dealing with great challenges of organisation, especially in emergency situations.

Smart cities will face a number of legal challenges related to cyber protection and the protection of personal data and privacy of citizens. It is necessary to continuously improve the legal regulations, which implies close cooperation between experts in the field of IT sector and legal experts, in order to find appropriate solutions. With regard to emergency regulations, special attention will be paid to disaster risk assessment, organization and civil protection measures, early warning, notification and alert measures, as well as the development of appropriate planning documentation.

Endangering smart cities in the context of natural and technological hazards is a reality. The consequences of events caused by natural effects are significant and can lead to such a scale of consequences that they prevent functioning of the city for a certain period. Arisen emergencies as a result of such events and the realistic concept of smart cities must include preventive forms to reduce such a situation or mitigate it.

The context of preventive measures to mitigate the consequences of emergencies in smart cities has been identified through existence of a secure smart city early warning platform that would (1) integrate and correlate real time city information from different purposely deployed devices and systems (2) collect the city's historical data on hazards, (3) include experts' knowledge on different types of hazards, (4) engage scientists to implement algorithms and models for data processing, visualization and inference (4) provide early warnings with specified protocols and recommendations for all involved parties that would be disseminated and communicated through the platform channels in accordance with assigned roles.

ACKNOWLEDGMENT

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Application of Modern Accounting Tools to Achieve Efficient Company Resources Utilization

Mirjana Štaka[1]

[1]Faculty of Economics, Banja Luka, Bosnia and Herzegovina

[1]mirjana.staka@gmail.com

Abstract—**Information technology is undoubtedly a key resource of today. We live in a world in which technological progress leads to an information leap that has all the characteristics of a modern industrial revolution. Jobs that are a few years performed with a comparison dentinal intensity today with the use of new methods of work are simplified regard to modern technology. At the same time, there is a merging of traditional spheres of human activity, such as education, which we are witnessing to be applied and enabling distance learning due to the new situation caused by the virus. This enables students and students to have no significant shortcomings and irreplaceable waste of time thanks to the google classroom platform. At the core strategies of technological growth and development by standing the whole complex information and communications technologist different. In general, there is a developed understanding that due to constant development it can be imposed and dominated primarily by technology. In that context, the problem is the advancement of information technologies and the allocation for scientific research development. The research problem is the application of an innovative system solution that will monitor employees and the process of transition from conventional to modern way of business.**

Keywords - finance, applications, programs, resource rationalization

I. INTRODUCTION

The financial statements present an overview of financial activities at the end of the business year or on a semi-annual basis, depending on the complexity and type of organization. Include: Balance apartment I, income statement, statement of cash flows and statement of changes in equity. They are used for the purpose of recording and documenting the financial, economic and balance sheet position of the company. It represents the basis for planning, and later for decision-making of the management and administration of the company. The results obtained in the financial statements provide basic information to creditors and banks for the purpose of analyzing the credit rating of the company. They also serve as a starting point for corporate taxation in the form of income taxes and dividends. The introduction of the FIA application in the accounting business significantly reduces and optimizes the time spent during the preparation of the financial report, especially when it comes to the conventional, previous method of preparation of annual accounts. Previously, a significant period of time was needed in which to perform arithmetic and accounting operations, while the use of modern technologies and applications through activities was reduced to a very short series of accounting steps. The FIA application was created by APIF[1] representing the only legally accepted software used in the preparation of financial statements. The application was created following the rules of regulations in accounting.

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[1]Agency for intermediary, information and financial services.

Computer hardware and software can be used to perform everyday demanding operations, but with less time and process complexity. The software is comprised of programs that maintain computers which can be highly automated, and the application software consists of computer programs that computer applicable to the needs of the user executing the task that the user wishes to perform, and both represent a challenge for employees when it comes to the application of modern techno logy and modernistic progress . These software tools can be used by state-of-the-art corporations to increase their capacity [1].

System theory and information, accounting defines as an information subsystem of the financial function in the business system and is one of the basic instruments of management and decision making in that system. The turbulent environment and the current economic situation are forcing the company to adapt quickly and flexibly to change. They spin words for this is an effective system management and counter only [2]. The hypotheses of the work that will be refuted / proven by research and analysis are H0: "The use of modern technology has an impact on increasing the resources of the company's resources" An alternative hypothesis is H1: "The introduction of modern technology affects the reduction and rationalization of material consumption."

II. RESEARCH MATERIALS AND METHODS

The research will use primary data taken according to the data of the accounting agency "Bilans DD" from Sarajevo. Based on the downloaded data and applying a multiple regression model, it will be presented in a universal and original model the model. The model will be presented in the form of a function, which will have the value of parameters on the basis of which the influence of independent variables on dependent ones will be determined. The subject of this paper is the analysis of the impact of modern technologies. More precisely , the impact of the application of the FIA software package will be examined, an application created by APIF, which is used to prepare semi-annual and annual reports in order to replace the previous conventional form filling. Taking these indicators into account, the thesis whether there is a connection between the application of modern technology and saving companies' resources will be proven or refuted. Examining the impact and relationship between the application of technically modern applications on the one hand and the optimization of company resources, time spent on semi-annual and annual reports on the other hand, can be proven using a multiple linear regression model. With a this purpose as the dependent variable (regresando, explained, exogenous) represents profit agencies during observed years , while independent variables (regression, explained, explanatory, endogenous) represent consumptions working hours and materials necessary for the production of the report. The paper will present the correlation, regression, determination, F test on the significance (significance) of the model.

$$Y_i = \beta_0 + \beta X_1 + \beta X_2 , \qquad (1)$$

$\beta_0, \beta_1, \beta_2 =$ regression parameters to be estimated, $\varepsilon_i =$ stochastic term (random deviation, error or residual.

To evaluate a multiple regression model means to find the value of the parameters $\beta_0, \beta_1, \beta_2$ i.e. to find the estimated value of the model is:

$$\hat{Y}_i = \hat{b}_o + \hat{b}_1 X_1 + \hat{b}_2 X_2 . \qquad (2)$$

The result of the regression analysis shows impact on the company's profit in relation to the number of working hours required for the preparation of financial statements and the impact of materials in the preparation of financial statements during the calendar year. Regression analysis is a standard statistical procedure. This method is multiple and reliable (for example, it mutually excludes positive and negative errors). For the purposes and for the purpose of calculation, the average linear correlation is the best direction of presentation of the observed variables.

III. THEORETICAL MODEL OF MEASURING COST OPTIMIZATION PERFORMANCE

Good cost management is a feature of successful organizations and educated and motivated management. In an effort to better manage costs, a number of methods and procedures have been developed that provide management with certain information necessary for decision-making in order to optimize costs based on facts [3]. These are the following methods:

Cost optimization and resource rationalization due to the introduction of technology Bronfenbrenner, Sichel and Gardner define economics as a social science that deals with the problem of using or managing scarce resources in order to maximize the unlimited needs of society" [4], while Lipsey and Cristal, as the use of scarce resources for the unlimited satisfaction of human needs [5]. The rationalization of resources in the company is based on the principles of economic science, so that with as few satisfied outputs as possible, it gets as much output as possible. Profit (marked pf) - the difference between TR and TC, or $pf = TR - TC$. The company realizes:

- Profit when $pf > 0$, or $TR > TC$;

- Loss when $pf > 0$, or $TR < TC$;

- Zero profit (so-called coverage point) when $pf = 0$, or $TR = TC$.

A. *Target Function of the Company - Profit Maximization*

Target function of the company:

Max. $PF = TR - TC$ where T is $R = pQ$, where p represents a given price, so $TR = f(q)$.

$Q = f(x_i), i = 1, \ldots n$, where x_i is the quantity of the i-th factor of production. $TC = \sum iX_i$, $i = 1, \ldots, n$ where i is the price of the i-th factor of production, given on the market, so that TC depends on the consumption of x_i, i.e. the production of Q, so that the final function has a shape $\max Pf = pf(x_i) - \sum iX_i$, $i = 1, \ldots, n$.

The condition of profit maximization (designation $\max Pf$) implies the equality of marginal revenue to the marginal cost of MR and MC (applies to any market situation).

$\max Pf\ P = MC$ for a state of perfect competition

The problem of maximum profit can be viewed in two ways:

based on the $R - TC$ ratio based on the relationship between marginal and average values of revenue and cost functions.

Profit maximization based on $R - TC$ ratio.

The maximization problem pf: $R - TC$ implies that $(pf)'0 = (= 0)$. Therefore, $pf = PQ - TC$.

Profit maximization based on TR and TC ratio, the difference between TR and TC is economic profit.

$Pf = (TR + \Delta TR) - TC$ which is an increase in profits due to the introduction of technology, or cost reduction.

$Pf = TR - (TC - \Delta TC)$, which can be seen graphically illustrated in Part 3 of the paper.

IV.   RESEARCH RESULTS

In this part of the paper it will be present the connection between the impact of the use of modern information packages in companies and the benefits that arise from it. The following illustration presents the impact on total costs and revenue that the company generates through the use of modern software applications.

Graph 1 illustrates the maximization of the enterprise by the cross section $MC1 = MR1$. At the same time, the preparation of the final financial report is an important indicator of the company's operations, in this regard, most companies strive to make the final financial accounts as accurate as possible using the tools of modern digitalization. The application of software packages provides a service of this type because it is unique and requires a special approach and training. Considering that it is about uniqueness and exclusivity, the price of the service and preparation of financial statements increased to the level of $p = 87KM$, thus the volume was reduced to 92 units, but the agency's profit increased. If the company were to operate below the average total cost (ATC) curve, it would face a loss.

Pf=TR-TC
$\frac{dPf}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ}$
$\frac{dTR}{dQ} - \frac{dTC}{dQ} = 0$
$\frac{dTR}{dQ} = \frac{dTC}{dQ}$
MR1=MC1
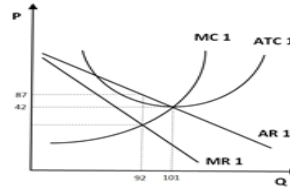
Pf=TR-(TC-ΔTC)
$\frac{dPf}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} + \frac{d\Delta TC}{dQ}$
$\frac{dTR}{dQ} - \frac{dTC}{dQ} + \frac{d\Delta TC}{dQ} = 0$
$\frac{dTC}{dQ} + \frac{d\Delta TC}{dQ} = \frac{dTR}{dQ}$
$MR = MC - \frac{d\Delta TC}{dQ}$
MC2 <MR1
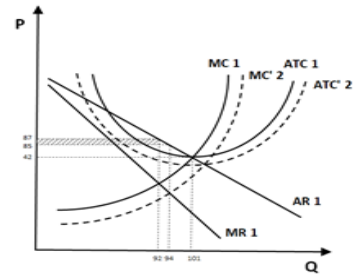
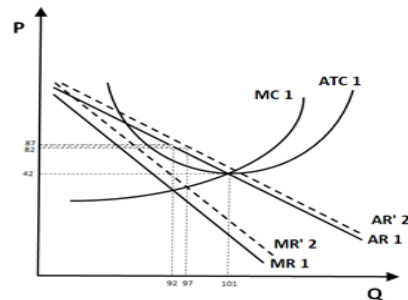| Pf=(TR + ΔTR)-TC |
|---|
| $\frac{dPf}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} + \frac{d\Delta TR}{dQ}$ |
| $\frac{dTR}{dQ} - \frac{dTC}{dQ} + \frac{d\Delta TR}{dQ} = 0$ |
| $\frac{dTR}{dQ} + \frac{d\Delta TR}{dQ} = \frac{dTC}{dQ}$ |
| $MR + \frac{d\Delta TR}{dQ} = MC$ |
| MR2>MC1 |

Figure 1.   Maximizing corporate profits.

Graph 2 k their management agency can offer a range of services $Q = 92$, at a price $p = 87$, where the marginal revenue curve ($MR1$) intersects the marginal cost curve ($MC1$). However, if the application of modern technology reduces the company's costs, and thus reduces its marginal costs ($MC1 = MC2$), which are additional costs of providing the service of another reporting unit and the average total cost ($ATC2$). In doing so, the accounting agency begins to provide services at the level of $q = 94$, which represents an increase in the volume of services they can offer. The result will lead to a drop in price $p = 85$, the point of profit maximization, which causes a reduction in marginal cost, and thus the average total cost, but also a reduction in total profit by the amount of the marked rectangle, since the agency slightly reduced the cost of service.

Graph 3 illustrates the impact of modern technology and the possibility of increasing marginal revenue or increasing sales of additional service units ($MR1 - MR2$) and average revenue ($AR1 - AR2$) which will also result in an increase in the volume of services and their sales $q = 97$ and the price level of the service $p = 82$ that the user is willing to pay for the final account creation service.

The research and analysis of multiple regression analysis begins with the observation of data on income, number of working hours and input of materials used in the preparation of financial statements in the time interval from 2011 by 2020.

In this section we present the connection and relationship between the growth of profits, the number of working hours cha with the important and material consumption required for the preparation of financial statements prior to use FIA App whose modern technology and operations is the use of modern and technology, after 2019. year, where the need to prepare a larger number of financial statements requires significantly less resource consumption .

From regression analysis m the work we get that $b0 = 96,721; b1 = -0.5333; \quad b2 = -0.9333$ and therefore the regression equation reads:

$$= 96.721 - 0.5333 - 0.9333 .$$

From the evaluated more professional regression model we conclude:

- If there is an increase in material consumption by only 1 unit, it will lead to a decrease in profit by $0.5333 \, (533.33 KM)$.

- If the number of working hours is increased by one unit of work, it will lead to a decrease in profit by 0.9333 .

- Assuming that there are no oscillations in the variables of labor resource costs and materials, the company would make a profit of $96721 \, KM$.

With this multiple regression analysis, the hypothesis was confirmed in an economic-mathematical way, ie without the introduction of technology, and by increasing the volume of business, the company would face an increase in labor costs and materials, which would result in higher costs and thus lower profits. The introduction of modern technology results in a reduction in working hours and office supplies.

Using the set hypotheses and the F test, we will evaluate the statistical significance of the model

$$H0 : R2 = 0$$
$$H1 : R2$$
$$F2 = 4.684$$

TABLE II. RESULTS OF HIGHER PROFESSION REGRESSION ANALYSIS.

Variable	Coefficient	Std. error
$b0$	166721	20.882 th most common
$b1$	-0.5333	0.978
$b2$	-0.9333	
R^2	0.572 th most common	
corrected $\overline{R}^2$	0.450	
F^2	4.684 th most common	
$F^{'}$	3.97	
Pearson coefficient	-0.734	

With a risk of 5%, or a probability of 95% and the degree of freedom ($nk - 1 = 7$), using tabular values we get the value:

$$F^{'} = 3.97 .$$

Based on the pair of meters we calculated, $4.684 < 3.97$, the H0 hypothesis is rejected, and H1 is accepted because $F^{'} > F_2$ and the model is not statistically significant, i.e. significant.

The coefficient of determination is 0.572% which means that there is little correlation between the variables.

The Pearson coefficient shows a strong correlation between the variables, but is negative which means that with greater use of technology, there is less use of enterprise resources.

The coefficient of determination explains the variation of the change of the dependent variable or profit, it is explained by the changes of the independent variable or the consumption of enterprise resources, how much it affects the dependent variable or profit 57.20% while the remaining 42.0% is the influence of other unused variables. Happen at work. The coefficient of determination shows in which percentage not dependent variable. The consumption of labor and materials explained the change of profit that is dependent on variables. As the number of observation data increases, the number of errors decreases and the coefficient of determination will be more realistic, otherwise the smaller the number of data, the greater the number of errors. The standard deviation error represents the average

deviation from the regression model and is 20.882 units.

V. Discussion

Problem of many companies in our country is ignorance and the possibility of applying innovations and digitalization that they could use to increase their competitiveness, and lack of relevant skills for the development of innovative ideas through digitalization and their advantages. Modern technologies have become a key carrier of accounting information in today's global knowledge society, and one of the most significant drivers of company development [6]. All of the above ultimately led to the conclusion that the financial sector is increasingly occurring changes n I and adjust to a changing IT. In the new era, accounting reports should be more automated and transparent. Competence in the field of IT is one of the crucial factors in the knowledge economy, and professional accountants must possess sufficient IT knowledge and skills due to the ever-present use and necessity of IT in the business world [7]. The challenge of the future is how to maintain a recognizable method of doing business in the past, applying the changes and modernization that the present brings. Other words, companies operating at the time of a new era should it strive for proactive and experiential philosophy, policies and technologies that will enable to meet their internal and external adaptation to changes by providing them quality services and performance [8]. If today's accountants cannot be disciplined in order to adapt to the changes and needs of the global world, they could become outdated accountants who will not have the necessary information technology to perform accounting tasks [9]. Competence in the field of technology is one of the crucial factors in the knowledge economy, and employees must possess sufficient knowledge and skills for all more present use and necessity in the business world [7]. Very is important to assess the needs of the company and carefully implement the rationalization of costs.

The technological revolution and progress in organizations in the coming years will only gain in importance, especially due to a number of global forces influencing the practice of management accounting, including digitalization and intellectual capital [10].

TABLE I. Worksheet Required to Determine the Estimated Multiple Regression Model.

YEARS	Y	X 1	X 2	Y ²	X 1²	X 1 X 2	X 2 ²	X 1 Y	X 2 Y
2011	71	370	78	5041	136900	28860	6084	26270	5538
2012	88	385	85	7744	148225	32725	7225	33880	7480
2013	90	385	91	8100	148225	35035	8281	34650	8190
2014	91	345	124	8281	119025	42780	15376	31395	11284
2015	90	365	78	8100	133225	28470	6084	32850	7020
2016	91	370	81	8281	136900	29970	6561	33670	7371
2017	92	375	87	8464	140625	32625	7569	34500	8004
2018	101	375	42	10201	140625	15750	1764	37875	4242
2019	107	125	20	11449	15625	2500	400	13375	2140
2020	109	125	18	11881	15625	2250	324	13625	1962
				87542	1135000	250965	59668	292090	63231

VI. Conclusion

This paper work has focused on exploring a range of advantages of the AVR Emen technology in the field of finance and accounting. It is necessary to point out that every company, with the introduction of modernization, becomes more flexible. Also, the need for the implementation of certain information technology is applicable from the point of view of the use of documentation in paper form, which is partially, but also in certain business processes, completely replaced by digital forms.

The use of modern technology in the field of accounting is one of the key components of the success of fashion companies. Information technology not only to improve the quality of preparation of the financial statements have already been initiated and series and other operations that replace the conventional type recording, which allows rationalization time to the reduction in the number of errors in the work. If we talk about the practical advantages of information technology in the field of accounting, it is confirmed by the requirements of medium and small companies, not only large corporations, the transition to digital way of preparing financial statements through the FIA

application. At a higher corporate level, the introduction of computerization has been accompanied by the use of local networks and faster telecommunications systems. The emergence and application of new interactive information technologies also marks a new evolutionary phase in the field of financial operations. With contemporary business conditions require adapting modern technologies. The reasons for the application of computer technology have multiple advantages, especially when it comes to optimizing and minimizing costs. Today's conditions are characterized by growing uncertainty in business. In addition to significant external changes that the company is facing, special attention should be paid to internal factors, especially when it comes to the company's costs. Rationalization of costs and planning of expenses is one of the key factors for the business of a company. If the costs are not controlled permanently and are not continuously rationalized, the company can endanger its survival. Cost reduction requires a detailed analysis and assessment of what costs can be reduced and to what extent with an understanding of the broader business picture as well as an understanding of the long-term implications of current decisions. The most significant advantage of introducing and installing this type of application is saving time with the simultaneous accuracy of the entered data because it is designed to detect the illogicality of the balance of assets with liabilities when filling out and creating a balance. Additionally, clicking on the final creation FINANCIAL them reports were summarizing & Controls that detect errors and thus performs saving time employees with the

same kind of em e nu accuracy of mathematical operations in the formation of balance positions, without the use of additional forms and the cost of office supplies necessitated previous way of making.

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Women in Entrepreneurship - Models of Learning Organizations

Svetlana Janković[1], Nina Mitić[2], Katarina Štrbac[3]

[1,3]Faculty of Engineering Management, Belgrade, Serbia
[2]Faculty of Applied Management, Economics and Finance, Belgrade, Serbia

[1]svetlana.jakovic.cacak@gmail.com, [2]nina.mitic58@gmail.com, [3]katarina.strbac@fim.rs

Abstract—**The paper analyzes the systemic security risks that occur in times of crisis as a disruptive factor for the willingness to change, adapt through the prism of new visions. Socially safer, more sensitive and more equitable models of organizations are possible in the future after emerging from the pandemic crisis only if our current image inevitably contains an embedded gender aspect of transformation. The main goal is to ensure organizationally that state interventions do not exacerbate injustices and gender-based inequalities. Also, to promote, where possible, greater equality in gender relations in the organization, access to equal access to resources and control, but also to the constraints they face. Innovative models of the organizations we strive for should contain a different picture of gender roles, activities, needs, opportunities, and rights that affect men, women, girls, and boys in a particular economic situation or social context. The inclusion of women in entrepreneurship is one of the necessary conditions for innovative models of organizations that permanently learn, reduced to everyday pragmatism, colored by persistence, struggle, and empathy. It is not just a vision for new organizational models. It is simply a futuristic orientation, as shown by case studies of the functioning of women entrepreneurs from Čačak during emergency measures.**

Keywords - women entrepreneurs, security risks, gender analysis, learning organization

I. INTRODUCTION - THE CONTEXT OF UNCERTAINTY AND HOPE

The world order in the changed picture of recent years, characterized mainly by the crisis, has unmasked all discourses and opened many questions about the understanding of security, both in a narrower and broader sense. Today, the readiness to change, adapt and adopt new concepts is questionable; we are conquering new strategies, after the formation of new visions, due to the crisis caused by the virus. As we learned in 2008, austerity can be counterproductive and create more hardship, social marginalization and poverty. Questions of humanism, cooperation, solidarity, and humanity's survival, fundamental in their vocation, are increasingly being asked. All the security concepts, threats, risks and challenges we have had so far are being re-examined. Questions are asked how to stimulate the economy and financial recovery in the context of a pandemic crisis and pandemic measures, how to rehabilitate the public health sector, how to fight unemployment and poverty, how to use this and every future crisis in our country with all its internal organization and organizations. Within that arrangement, do they become socially and gender-safer, more sensitive and more just? Is democracy in danger and globalization anathematized as the main culprit for the spread of COVID-19?

Maybe that is the right moment because of this time of crisis, above all for the progressive forces (left and social democratic) to return, to reactivate in protecting just socio-political systems, social justice and solidarity. These are "seen" powers to take a leading role in launching ambitious and bold recovery plans and thus rehabilitating strategic commitments at all levels

for a post-pandemic economic order [1][1]. So it can be, e.g. shape a fair feminist economy through gradual taxation, gender budgeting, corporate responsibility, progressive public services, social protection, an appropriate balance between work and private life, recognition and distribution of unpaid care work [2].

II. GENDER ASPECTS OF PANDEMIC SECURITY RISKS

Globalization creates systemic risks that intensify in times of crisis, such as this pandemic. Each crisis is then reflected separately on the vulnerable categories of society, and it always turns out that they are women. They are burdened with double shifts - both at work and at home, and during the pandemic, they are on the front line of the fight against the virus. The general increase in risk for women makes pandemic hunger, human rights violations disproportionate to the needs of protection against infection, the position of the elderly and their chances of survival, the increase in violence against women, the noticeable increase in the workload for women in performing the riskiest jobs. But never, as is the case now, is the fact that every life does not have the same value stated with calm shamelessness, warns the French writer Michel Houellebecq [3].

The burden of the corona virus epidemic and the measures taken in the state of emergency were born to a much greater extent by women than men. They make up the majority in sectors that were "at the forefront": health, trade, hygiene, but at the same time in most cases carried a more significant burden of housework, unpaid work, one in which they have been present for decades, more than men, and now with additional responsibilities for caring for family members, especially the elderly, children and their school obligations. In 70% of cases, these jobs are performed by women [4]. Moreover, since the beginning of the

closure, due to Corona virus, police, women's shelters and NGOs have reported an increase in domestic violence, especially violence against women. The pandemic revealed how serious this human rights violation is and how still this fragmentary but illustrative fact is that only in the first week of pandemic measures in Serbia, 31% of women who experienced violence lost their jobs, in the second week 55%. According to research by the NGO "Athens" in the fourth week, 92% were left without any income, according to a study by the NGO "Athens"[2].

We find a gender analysis of pandemic risks in the Feminist Manifesto [3], which points out those women are among the most vulnerable groups - especially those in low-paid professions [5]. Women with young children or other household chores and responsibilities experience social insecurity, have lower incomes, are more likely to be engaged in part-time, low-paid, precarious work, and are the first to lose revenue. In addition, women are more represented in education, health, social work and other services that are now considered "necessary", making them more exposed and vulnerable to many risks (infection, violence).

The Central and Eastern European Network for Gender Issues, in its publication on gender analysis of the pandemic, indicates that gender-disaggregated data are lacking at the outset playing sports. However, women predominate in the health sector and care economy (up to 70%) and the informal economy, tourism, service industries such as catering, shops, and the pharmaceutical industry [6].

III. WOMEN ENTREPRENEURSHIP IN SERBIA

There are 180,000 more women in Serbia than men, they live five years longer on average, but they are also more challenging to get a job and easier to get fired. Women make up the majority in lower-paid professions such as health, education, social protection, occupy only

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[1] Josip Juratović is a social democrat and member of the German Bundestag serving his fourth mandate. He is a member of the Foreign Affairs Committee, Chair of the Parliamentary Group for West Balkans and Vice President of the parliamentary group Germany-North Adriatic (Croatia and Slovenia).

[2] Hrnjak, Jelena from the NGO "Athens" - Women's Social Entrepreneurship is the right recipe for overcoming the consequences of this and all other crises For UN Women.
[3] That was written by members of the European feminist working group Rosa-Luxemburg-Stiftung, who live and work throughout Europe: in Belgium, the Czech Republic, Germany, Greece, Poland, Russia, Serbia, Spain, Great Britain and Ukraine.

a third of managerial positions, and own only a quarter of real estate [7].

In the current crisis of the world economy, women entrepreneurs are most affected. Serbia is in the EU average in terms of the number of women in business, but the statistics are far below the EU average when it comes to the percentage of women's companies that are shutting down. As the initial study on entrepreneurship showed, women in Serbia also differ in their motives for entering entrepreneurship. The three are the most common motives to start their own business, the desire to solve the problem of unemployment, the desire to be independent and the desire to realize a good business idea. Among young entrepreneurs, a higher share is recorded by entrepreneurial motives (independence and business idea), and entrepreneurship out of necessity is less represented (to solve the problem of unemployment). Younger entrepreneurs operate more often than older ones in the sector of accommodation and food services (17.3% vs. 7.1%), information and communication (6.2% vs. 1.8%), other service activities (9.9% vs. 5, 3%), while the elderly more often operate in the sector of manufacturing (16.2% vs. 11.0%), construction (7.1% vs. 3.6%) and trade (29.8% vs. 19.9%) [8].

Women entrepreneurs and owners of micro-enterprises in Serbia, as in other parts of the region and the world, face a great threat from the cessation of money circulation, while the demand for goods and services is decreasing. There is a sharp decline in demand for products and services, especially in the sector where women predominate, especially in service industries where everything is mainly dependent on social interaction. Therefore, there is a need for a rebalance of the financial support package for small and micro enterprises because, through it, support for women entrepreneurs should be directed. Such incentives from the state are needed permanently, and not only in times of crisis and sporadically.

The Business Women's Association points out that the situation, since the declaration of the state of emergency, including complete uncertainty regarding the duration of pandemic restrictions and the impact on economic flows, is more difficult for women's companies. Metaphorically, but precisely, it is stated that every crisis affects women like a big wave, which throws them back miles [9]. Everything that has been won in terms of gender equality disappears the moment the crisis brought women back home and brought them duplication of working hours and responsibilities.

IV. GENDER ANALYSIS

As part of the project "Key Steps to Gender Equality", UN Women, in partnership with NALED[4], 2020., conducted gender analysis,[5] seven different areas of business in Serbia [10-12]. Here we use excerpts from three such comments: the support program to small and medium enterprises at the local level, the program of support to entrepreneurship, and the Innovation Fund program.

A. Entrepreneurship Support Program - Indirect Discrimination

The analysis of the entrepreneurship support program reveals that women own part of the companies and that the beneficiaries of business subsidies, in terms of the number of grant beneficiaries and the number of funds received, are far below the level of their total participation in the economy. This means that the analyzed programs, taken together, further reduce the share of women in the economy. The key driver of this "unintentional/indirect discrimination" is the focus of the subsidy program on production, processing, and export activities - sectors in which women's participation is traditionally below average. Therefore, gender impact on application evaluation criteria needs to be considered.

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[4] National Alliance for Local Economic Development.
[5] Gender analysis is a critical re-examination of how differences in gender roles, activities, needs, opportunities and rights affect men, women, girls, and boys in a particular situation or context. Gender analysis examines the relationships between women and men and their access to resources as well as the control and constraints they face

with each other. The main goal of gender analysis is to ensure that injustices and gender-based inequalities are not exacerbated by interventions, and that, where possible, greater equality and fairness in gender relations are promoted.

Furthermore, it is essential to make available to the public as much information as possible about the program's implementation. This can result in an increased number of high-quality applications and increased participation of female candidates. Finally, it is also necessary to consider the benefits of continuity in program implementation before introducing new programs and terminating existing ones.

B. Local SME Support Program

Gender differences in the economy are recognized and addressed in local government programs, often in self-employment, agriculture, tourism, and to some extent in support programs for existing firms. Emphasis is placed on the need to use gender-responsive budgeting to address women's economic inequalities in local government budget programs. Local governments recognize the need to support socially excluded self-employment groups, including Roma, rural women, young people who are not employed, and people with disabilities. These calls are usually planned as part of local employment action plans, which are done in cooperation with the National Employment Service and co-financed by Serbia's Government. Although these self-employment programs are sometimes explicitly targeted at vulnerable groups, application requirements, evaluation criteria, and contracting procedures are such that they can result in the exclusion of an entire group of women, thus creating an additional barrier in the evaluation and contracting process. An important aspect for local governments recognizes the contribution of women to the local economy by providing support to women entrepreneurs and local business owners, establishing links with women's organizations and supporting programs that offer technical assistance/business services to women entrepreneurs. Access to gender-sensitive data needs to be improved to monitor access to local-level resources offered through public calls. Also, increase understanding and knowledge about gender gaps in the economy and tools for introducing a gender perspective into the mainstream among local government employees. Of particular importance is the

assistance in preparing project documentation for application to international donors for funds.

C. Program of the Innovation Fund

The approach is built on universality and neglects the actual effect of the program on women and men, and as a result, mini, and co-financing grants are gender blind. At the same time, the participation of women-owned companies is worryingly low in both programs and does not exist in the co-financing grants program. These programs disqualify small properties based on the fact that the applicants must be legal entities. In practice, this represents the disqualification of one part of the micro-business with the above-average participation of women as their owners. The Fund should prioritize the engagement, encouragement and support of women-owned firms. Approaches to programs should be harmonized, relying on the legal authority to introduce special measures to benefit the under-represented sex.

V. OUTPUT - THREE SCENARIOS OF PUBLIC POLICIES

According to their semantics, Crises have a negative signs, but they can also be moments of initiating change. The chance for change was not used in 2008 when the global economic crisis was a red signal to which it did not respond adequately. Instead of being used for positive changes in the world, that crisis caused even more significant inequalities [13]. Without losing sight of that, we should face the fact that we now live in one of the most remarkable social experiments in which we will ever participate and that the chances must not be missed anymore. Crosses can lead societies to do previously unthinkable things. It is now being decided whether the burden of the recession will be borne by the rich; or by the already greatly tormented middle class (in extinction) and the poor [14]. That is why measures that take into account gender impact must be introduced now, and that perspective must be used to find appropriate solutions for the current situation.

More than ever, awareness is needed today that equality and women's empowerment have immeasurable positive effects on society as a whole. Progressive forces, from parties to unions and feminist organizations, are now set to their biggest rehearsals - whether they will

discuss solutions during and after COVID-19. If not, it would mean renouncing the centuries-old struggle of generations of women for equality, social justice, democracy and human rights. Women and men deserve better. A better legacy must be left for generations to come [6]. A possible way out and hope is in women who support each other because today, more than ever, feminist principles, a feminist ethic of caring for oneself and others, along with women's solidarity and cooperation, are needed. Also, universal cash payments can provide security of family income in the short term and help maintain consumption, thus enabling the survival of small businesses, i.e. families with low incomes [15, 16].

Three potential scenarios can be defined as ways to design public policies regarding the position of women at work after COVID-19. The first is the gender-regressive scenario "do nothing", which, as a response, entails a more significant negative impact of COVID-19 on women. The second scenario is "take action now", which improves gender parity compared to the previous gender regression. Finally, the third scenario is a cautious approach, "wait to take action", which delays activities until the economic impact of COVID-19 disappears, for example, until 2025.

The "does nothing" scenario is the most negative because it is estimated that according to that gender regression scenario, even under those conditions, 33 million women would find employment by 2030. The best option is the "take action now" scenario, which gives women significant economic opportunities. Policymakers should make relevant decisions, which will significantly improve gender equality in the next decade. This scenario also increases the participation rate of women in the male workforce from 0.61 in 2020 to 0.71 in 2030 - creating 230 million new jobs for women globally.

According to the "wait with action" scenario - in which policymakers and other economic actors wait until 2025 to improve conditions for the female workforce, global GDP will grow in 2030 but is $ 5.4 trillion lower than it would now take action. Thus, failure to do or delay activities

to maintain and promote gender parity in the economy can negatively affect women's economic and social life and economic growth in a broader sense. In contrast, investing in women and girls for a more comprehensive recovery represents a significant opportunity to improve gender equality and drive inclusive economic growth [17].

A. Learning Organisations[6]

The dynamics of change in the 21st century, the transition to the information society require that businesses be "armed" with the concept of a learning organization, the ideal model for entrepreneurship. The essence is to work in a new way as a consequence of changed circumstances. Unique individual and collective knowledge are acquired because it is a continuous process of self-improvement, reorganization (rearrangement). A new reality is being created, independently, but also with the help of the state. In this way, entrepreneurs include the ability to understand phenomena and events in the world. It is also an opportunity to incorporate innovative principles into one's entrepreneurship and to adopt traditional approaches. The goal is flexibility and adaptability to the new conditions. Getting to know your environment but also your abilities creates a correlation of success. The main goal is to ensure that entrepreneurship behaves like a living organism, for which the most important thing is to adapt for survival. Also, to promote, where possible, greater equality in gender relations in the organization, access to equal access to resources and control, but also to the constraints they face. Innovative models of the organizations we strive for should contain a different picture of gender roles, activities, needs, opportunities, and rights that affect men, women, girls, and boys in a particular economic situation or social context instead of traditional ones. One of the standards should be inclusiveness.

VI. Case Study

Common to all these cases is a mild but clearly expressed optimism, based on the support received and their entrepreneurship. It is characteristic of small entrepreneurs that from the phase of waiting for something to pass

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[6] The term was introduced into scientific use by Peter Senge, the author of the world-famous book "Fifth Discipline: The Art and Practice of the Learning Organization", Doubleday Currency. New York, pp.406.

(emergency, measures, pandemic), thanks to their entrepreneurship, but also support from the institutional and above all from the private side, they all entered the phase of adjustment and functioning in new conditions. It will be more permanent.

The case study relies on an applied comparative longitudinal business case analysis of a pilot sample of successful women entrepreneurs from Čačak, a city traditionally considered a favourable business environment for private entrepreneurship. The first data were obtained in the focus group held on February 18, 2018, in Čačak. The second analysis was done in April and May 2020, during and after the declared state of emergency.

A. Examples of Comparative Longitudinal Analysis of the Business of Small Entrepreneurs from Čačak [7]

In 2017, the city of Čačak was more suitable in terms of quality of life, which is shown by the fact that it was ranked among the more developed towns and municipalities in several areas within the social development index. In terms of employment, 46.66% of people aged 15 to 64 in Čačak had a formal job, which was above the average employment of 44.51% at the level of the Republic of Serbia. In the period 2011–2017. The unemployment rate in Čačak decreased from 26.69% to 19.97% [18].

1) Initial motives for starting a business, previous experience and sources of support 2018.

Initial motives for starting own business. Mila (hair salon) states that she divorced has had a child, and have had to work and earn for a living; Zorica (confectionery) had as her first motive a literal survival after the death of her mother, then her mother-in-law, and the influence was that in the catering, where she worked, she did not have enough free time, but burdening compulsory work on weekends and shifts; Vesna's (private kindergarten) motive is economic independence and the opportunity to

work in the profession, and Jovana (bakery) points out that her shop enables her to earn more.

Previous experience. Slavica (unique embroidery), she first worked for five years with a private individual. However, after maternity leave, she could not return to work, Ljubica (press kiosk) worked for 44 years in AD Politika, Dušica (kiosk worker) after Ljubica's retirement took over the job, Mirjana (bookstore) worked in the civil service for 14 years, Zorica, (confectionery) started working in catering as a waitress, Vesna, (private kindergarten) worked for 15 years in a state company, Jovana (bakery), previously she worked for 11 years in her uncle's bakery. [8]

Support. All entrepreneurs from Čačak point out that they had the necessary support in starting and running a private business, which is probably one of the bases of their business success: Vesna (kindergarten) had the support of her parents first, and then her son and daughter when they grew up, Zorica (pastry shop)), she had the support and help of her parents while they were alive (but the young died) and the use of a neighbor trader who gave her goods on hold, Mirjana (bookstore), supported by her brother, later husband, and today daughter and son-in-law, Ljubica (kiosk for the press), was supported by the family, especially the sister, Mila (hair salon) says that her friends were with her all the time, Slavica (unique embroidery) was supported by her husband, Jovana (bakery) aunt and uncle.

B. Barriers, Incentives, Perspectives

The main obstacles during a state of emergency. Slavica (Unique embroidery)[9] states reduced workload, complete cessation of activities during the month, in the period from March 23 to May 4, fear of illness for family members, restrictions due to compliance with measures by customers; Jelena and mother Zaga (electrical device service) [10] , faced an unexpectedly increased workload, and apart from the application of security measures,

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[7] Focus group, held in February 2018 in Čačak with seven successful entrepreneurs: Zorica (pastry shop), Vesna (private kindergarten), Slavica (decorative embroidery), Ljubica (press kiosk), Mila (hair salon), Mirjana (bookstore), and Jovana (bakery). The economic activities of the same group of small entrepreneurs were analyzed in April and May 2020, during and after the lifting of the state of emergency. Instead of Jovana (bakery), Jelena and her

mother Zaga (electrical device service), Jelena (transport), and Dušica, who took over the kiosk instead of Ljubica, who retired, entered the sample in 2020.

[8] The same focus group from Čačak.

[9] Slavica Ilić, art workshop "Unique embroidery".

[10] Jelena Arsenijević and mother Zaga, company "SUR UNIELEKTRO, specialized service shop for repairs of electric motors and maintenance of electrical devices".

curfew, there were no changes in their business except for quantitatively more work; Ljubica, the owner of the kiosk[11], could not work because she was in the 65+ category, the job was difficult because at that time, during the emergency measures, everything that was a job for two, the worker Dušica had to do by herself; Mirjana (bookstore)[12] stated that the biggest problem was that the volume of work was significantly reduced because the children did not go to school, the turnover was reduced by 80%. Another problem was that the owner was in the 65+ category, so her daughter and son-in-law took over the business, and they also had to close another store because it was not economical. They respected all the prescribed measures, curfew, distance between customers and the number of customers in the bookstore. Apart from that, there were no other problems, but they still worked; Zorica (cakes)[13] pointed out the lack of work as the biggest problem. Her activity is related to celebrations, and gathering was forbidden. She did not wholly interrupt her activity, but it was a "death" from work. Until the old condition returns, her firm will have business problems; Vesna (kindergarten)[14] points out that the main problem in her business was the complete cessation of activities from the declaration of the state of emergency, from March 16 to May 13, as a complete two-week cessation of activities, when all her workers were on vacation. Jelena (transport)[15] believes that the main problem was the new protection measures and procedures at the borders, which significantly slowed down her transport; Mila (hair salon)[16] stated that the main problem was that she was not allowed to work at all, and there was work to be done. The work was interrupted from April 16 to May 13, and then she worked occasionally and by appointment.

Incentives during a state of emergency. Slavica (embroidery) thinks that all the measures taken by the state, securing the minimum wage, postponing the loan, allocating 100 euros to everyone, were positive for her so that she did not fire the workers; Jelena and Zaga

(service) state that the best thing in the whole situation is that they did not interrupt their work at all, and, interestingly, people repaired what they put aside for some other time. On top of that, they worked a lot for bakeries. The workload in those months; Dušica (kiosk) positively assessed the Government's measures, especially the moratorium on loans and assistance of 100 euros; Mirjana (bookstore) states that they used the time to list, tidy up the rooms and warehouses; Zorica (cakes) points out as positive that all her workers had an understanding for the situation, and the help of the state was welcome, especially the moratorium on loans. He also states as positive that they worked for volunteers, which unexpectedly received considerable publicity [19]. Vesna (kindergarten) points out that they used the time for general cleaning, arrangement and disinfection of rooms, furniture, toys and devices in the yard, as well as complete yards, and it is a fortunate circumstance that no one got sick from children or staff in any of three work units; Jelena (transport) thinks that everything worked well as far as the goods are concerned, so the work was not interrupted at all; Mila (hair salon) states as a reasonable circumstance that she finally got a good rest, and started the procedure for the construction of the building in which her new salon will be.

Withdrawal from work, interruption of activities. Withdrawal from work and interruption of moves for almost all women entrepreneurs from the sample was out of the question, although some had significant delays and other problems during the summer. Slavica (embroidery) states that they never had that in mind; Jelena and Zaga (service) point out that it is no coincidence that she and her mother will not retire from work, because finally, as a company, they have been around for a long time and intend to stay that way; Ljubica (kiosk) states that she retired and left the job to worker Dusica Zivkovic, who emphasises that there is no withdrawal from work, on the contrary, she used to open another kiosk, which is now run by

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[11] The owner retired during the measures, and her company, a newsstand in the city center "ELLE 2019", was taken over by her long-term employee Dušica Živković.

[12] Mirjana Marković company "OAZA bookstore-gallery-paper mill".

[13] Zorica Selaković company "Workshop for making cakes and pastries DESSERT".

[14] Vesna Milošević company "Preschool institution GIMNAZION".

[15] Jelena Borišić company, "Auto transport company for transport of goods KING TRANS".

[16] Mila Borišić company "Hair salon MILA".

her sister, who was fired from a private company; Mirjana (bookstore) also has no intention of giving up her job. She emphasises that she and her family have survived everything during these twenty years, so this will happen; Zorica (cakes) never thought of retiring from work, and the shops indeed remain with her daughters even when she retires; Vesna (kindergarten) is clear that for now this option is not being considered at all, on the contrary; Jelena (transport) is not thinking about quitting her job, neither she nor her husband (the main driver), because they live and raise three children from that; only Mila (hair salon) thought intensively about quitting her job, but she can't leave customers who "don't allow" her to quit her job.

Business prospects after a state of emergency. Slavica (embroidery) states that everything is slowly returning to normal, although there are not many customers yet, but she used the interruption to prepare new models to sell, procured goods, planned further steps; Jelena and mother Zaga (service) say that everything is the same for them even after the measures. They continue to serve both the people and the state; Dušica (press kiosk) indicates that she has almost returned to normal; Mirjana (bookstore) has returned to work as the owner, but she still cannot have expectations of normalisation until schools and faculties open, where the main clientele comes from; Zorica (cakes) emphasises that she will return to standard 100% only when safe gatherings are possible again. He now works in catering, for confectioneries, and cakes and pastries for shops, but that is still not at the previously set standard. Therefore, he thinks that recovery will be difficult. But she points out that she did not fire people. Instead, they used vacations, unpaid leave, sick leave; Vesna (kindergarten) says that everything is slowly returning to normal, but it is not yet in the capacity as it was before these events; Jelena (transport) is happy, and thanks to God that she is constantly busy, of course with increased precautions; Mila (hair salon) says that her return to normal is related to the construction of a new building.

C. Government Intervention

In 2020, since the outbreak of the pandemic crisis, the Government of Serbia had supported the economy with three packages of economic measures. In the first, one of the measures was participation with a three-month minimum. The first was paid into the company's accounts at the beginning of May, the second on June 4, and the third on July 7. So, in the three months before July, three minimum wages were paid for 1,050,000 employees in 235,000 businesses. In addition, all entrepreneurs in small and medium enterprises employees received 60 per cent of the minimum wage from the state on August 10 and then in September [20]. Thus, entrepreneurs are financially helped with 60 per cent of the minimum for all their workers, from hairdressers, shoemakers to people who have their own private companies for furniture production, which is especially important for caterers and travel agencies.

Then, in February 2021, the Government of the Republic of Serbia adopted the third package of economic measures to help citizens and the economy, worth 249 billion dinars. The new set of measures included direct assistance to entrepreneurs, micro, small, medium and large companies, support to the catering sector, hotels, travel agencies, the passenger and road transport sector, as well as one-time financial assistance to citizens and extension of the guarantee scheme to maintain private liquidity. It is also essential for entrepreneurship in Serbia that public sector wages and pensions are stable. In addition, all citizens receive assistance from the state (both vaccinated and unvaccinated, especially pensioners) [21], because that is where their potential customers and other clients are. Then, a decree was passed on establishing a program to encourage entrepreneurship development through financial support for women entrepreneurs and young people in 2021. The Ministry of Economy implements the program in cooperation with the Development Fund of the Republic of Serbia. The funds determined by the program are intended for financial support to newly established entrepreneurs, micro and small companies, which are registered with the Business Registers Agency at the earliest five years with the year of submitting the request. And the last in a row is the program of support for the development and promotion of women's innovative entrepreneurship for 2021, which is implemented by the Cabinet of the Minister in

charge of innovation and technological development of the Republic of Serbia.

VII. CONCLUSION

Entrepreneurs are aware that it is always difficult after the crisis, probably more demanding than before because overcoming the consequences is unknown to everyone. They are all afraid of uncertainty. But on the other hand, people in Serbia have been living from the beginning and this will probably also be one such story of new beginnings. As stated in the research on the work of women entrepreneurs, perhaps the cooperation of women and their mutual support is a winning combination. In addition, entrepreneurship can transform following the needs of jobs and services dictated by the market because there is less capital in the game. Thus fewer risks and losses, fewer employees (usually relatives and friends) facilitate good communication and decomposition of the work program such and similar situations, perhaps even in some new crises. These small companies have not created an accumulation and are a problem when they have additional costs and reduced turnover. Their profitability is endangered. Therefore, the state's role must not be negligible, flat, and politically abused, but must have an incentive character to return to the "normal track".

However, such crises have shown the importance of small businesses and their primary asset - transformation. Every problem can also be a new opportunity. The inclusion of women in these new opportunities is one of the necessary conditions for innovative organizations that permanently learn, reduced to everyday pragmatism, colored by perseverance, struggle, and empathy. "What is good for gender equality is good for both the economy and society as a whole" [22]. That is not just a vision for new organizational models; it is simply a futuristic orientation, as shown by case studies of the functioning of women entrepreneurs from Čačak during emergency measures.

Maintaining opportunities for women in business and all sectors of society is a condition for quality assurance - a long-term strategic need. It's not just the right attitude. It's the intelligent orientation. Erika Kvapilova, UN Representative for Women in Georgia, further emphasized the role of women's business: "The principles of women's empowerment offer business guidelines to encourage women's advancement in the workplace, the market, and the community. When women are empowered and earn an income, they can return on investment in their families and communities, which is good for all of us and society. Women's business can bring a lot to these efforts [23].

Gender parity is an economically powerful instrument, not a concession to women; gender diversity is a winning combination for society and not just another expense [24]. This is the time for policymakers and business leaders to step up activities to stimulate gender equality in economics so that it becomes a reality rather than a utopian declarative polygon.

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Smartphone Selection based on the PIPRECIA and CoCoSo Methods

Gabrijela Popović[1], Darjan Karabašević[2], Đorđe Pucar[3]

[1,2,3]Faculty of Applied Management, Economics and Finance, Belgrade, Serbia

[1]gabrijela.popovic@mef.edu.rs, [2]darjan.karabasevic@mef.edu.rs, [3]djordje@mef.edu.rs

Abstract—**The primary goal of this paper is to select the optimal smartphone for procurement by an organization. The choice is made between eight smartphones of different brands, different performances and prices. The Multiple-Criteria Decision-Making (MCDM) approach is used for the selection of the best alternative smartphone according to the defined requirements.** *The PIvot Pairwise RElative Criteria Importance Assessment – PIPRECIA* **method is used for determining the weights of the criteria, while** *the Combined Compromise Solution – CoCoSo* **method is used for final evaluation and ranking of the alternatives. Eight alternative smartphones are assessed relative to the five evaluation criteria, and the decision process involves three decision-makers with the aim of gaining the appropriate and reliable results.**

Keywords – MCDM, PIPRECIA method, CoCoSo method, smartphone, selection

I. INTRODUCTION

Everyday life, both private and business, could not be imagined without using the various types of gadgets. Thanks to computers, laptops, tablets and smartphones, people easier reach and shares the needed information and mutually communicate. Especially popular are smartphones which provide their users with different types of services [1]. Consequently, there are various types of smartphones with different features and possibilities. Because of that, it is very complex to select an appropriate one from a wide range of offered types and brands. Besides the price, an adequate smartphone should fulfil other users` requirements regarding its technical performances and possibilities. The fact that this decision requires involving a greater number of criteria leads to the conclusion that the application of the Multiple-Criteria Decision-Making (MCDM) methods is fully justified and necessary.

As Vincke stated in his paper [2], the MCDM could be precisely described as a set of multiple-criteria method. Since mid-50s a significant number of MCDM methods have been proposed, to mention some of the best known: *the Weighted Sum* – WS or *the Simple Additive Weighting* – SAW [3,4], *the Analytic Hierarchy Process* – AHP [5], *the Technique for Order of Preference by Similarity to Ideal Solution* – TOPSIS [6], *the Preference Ranking Organization METHod for Enrichment of Evaluations* – PROMETHEE [7], *ÉLimination et Choix Traduisant la REalité* – ELECTRE [8], and *Višekriterijumsko KOmpromisno Rangiranje* – VIKOR [9]. There are the new methods that have been recently proposed such as: *the Weighted Sum adapted for an analysis based on decision maker Preferred Levels of Performances* – WS PLP [10], *the Full Consistency Method* – FUCOM [11], the *Measurement of Alternatives and Ranking according to COmpromise Solution* – MARCOS [12], *the Integrated Simple Weighted Sum Product Method* – WISP [13], and *the MEthod based on the Removal Effects of Criteria* – MEREC [14]. The authors have proposed adequate extensions of the MCDM methods that make them more suitable for the application in the conditions of uncertainty [15].

MCDM methods have been used for the optimization of different business processes as well as for making different kind of decisions [16-18]. The main intention of this paper is to propose an MCDM approach for the evaluation and selection of an appropriate smartphone for procurement. Until now, the authors have

observed decision-making regarding various issues relative to smartphones, which results in the following papers [19-22]. For the purpose of this paper, the selection of the adequate smartphone for purchase is performed by applying the The *PIvot Pairwise RElative Criteria Importance Assessment – PIPRECIA* [23] and *Combined Compromise Solution – CoCoSo* [24]. The weights of the criteria are determined by applying the PIPRECIA method, while the final ranking of the alternative smartphones is performed by using CoCoSo method. Eight smartphones are assessed against five criteria, by three decision-makers.

II. THE METHODOLOGY

A. *The PIPRECIA method*

In the application of any type of MCDM method the first step is the determination of the criteria weights. Until now, many different approaches have been proposed for that purpose, such as: AHP [5], the *KEmeny Median Indicator Ranks Accordance* – KEMIRA [25], FUCOM [11] and *the Stepwise Weight Assessment Ratio Analysis* – SWARA [26]. In this paper the PIPRECIA method [23] is used because of its simplicity and reliability. Maybe the dominant advantage of this method relies in its convenience for the application in a group decision environment. So far, the PIPRECIA method is used for defining the weights of different types of criteria as well as for the prioritization of various business options. Besides, the authors proposed certain extensions with the aim of incorporating the uncertainty of the decision environment to a higher degree.

The computation procedure of the PIPRECIA method can be explained in the following way.

Step 1. Choosing the evaluation criteria. In the case of using the PIPRECIA method, there is no obligation for pre-sorting the criteria according to expected significance. mandatory.

Step 2. Determining the relative importance s_j, beginning from the second criterion, as follows:

$$s_j = \begin{cases} >1 & when \quad C_j > C_{j-1} \\ 1 & when \quad C_j = C_{j-1} \\ <1 & when \quad C_j < C_{j-1} \end{cases}. \qquad (1)$$

Step 3. Defining the coefficient k_j using the Eq. (2):

$$k_j = \begin{cases} 1 & j = 1 \\ 2 - s_j & j > 1 \end{cases}. \qquad (2)$$

Step 4. Computing the recalculated value q_j, in the following way:

$$q_j = \begin{cases} 1 & j = 1 \\ \dfrac{q_{j-1}}{k_j} & j > 1 \end{cases}. \qquad (3)$$

Step 5. Defining the relative criteria weights by using the Eq. (4):

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k}, \qquad (4)$$

where w_j represents the relative weight of the criterion j.

Step 6. Defining the relative criteria weights under group decision-making conditions. When a greater number of decision-makers are involved in the procedure, then the overall criteria weights are defined in the following manner:

$$w_j^* = \left(\prod_{r=1}^{R} w_j^{nr} \right)^{1/R}, \qquad (5)$$

$$w_j = \frac{w_j^*}{\sum_{j=1}^{n} w_j^*}, \qquad (6)$$

where w_j^{nr} denotes the weight of criterion j that is defined by the respondent r, R is the total number of the respondents, w_j^* is group weight of criterion j before its adjusting in order to fulfill the condition $\sum_{j=1}^{n} w_j = 1$, and w_j is the overall weight of criterion j.

B. *The CoCoSo method*

The CoCoSo method is introduced by Yazdani, Zarate, Zavadskas, and Turskis [24]. The essence of the CoCoSo method is the combination of weighted sum method and exponentially weighted product method. The computation procedure of the CoCoSo method could be precisely illustrate by following series of steps.

Step 1. Defining the initial decision-making matrix. This matrix *X* could be shown as follows:

$$X = \begin{bmatrix} x & x & \cdots x & \cdots & x \\ x & x & \cdots x & \cdots & x \\ \vdots & \vdots & \ddots \vdots & \ddots & \vdots \\ x & x & \cdots x & \cdots & x \\ \vdots & \vdots & \ddots \vdots & \ddots & \vdots \\ x & x & \cdots x & \cdots & x \end{bmatrix}, \quad (7)$$

where x_{ij} denotes a performance rating of alternative *i* in relation to criterion *j* ($x_{ij} > 0$), *n* represents the number of alternatives and *m* denotes the number of criteria.

Step 2. Normalization of the criteria performance ratings. Depend on the type of evaluation criteria, normalization procedure is performed by using Eq. (8) and (9), as follows:

$$r_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}, \quad (8)$$

when criterion is benefit.

$$r_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}, \quad (9)$$

when criterion is cost.

Step 3. Define the sum of weighted comparability sequence and power-weighted comparability sequences of alternative by using the following Eqs.:

$$S_j = \sum_{j=1}^{n} r_{ij} w_j, \quad (10)$$

$$P_i = \sum_{j=1}^{n} r_{ij}^{w_j}, \quad (11)$$

where *Si* and *Pi* represents the sum of weighted comparability sequence and power-weighted comparability sequences of alternative *i*, respectively, w_j is weight of criterion *j*, and r_{ij} denotes normalized rating of alternative *i* according to criterion *j*.

Step 4. Ranking of the alternatives. For ranking of the alternatives, CoCoSo method uses relative performance score k_i, that is calculated based on three aggregated appraisal scores k_{ia}, k_{ib} and k_{ic}, as follows:

$$k_i = \frac{1}{3}(k_{ia} + k_{ib} + k_{ic}) + (k_{ia} k_{ib} k_{ic})^{\frac{1}{3}}, \quad (12)$$

with:

$$k_{ia} = \frac{S_i + P_i}{\sum_{i=1}^{m}(S_i + P_i)}, \quad (13)$$

$$k_{ib} = \frac{S_i}{\min_i S_i} + \frac{P_i}{\min_i P_i}, \quad (14)$$

$$k_{ic} = \frac{\lambda S_i + (1-\lambda) P_i}{\lambda \max_i S_i + (1-\lambda) \max_i P_i}, \quad (15)$$

where: λ is coefficient, $\lambda \in [0,1]$ and it is usually set to $\lambda = 0.5$.

III. NUMERICAL EXAMPLE

The applicability of the proposed methodology is presented by using a real case study pointed to the selection of an optimal smartphone for procurement by an organization. The alternative smartphones that will be assessed are:

- A_1 – Samsung Galaxy A52s 5G
- A_2 – Xiaomi Mi 10T
- A_3 – Realme GT
- A_4 – CAT S52
- A_5 – Vivo V21
- A_6 – BlackShark 4
- A_7 – Crosscall Trekker X4
- A_8 – Huawei P40

These alternative smartphones are evaluated against five criteria that are as follows:

- C_1 – Price (din.)
- C_2 – Weight (g)
- C_3 – RAM memory (GB)
- C_4 – Internal storage (GB)
- C_5 – Battery (mAh)

The list of the evaluation criteria is based on the one presented in the paper of Goswami and Mitra [27].

In the beginning, there is a need for defining the criteria weights which is done by the help of three decision-makers who are managers in the organization. The reason for involving more than one decision-maker is minimizing the

subjectification of the gained results. The weights obtained from the first decision-maker are presented in Table I.

TABLE I. THE CRITERIA WEIGHTS OBTAINED BY THE FIRST DECISION-MAKER.

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.17
C_2	1.10	0.90	1.11	0.19
C_3	1.10	0.90	1.23	0.21
C_4	1.00	1.00	1.23	0.21
C_5	1.10	0.90	1.37	0.23
			5.95	1

As Table I shows, the most important criterion according to the first decision-maker is C_5 – *Battery*. Criterion C_1 – *Price* is the least significant according to the opinion of this decision-maker.

Table II contains the criteria weights defined by the second decision-maker.

TABLE II. THE CRITERIA WEIGHTS OBTAINED BY THE SECOND DECISION-MAKER.

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.21
C_2	0.90	1.10	0.91	0.19
C_3	1.00	1.00	0.91	0.19
C_4	1.10	0.90	1.01	0.21
C_5	0.90	1.10	0.92	0.19
			4.75	1

The second decision-maker considers the criteria C_1 – *Price* and C_4 – *Internal storage* as the most significant and influential.

The criteria weights according to the third decision-maker are presented in Table III.

TABLE III. THE CRITERIA WEIGHTS OBTAINED BY THE THIRD DECISION-MAKER.

Criteria	s_j	k_j	q_j	w_j
C_1		1	1	0.16
C_2	1.20	0.80	1.25	0.20
C_3	1.05	0.95	1.32	0.21
C_4	1.00	1.00	1.32	0.21
C_5	1.00	1.00	1.32	0.21
			6.20	1

Third decision-maker assigned equal significance to the three criteria namely: C_3 – *RAM memory*, C_4 – *Internal storage*, and C_5 – *Battery*.

It is easy to conclude that the different decision-makers prioritize the criteria in different way. In order to elicit the overall weight of criteria we applied Eqs. (5) and (6), and obtain the final results that are presented in Fig. 1.
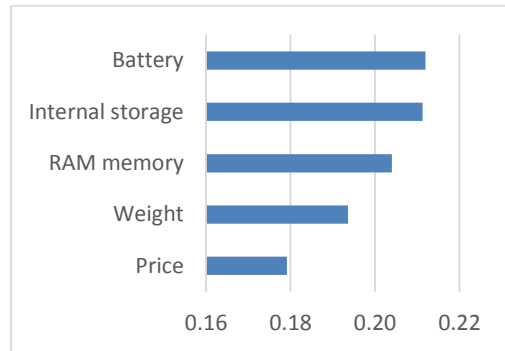

Figure 1. The overall criteria weights.

As the final results show, the greater significance has the criterion C_5 – *Battery*, while the criterion C_1 – *Price* is the least important in this case.

When the calculation of criteria weights is performed, we have all the needed data for the final ranking of the considered alternatives. The features of alternative smartphones that are submitted under evaluation are presented in Table IV. Data about considered smartphones are retrieved from an online shop that is not mentioned to avoid its promotion.

TABLE IV. INICIAL DECISION-MAKING MATRIX.

	C_1	C_2	C_3	C_4	C_5
	0.179	**0.194**	**0.204**	**0.211**	**0.212**
	din.	*g*	*GB*	*GB*	*mAh*
	min	*min*	*max*	*max*	*max*
A_1	52990	189	8	256	4500
A_2	56990	194	6	128	5000
A_3	74990	186	12	256	4500
A_4	49990	210	4	64	3100
A_5	49990	176	8	128	4000
A_6	84990	210	12	256	4500
A_7	82990	253	2	64	4400
A_8	99990	175	8	128	3700

The normalized performance ratings of the considered alternatives are calculated by using Eqs. (8) – (9) and they are presented in Table V.

TABLE V.   NORMALIZED DECISION-MAKING MATRIX.

	C_1	C_2	C_3	C_4	C_5
	0.179	**0.194**	**0.204**	**0.211**	**0.212**
A_1	0.94	0.82	0.60	1.00	0.74
A_2	0.86	0.76	0.40	0.33	1.00
A_3	0.50	0.86	1.00	1.00	0.74
A_4	1.00	0.55	0.20	0.00	0.00
A_5	1.00	0.99	0.60	0.33	0.47
A_6	0.30	0.55	1.00	1.00	0.74
A_7	0.34	0.00	0.00	0.00	0.68
A_8	0.00	1.00	0.60	0.33	0.32

Now, the rank of the considered alternatives will be defined by using the CoCoSo method. In Table VI the calculation details regarding the used method are presented.

TABLE VI.   CALCULATION DETAILS WERE OBTAINED USING THE CoCoSo METHOD.

	S_i	P_i	k_{ia}	k_{ib}	k_{ic}
A_1	0.039	3.28	0.156	6.709	0.998
A_2	0.031	2.20	0.145	5.827	0.927
A_3	0.037	2.95	0.157	6.760	1.000
A_4	0.040	3.64	0.082	3.081	0.523
A_5	0.038	3.42	0.145	5.823	0.927
A_6	0.036	2.55	0.150	6.207	0.955
A_7	0.039	3.27	0.055	2.000	0.348
A_8	0.038	2.81	0.110	4.192	0.700

Finally, by using Eq. (12) we achieved the final results relative the ranking order of the considered alternative smartphones.

TABLE VII.   THE FINAL RANK OF ALTERNATIVES.

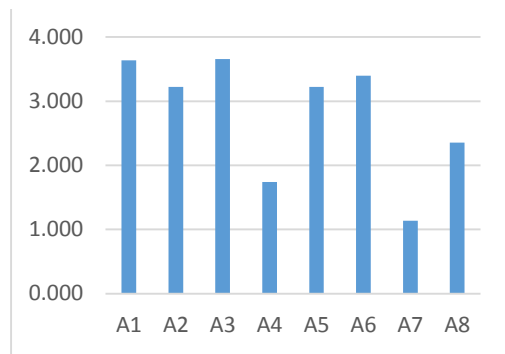|	k_i	Rank
A_1	3.637	2
A_2	3.222	4
A_3	3.659	1
A_4	1.738	7
A_5	3.221	5
A_6	3.398	3
A_7	1.137	8
A_8	2.352	6

Figure 2. The rank of the alternative smartphones.

According to the given results, the optimal choice is the alternative A_3 – *Realme GT*, while the least desirable is the alternative A_7 – *Crosscall Trekker X4*. According to the input data, it could be concluded that this option fulfills the set requirements. The obtained result is presented graphically, as well (Fig. 2).

IV. CONCLUSION

This paper was pointed to the identification of the optimal smartphone for purchase by using MCDM techniques. The evaluation and selection process is based on the application of the PIPRECIA and CoCoSo methods. The weights of the criteria are defined with the help of the PIPRECIA method, while the final ranking is performed by using CoCoSo method. Eight smartphones are assessed regarding to five criteria in the group decision environment. The used methodology proved its applicability because it facilitated decision process and enabled finding such a solution that fulfils the requirements.

The main limitation of this paper is reflected through using crisp numbers. The vagueness of the environment could be better expressed if the fuzzy, grey or neutrosophic numbers are applied. The aforementioned also is the first preposition for future work. Secondly, it would be desirable to involve a greater number of the criteria in the evaluation process because the results would be more representative in that case. Here, the criteria weights are determined by using the subjective weighting method; it would be interesting to observe the case of using a combination of the subjective and objective weighting methods.

Finally, the conclusion is that the proposed MCDM approach proved its simplicity and efficiency in the case of selecting the optimal smartphone. It provides reliable and adequate

results which candidates it for application in the resolving of various perceived problems in other fields.

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Impact of Innovation on Employment: Evidence from BRICS-T Countries

Funda H. SEZGİN[1], Yılmaz BAYAR[2],

[1]Istanbul University-Cerrahpaşa, Department of Industrial Engineering, Istanbul, Turkey
[2]Bandirma Onyedi Eylul University, Faculty of Economics and Administrative Sciences, Bandirma, Balikesir, Turkey

[1]hfundasezgin@yahoo.com, [2]yilmazbayar@yahoo.com

Abstract—**Innovation has become a significant determinant of economic growth in the globalized world. This study investigated the effect of innovation proxied the number of patents and R&D expenditures/GDP on employment in BRICS-T countries through regression analysis for the period of 2010-2020. The regression analysis revealed a positive employment effect of innovation.**

Keywords – innovation, employment, panel regression analysis, BRICS-T countries

I. INTRODUCTION

The globalization process raised the competitiveness in the world and countries should make innovation to survive in the highly competitive environment. Innovation is the process which develops and applies the ideas and technologies for the improvement of goods and services or more efficiently production of goods and services [1]. Innovation is accepted as one of significant determinants of economic growth [2-7]. Innovation has potential to affect the economic growth through channels of competitiveness, financial system, life quality, trade openness, and infrastructure development etc. [8]. However, economic growth can also raise the innovation [8]. Therefore, a mutual interaction between innovation and economic growth is possible.

The innovation can create new jobs or destroy the existing jobs through different channels and the net employment effect of innovation depends on firm, sector and country specific factors. In this context, the employment effect of technological progress depends on the current production technology, nature, type (product or process innovation), direction (labor or capital saving, neutral etc.), and dimension (incremental or radical innovation), of technological progress, direction of technological progress in the short and long run [9]. Furthermore, consumer preferences, competition in labor and commodity markets and structure of labor force are important for the interaction between technological progress and employment [9].

In the study, the impact of innovation on employment is analyzed in sample of BRICS-T economies (Brazil, Russian Federation, India, China, South Africa, and Turkey) through regression analysis. The next section presents the related empirical literature and the dataset and method are explained. Section 4 conducts the empirical analysis and the findings are discussed and the study is over with Conclusion.

II. LITERATURE REVIEW

The interaction between innovation and employment has been extensively explored in the relevant literature. Most of the scholars have disclosed a positive employment growth effect of product innovation (e.g., see [9-14]). On the other side, mixed findings have been revealed from the studies on the interaction between process innovation and employment (e.g., see [15-17]).

Üçdoğruk [12] researched the effect of product and process innovations on employment in manufacturing sector in Turkey for the period of 1995-1997 and 1998-2000 and reached that the aforementioned innovation types raised the employment in industries with low technology.

On the other side, Merikül [13] explored the employment effect of innovation at firm and industry levels in Estonian and revealed a positive effect of innovation on employment at firm and industry levels. However, the employment growth effect of product innovation was found to be higher than that of process innovation.

Bogliacino et al. [18] investigated the impact of R&D on employment with the data of 677 European manufacturing and service firms and revealed a positive interaction between R&D expenditures for product innovation and employment. On the other side, Cirera and Sabetti [19] analyzed the effect of technological and organizational innovation on employment at firm level in a sample of 15,000 firms in developing countries and revealed that product innovation positively affected the employment, but process innovation did not have a negative effect on firm level employment. However, the positive employment effect of innovation weakened as the firms approached the technological frontier.

Okumu et al. [14] analyzed the effect of innovation on employment in manufacturing firms in Africa through regression analysis and revealed that process and product innovations positively affected the employment. Lastly, Medase and Wyrwich [17] analyzed the interaction between innovation and employment in Nigeria for the period of 2005-2010 and reached a positive employment effect of process and product innovations.

III. DATASET AND METHOD

In the study, the employment effect of innovation was explored in sample of BRICS-T (Brazil, Russia, India, China, South Africa and Turkey) countries. The innovation was proxied by R&D expenditures/GDP and patent number, and employment was represented by share of employed persons to ages 15 and older persons. All variables were annual and provide from database of World Bank as seen in Table I. The study period covered 2010-2020 period.

TABLE I.   DATASET DEFINITION

Notation	Variable	Source
lnR&D	Logarithm of R&D expenditures/GDP	World bank [20]
lnPATE	Logarithm of patent numbers	World bank [20]
lnEMP	Logarithm of employment ratio	World bank [20]

The summary statistics of the dataset were presented in Table II. The mean of R&D expenditures as % of GDP, patent number, and employment rate were respectively 1.265%, 31382, and 51.58%.

TABLE II.   DESCRIPTIVE STATISTICS FOR VARIABLES

	R&D	PATE	EMP
Mean	1.265	31382.16	51.583
Median	1.389	14982.62	52.964
Maximum	2.861	15843.00	68.201
Minimum	0.659	178.00	35.336
Std. Dev.	0.463	40274.11	8.349

IV. EMPIRICAL ANALYSIS

First, cross-sectional dependence and homogeneity were tested, because the result of these tests are important for specification of unit root tests [21]. The homogeneity and cross-sectional dependence tests by Pesaran and Yamagata [22] and Pesaran et al. [23] help us to select first- or second-generation unit root tests. The second generation unit root tests are applied if there exist cross-sectional dependence [24]. In the study, as there were 6 countries (N=6) and 11 years (T=11), in turn the results of Breusch and Pagan [25] CD_{LM1} test in Table III were considered for determination of the cross-section dependence.

TABLE III.   CROSS SECTION DEPENDENCY AND HOMOGENEITY TEST RESULTS

Variables	CD_{LM} Test Statistics	LM_{adj} Test Statistics	CD_{LM} p Value	LM_{adj} p Value
R&D	6.713	8.462	0.000	0.008
PATE	9.784	10.034	0.000	0.000
EMP	9.202	10.325	0.001	0.003
Coefficient Homogeneity Test Statistic Value	Δ = 12.774		p=0.000	
	Δ_{adj} = 15.832		p=0.000	

The results of homogeneity tests in Table IV revealed the presence of heterogeneity, because the probability values of the test results were less than 5%, and in turn the null hypothesis (slope coefficients were homogeneous) was rejected. The cross-sectional dependency was also determined between the cross-sections ($p<0.05$). First generation unit root tests were divided into two as homogeneous and heterogeneous models.

As the coefficients were heterogeneous, first generation unit root tests were used with Im et al. [26] and Maddala and Wu [27] and Choi [28] based on the heterogeneous model assumption.

TABLE IV.   FIRST GENERATION UNIT ROOT TESTS RESULTS

Unit Root Test	R&D	PATE	EMP
Level			
Im et al. [26]	-0.948 (0.124)	-1.131 (0.149)	-1.217 (0.122)
Maddala and Wu [27]	8.955 (0.130)	9.358 (0.158)	7.584 (0.182)
Choi [28]	-0.942 (0.151)	-1.216 (0.169)	-1.319 (0.148)
First Difference			
Im et al. [26]	-6.771 (0.016)	-8.165 (0.000)	-7.558 (0.000)
Maddala and Wu [27]	37.382 (0.000)	39.450 (0.002)	35.381 (0.000)
Choi [28]	-8.472 (0.000)	-9.735 (0.000)	-8.269 (0.000)

Note: *The deterministic specification of tests includes constant and trend. Probability values are shown in parentheses. Tests were conducted for significance at the 5% level. The null hypothesis of the tests is that there is a unit root. The optimal lag length was determined using the Schwarz information criterion.*

The unit root tests revealed that all variables were I(1). In this case, the regression analysis was conducted by first differences of the series. However, use of second-generation unit root tests yields more consistent, efficient, and powerful estimations, if there was cross-section dependency in panel data. In the study, second generation unit root tests should be used, because cross-sectional dependence was determined among the series. Therefore, second generation unit root test of CADF by Pesaran [29] was applied and the results were given in Table V.

TABLE V.   SECOND GENERATION PANEL UNIT ROOT TEST CADF RESULTS

Variables	Level		1st Difference	
	Constant	Constant + Trend	Constant	Constant + Trend
R&D	-0.913	-1.114	-8.771*	-8.901*
PATE	-8.495	-0.983	-9.316*	-9.836*
EMP	-1.044	-1.234	-7.325*	-9.607*

* Significant variable for 0.05

The maximum lag length was taken as 1 in CADF test, and the optimal lag length was identified according to the Schwarz information criterion. The unit root test results showed that the series was not stationary at the level, i.e., they had a unit root, and the variables were stationary at the I(1) level. In this case, regression analysis was made with first-order differences. Chow and Breush-Pagan's (BP) pre-tests were applied in the first step for the panel regression estimation process. For the Chow test, the H_0 hypothesis was the pooled regression, the H_1 hypothesis was the fixed effects model (FEM), and the H_0 hypothesis was pooled regression for the BP test, and the H_1 random-effects model (REM).

TABLE VI.   PANEL REGRESSION METHOD SELECTION TEST RESULTS

Test	Probability (p)	Decision
Chow (F test)	0.002	H_0 rejected
BP (X^2 test)	0.001	H_0 rejected

As shown in the Table VI, the H_0 hypothesis was rejected for both tests. For this reason, it was necessary to make a choice between REM and FEM models. In this case, selection between FEM and REM will be made with the help of the Hausman test. The hypotheses of the test are given below, and the test results are seen in Table VII. H_0: Random effect (REM), H_1: Fixed effect (FEM).

TABLE VII.   HAUSMAN TEST RESULTS

Test Summary	Chi-Square Statistics	df	p
Cross-Section Random	563.881	2	0.000
Period Random	623.540	2	0.000
Cross-Section and Period Random	716.925	2	0.000

According to the results of the Hausman test, the H_1 hypothesis was accepted, and the FEM model was decided. Also, when this model was analyzed, different solution algorithms were tried, and the "Cross section SUR algorithm", that yielded the smallest total squared error value, was used.

TABLE VIII.   PANEL REGRESSION ESTIMATION RESULTS

Dependent Variable: D(LnEMP)				
Method: Panel EGLS				
Sampling: 2009 - 2020				
Cross Section: 6				
Variables	**Coeff.**	**Std. Error**	**t-Statistics**	**p**
D(LnR&D)	0.101	0.008	11.526	0.000*
D(LnPATE)	0.061	0.018	3.267	0.001*
Constant	0.604	0.080	7.523	0.000*
R^2 = 0.712 **F_{ist}** = 21.56 **F(p)** = 0.000 **DW** = 2.05 **Wooldridge (p) = 0.128 Greene Heteroskedasticity Test (p)** = 0.376				

Significant variable to 0.05,
"F" notation shows 1st level difference.

The findings of the regression analysis in Table VIII revealed that the independent variables had 71.2% explanatory power for the dependent variable of EMP. R&D variable had the largest effect on employment. 1 unit increase in R&D increased the EMP variable by 0.101 units. On the other side, 1 unit increase in the variable of PATE increased the EMP variable by 0.061 units. Both innovation indicators were found to positively affect the employment.

To test the assumptions of the model, the Wooldridge autocorrelation test and Greene heteroscedasticity test were applied, and the tests results revealed no autocorrelation and presence of homogeneity.

V.   CONCLUSION

The considerable improvements in innovation at the recent years have raised the question about the employment effect of innovation. In this context, the innovation can affect the employment through various channels and therefore the net employment effect of innovation various depends on which effect outweighs.

The aim of this study is to investigate the effect of innovation on employment for the period of 2010-2020 in sample of BRICS-T countries through regression analysis. The regression analysis revealed that innovation proxied by R&D expenditures and patent number positively affected the employment. However, the employment effect of innovation was found to relatively weak when compared with the relevant literature. and the weak effect can be resulted from that the product innovation is generally privileged in these countries.

National technological capability and infrastructure variables such as R&D, human capital level, number of researchers, physical capital investments in the developing countries are not sufficient to make a significant contribution to economic growth and employment. In addition, the protection of strict intellectual property rights in developing countries, where imitation is used extensively in the accumulation of technological talent, adversely affects the national innovation capacity. Future studies can focused on employment effect of innovation types at firm and industry level.

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Likeholism in Bosnia and Herzegovina

Slobodan Prodić[1], Vanja Prodić[2]

[1]Faculty of European Legal and Political Studies, Novi Sad, Serbia
[2]Community Health Centre of Novi Sad, Novi Sad, Serbia

[1]slobodan.prodic@gmail.com, [2]prodic.vanja@dzns.rs

Abstract— **Problem of social media and addiction of them became very important today. This problem has also got impact on Bosnia and Herzegovina. Unnecessary waste of time on collecting the information about what other people post on their profiles does not create only addiction, but also a lot of negative feelings that have got impact on person and his surrounding (family, friends, colleagues from job etc.). Targeting and recognition of a problem in some person presents a huge step into getting better and, concretely in this case, in limiting the usage of social networking sites. When we talk about Bosnia and Herzegovina, specific provincialists lifestyle that is dominant in BH's society and culturological and other differences create the problem of social media addiction more complicated compared with other societies, so the research of this phenomenon in Bosnia and Herzegovina becomes more interesting.**

Keywords- addiction, social networks, provincialism, Bosnia and Herzegovina

I. ENTRY NOTES

Development of social media had the effect on nowadays' civilisation on global level. The idea that 'someone' can easily be 'followed' thanks to platforms such as Facebook, Instagram and LinkedIn is spread all around us. There are a lot of researches about this phenomenon and many of them are focused on founding and popularisation of social media, while there are also a lot of them which are focused on problems that are connected with social media and about social media addiction.

In this work, I am going to focus on one, from geographic perspective, micro universe, what is to say, on geographical and demographic small area of Bosnia and Herzegovina (later in text: BH). The reason why it is important to analyse the social media's effect on everyday life in BH is that BH society is the society that was in the civil war three decades ago and that, after the end of the war, it has been 'winning the peace'. Convalescence of BH society after the war that lasted from 1992 to 1995 presents the specific appearances on today's geopolitical scene. In the contrast with the Federal Republic of Germany, or West Germany, that for only few decades after the catastrophic defeat in 1945, thanks to the given opportunities, was in such a good economic situation that it had to import cheap labour force from abroad to fill the needs of its growing economy, in BH we have got the opposite situation- this country is destroying itself slowly, but for sure through the politics of depopulation, or, said easier, through the politics of promoting the emigration of working age and reproductive age population, popular called 'arbeiters', usually in Germany.

In fact, this is only one out of many interesting phenomena in BH. Nothing less interesting phenomenon is social media addiction in BH's society. Even though young people in Bosnia use social media very little, compared with the rest of Europe, according to some researches, in the real life, the situation is totally different. People from BH in the last two decades have started to pay a lot of attention on social media, but not only because of curiosity. Primary because of war, and then, because of socio-economic issues, people started to emigrate from Bosnia into many different countries all over the world. The contact with the friends and family members that are spread all over the globe is the easiest and cheapest via cell phones and new technology. But, over usage of advantages of new technology easily transforms into the addiction, which is the main problem that I want to analyse.

II. SOCIAL MEDIA AS THE AREAS FOR SELF-MARKETING

Modern man, because of his estrangement, is usually oriented at different kinds of illusions about freedom. One of those illusions are social media. In cyber world, estrangement is getting a new dimension where being at distance and having a focus on creating your own digital world that will be adapted according to your ideas become dominant [1]. The person that accepts social media as a media usually use this media to present him or herself as a person who lives in the ideal world, according to him or her opinion, instead to present him or herself in the reality. There are not so many people in BH who do not follow these principles. In fact, they use social media as a possibility to create the illusion about their life at the other people, in spite of fact that their real life is total contrast compared with their virtual life. In the aim to understand this phenomenon, we need to define term 'life value'.

'Life value' in BH does not have any connection with truly values of European civilisations, no matter on fact that Bosnia and Herzegovina geographically belongs to Europe. 'Life values' for the majority of people in BH society are standardised by provincialists-consumerist philosophy of life where the basis of that philosophy is narcissistic modern individualism which can be described with a term 'I have, I own, which means I exist'. In this kind of system that is based on possessing currently important material things and doing popular activities, necessity for showing movable and immovable properties, exposing part of body that are made 'perfect' thanks to plastic surgery, fitness and other similar activities and living a one, idealised, lifestyle style should create a feel of satisfaction at the person. In BH society, not only after the civil war, but from 1960s, the phenomenon of exposing and self-promotion as 'successful person who owns something important' has been connected with going on temporary work in some western country. Return of someone from abroad, no matter is it only for vacation or for permanent, had strictly 'rules' about behaviour. BH's 'gastarbeiters' were extremely loud, extrovert and sometimes even intrusive in the order to show everyone else their 'success' and 'themselves'. One of the ways to show their 'success' was through wearing the branded clothes, driving the expensive cars and building unnecessary huge houses etc. Interesting fact is that we can still see this model of behaviour, but

it is transferred on social media too. Photos of properties, exotic destination and after plastic surgery or long training in fitness are posted in the aim to show their life fulfilment and success to their friends and family members. On that way, social media are used maximally. On the other hand, politicians also use maximally social media in the aim to improve their rating [2]. However, politicians have to have some level of self-control in their social media usage. They still control themselves in posting the photos of their houses, cars and other similar properties, but it has become common not to have even that dose of self-control. Fact that already mentioned 'success' is very important factor in positioning in social groups in BH, made exposing material property on social media normal everyday thing. And not only that, but social media have started to create a sense of jealousy at other persons, which complicates this problem more.

III. THE ROLE OF SOCIAL MEDIA IN CREATING A SENSE OF JEALOUSY

Aristotélēs had described jealousy as pain when you see someone's happy, as a pain that is encouraged from people who own something that we do not own [3]. Despite frequent and excessive insisting to show their religious belongness to other people, BH society does not realise that it based on making a feel of jealousy at other people. Provincialists surrounding finds making other people jealousy normally. In fact, provincialists surrounding has got jealousy in its value system and it will do everything just to make a visible jealousy at other people in as much occasions as it is possible. Possibility to present yourself as a 'happy' person, for example, in front of friend who has not got enough money to spend whole average monthly salary in BH on some clothes, will create you a feel of vanity and a sense of jealousy at the friend.

In this kind of system, we can only at the first look consider this as some funny game. In fact, this problem is much more complex than it looks like. Already mentioned feel of jealousy will not be kept inside of person who feel it, e.g. in our friend. The feel of pain that Aristotélēs mentioned will be transferred into family and closest friends of our friend. This internal pain presents the 'trigger' for the sense of unhappiness. Those unhappiness in our friend results in finding a way how our friend will become at least as 'good' as we or to become 'better' than you. This 'storm' of negative

feelings is going to create a lot of problems among family and friends of our friend. Many people, but mostly husbands, will 'solve' this problem by taking bank credits and by entering in 'debt slavery' and things will go towards totally different direction, in direction where whole BH society goes. It is only enough to look around ourselves and look who does communication among husbands and wives and among family members look like in the aim to understand that it has got a lot of problems which are not unimportant. One of the biggest problems of modern-day communication in BH is double-facedness. So, we have got a classic way of communication that is based on accidentally or intended meeting of two or more people. It is usually followed with smile, respecting and other normal ways of behaving at the conversation with other people.

On the other hand, communication via social networks is slightly different. If someone posts a photo on social media as kind of self-promotion (e.g. in front of valuable car or from expensive trip), he will do two important things for him or her- firstly, he or she presents him or herself as he or she wants to be seen from other people and proofs his or her material property and secondly, he or she expects the support and approval in the form of likes. Those approvals effects on ego and narcissism of him or her, no matter on finding a reason why would someone approve a photo of the expensive car or fine dining. What some other people actually think about those photos and those behaviour is not so important. If we study those pictures more, we can probably think that people who post those images actually want to make other jealous. But why? It is a new, different question.

IV. NARCISSISM AND VOYEURISM

In almost all researches about a problem of social media addiction, narcissism is often seen as one of triggers for today's relation of modern-day man and social media [4-7]. Narcissism, that is to say, narcissistic personality disorder, as it is defined in psychiatry, is easily visible at people who believe in their grandiosity and who expect the approvals of these statements from the others. Illusion about personal uniqueness, belongings to some higher social group, expectations about getting constantly compliments and having a empathy about other people wishes, necessities and emotions and even hurting other people in the aim to show personal superiority over other people can be easily noticed through activities of

narcissistic person on social media. In BH, before founding of the internet and social media, one of the most important things in life of narcissistic person was a mirror. Today, 'špiglo' (Spiegel, mirror, from German language) is substituted with cell phones and profile on social media. In fact, in the contrast with the mirror which reflects our image same as it is in reality, social media pages are made to present the imaginary picture of the users. Many of these 'profiles' are becoming more narcissistic and owner-oriented. It is not necessary to mention that content of 'profiles' are very concrete- they are based on necessities of narcissistic individuals. In the meantime, parallel with narcissistic exposing, a lot of 'profiles' are full of content that glorify some political organisation or idea because, as we know, BH society literally depends on few individuals.

'Profiles' are also created for watching. Watching profiles is done every day, sometimes so much that we can consider it as addiction [8]. Human's wish, or better said weakness, to look in someone's privacy is excellent used by the founders of social media. Sometimes an impression that this kind of voyeurism, called virtual voyeurism [9] became very interesting for BH citizens can be made. Some of reasons for this phenomenon can be seen in habits of BH ancestors. The wish to look inside someone's life used to be based on secretly watching other people and gossips that had been sent from house to house, but now it became more simplified. Now, only few clicks are required to find out where some friend went and with whom, what he/she wore, what he/she is doing etc. The fact that people who look the pictures that are posted and fulfil their needs and that people who post the pictures truly enjoy in using social media had been seen by founders of Instagram. The wish to improve someone's opinion about him or herself, especially about physical appearance and constant struggle with time and getting older become the main reason for founding the filters, important segment of Instagram which helps users to make 'fake mirror', which is considered to be 'the greatest invention of internet voyeurism' [10], so Instagram became the application 'that was founded to wish to have a life of your friend or family member' [11].

Even though classic form of voyeurism, until last few years, was considered as a lust for looking naked bodies or coitus, and used to be dominant among individuals, today, people are faced with a totally different phenomenon- with

a pornography made because of revenge as a shape of cyber misogyny. Also, people today are faced with other types of cyber-bullying. Creating fake accounts on social media and posting the explicit content that was often made by the victims, but mean people somehow received it make an uncomfortable feel at the victim and its family. But, consumer of social media in BH is ignoring all of this and continuing to self-promote on social media and to try to find out details from intimacy of other people. In BH, young women and teenagers are very affected on this problem. Emancipation of women is extremely important thing on which BH society constantly needs to work on, but sometimes there are a lot of unnecessary steps that are done, for example, insisting on exposing women's body. But, when women who are politicians, doctors or do some other important jobs do similar things and when those pictures become available online, then they, and actually whole society, enter in deep crisis.

V.   Collective Narcissism

Collective narcissism today is very visible on social media and BH people accepted it very welcoming. This phenomenon was helped by the last civil war (1992-1995) and grouping people into 3 nations inside their entities. Manipulation of common values, wish for solidarity, belongness and importance in group and feel of satisfaction in surrounding of obvious unhappiness of real life and intolerance to other people expanded aggressive behaviour explained with a resistance of whole nation. Collective narcissism in BH proofed thesis of researches such as Agnieszka Golec de Zavala and Jerrold Post that collective narcissism can effect on creating animosity inside a country or between countries because of wish for revenge after action that collective narcissistic recognize as offence [12]. And when we talk about collective narcissism in real life in BH, then we have many narcissistic individuals that follow charismatic leader [13].

Political parties not only in BH, but in all ex-Yugoslav republics present clearly evidence of Post's thesis. The result of action of narcissistic individual inside some social group can be easily seen, when we talk about social media, in something which is called 'party bot'. This person, who is commonly considered as a person with a low level of intelligence, is a party internet soldier whose duty is to show party loyalty and readiness to spend time on party's interests in the aim to get some reward (job in state-owned company, money, promotion in party hierarchy etc.). Activity of bots on web news portals is also visible on social media with a clear goal to improve public opinion of some party in pre-electional time. Management of some social media, such as Twitter tried to solve this problem by deleting profiles with pro-governmental content in some countries, including Serbia (in Serbia, it is mentioned that 8 558 accounts were closed in 2020). Of course, nothing was changed, so party bots just continued with their work on other social media, thanks to fact that today almost everyone has got a smartphone, so bots can include them in their advertising campaign for some political party or movement.

VI.   Conclusion

In relatively short time period of after-war recovery in BH that has been lasting since the end of civil war between 1992 and 1995, spread of the internet among wide social layers created the atmosphere of a total addiction on social media.

During the first two decades of the 21st century, and especially with the strong development and popularisation of cell phones, before all young, but also not so elderly people in BH society accepted possibilities of fast and easy communication with other people. Also, social media become accepted very easily and soon became world for itself. In the world of social media, individual, but also more and more organisations and movements, create a space for self-promotion. Idea to present yourself better than you are actually, which is usually based on possessing status symbols, and wish to create not only feel of personal satisfaction, but also a feel of jealousy at others, which is a consequence of provincialists lifestyle and whole surrounding in BH, stimulate usage of social media among all people, no matter of age, almost equally. There is a stereotype that social media are used only by young people, but if we focus on BH, we can actually see that there is no such a big difference between the number of young and number of elderly users of social media, especially after political parties have discovered them as a free space for advertising.

Users of social media filled them not only with a photos of themselves naked and similar content, but also with, usually political, attacking, harming and hurting other people and sometimes even with extremism and blackmails [14,15]. There is also a wish of social media's users to look into profiles of persons that they

know or do not know. This wish is just another, simpler, way for finding out information about someone else, which is one of the most exciting thing in the everyday routine of people in BH provincialistic surrounding. Finding out information, such as which clothes did someone wear on some event or what did someone order in restaurant, transforms into instant news that individuals spread in the aim to get positive comments, which we characterized as 'likeholism'. With those positive comments, individual's narcissism is being fed and individual is encouraged to continue with such behaviour. In the case when individual gets negative comment, he or she becomes hurt and his or her behaviour in this cases is almost same as a behaviour of toddlers. Social media are very interesting phenomenon and studying the behaviour of their users is extremely important. The importance of this firstly saw marketing experts, but today, more and more experts that work for political parties, so they can improve the rating and popularise that party and get more votes on different elections that are held very often in BH.

It is not required to analyse deeply condition of BH society to see that social media addiction is widely spread. This addiction is easily spread and even gets the shape of epidemic. Many people got so familiar with social media that they become a part of their everyday routine and do not see any problem with it. Proof of that is that people spend even several hours per day on social media, sometimes even on occasions that are not appropriate (e.g. in worships in churches or mosques or at some family gatherings). Necessity for treatment of this kind of behavioural addiction is required and it exist in many countries around the world. In BH, treatment of this illness is at starting stadium, like many other things in different aspects of life. People who want to do something for them and recover from this illness usually find doctor's help in neighborhood countries (Serbia and Croatia) or in some other countries, due to fact that many people from BH work and live in different countries of Europe and the world. Healthcare system in BH is faced with another challenge- to adapt one or more institutions that can treat this kind of patients as soon as possible. Also, state has got obligation to decrease or totally stop negative influence of social media on people, especially on younger generations. Non-governmental organisations can make a huge help in this process. Problem of social media addiction is being rapidly spread and it has got a lot of bad consequences, such as huge number of people who died in traffic accidents because they were driving and liking or sharing someone's naked photo on social media.

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Financial Development, Corruption and Entrepreneurship in Emerging Countries

Maliha Rabiee Faradenbeh[1], Mohsen Mohammadi Khyareh[2], Hadi Aminy[3]

[1,2,3]Gonbad Kavous University, Gonbad Kavous, Iran

[1]mal.rabiei67@gmail.com, [2]m.mohamadi@gonbad.ac.ir, [3]hady.aminy@gmail.com

Keywords

Financial development, corruption, entrepreneurship

Summary

Entrepreneurial activities can not only lead to sustainable economic growth and a steady increase in living standards through innovation and increased competition, but can also reduce income inequality and even promote equality and social justice [1,2]. Therefore, understanding the factors affecting entrepreneurial activities is very important for policymakers who see the promotion of innovation as a means to promote national prosperity.

Adequate institutional environment is one of the main prerequisites for entrepreneurial activities. Entrepreneurs adapt their activities and strategies to the opportunities and constraints offered through a formal and informal institutional framework. When the institutional environment supports entrepreneurship, there are more productive entrepreneurs who generate wealth through innovation. In contrast, an unfavorable institutional environment distorts incentives, increases transaction costs in economic exchanges, and strengthens barriers to the development of new entrepreneurial firms [3].

There are two different arguments about the relationship between corruption and entrepreneurship. From the perspective of the grease the wheels of growth hypothesis, corruption can promote entrepreneurship; in this way, corporate bribery reduces the bureaucratic effects and helps these firms to obtain bank loans. With this interpretation, corruption can reduce the inefficiency of public administration because it can reduce the waiting time for bureaucracy and inefficient and strict regulations imposed by the government; thereby stimulating economic growth in countries with weak institutions [4,5,6].

Corruption can be costly for economic activities. In highly corrupt societies, unproductive activities become more attractive than productive activities, causing them to increase more rapidly than production. Thus, corruption leads to the redistribution of resources to applicants for unproductive activities and has no benefit for other members of society. Thus, corruption can act as a deterrent to investment and savings by distorting resource allocation. Such incentives can undermine the financial system's decision-making process by creating problems such as poor choice, to the extent that corruption encourages banks to lend to unproductive activities, which in turn increase the volume of unproductive loans [7] and thus reduce the positive impact of financial development on economic growth.

According to the above, it is necessary to know and understand how corruption and financial development affect entrepreneurship and the relationship between these factors in order to develop entrepreneurship and remove barriers for entrepreneurs. On the other hand,

most of the studies on the subject have been in the field of financing and entrepreneurship or corruption and entrepreneurship, and according to the authors, no studies have currently specifically examined the joint effects of financial development and corruption on entrepreneurial activities. Therefore, it is necessary to conduct more extensive research on the impact of financial development and corruption on the formation of entrepreneurial activities. In this regard, this article is an attempt to create a theoretical model to describe how financial development and corruption affect entrepreneurial activities.

In this study, the impact of financial development and corruption on the formation of entrepreneurial activities in emerging countries during the years 2008 to 2020 as well as the impact of variables such as institutional quality, education, population growth rate, economic growth rate, unemployment and financial development were evaluated. The data will be extracted from the Global Entrepreneurship Watch (GEM) and Global Development Indicators (WDI) databases.

Given the role of entrepreneurship in job creation and economic growth, the existence of financial development in emerging countries promotes entrepreneurship; In addition, corruption has not been ineffective in creating entrepreneurship and can be said to have been effective in that corruption in financial institutions causes financial development to affect entrepreneurship and causes a series of loans to be provided to entrepreneurs as if An entrepreneur who pays a bribe to the authorities can do his job and succeed in getting a loan to start and run his business, and as a result, paying a bribe will help facilitate the entrepreneurial process and create entrepreneurship.

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Law and Entrepreneurship in India: Perspectives and Paradigms from the Indian Companies Act, 2013

Mohammad Nasir[1], Ahmed Musa Khan[2], Samreen Ahmed[3]

[1,3]Department of Law, Aligarh Muslim University, Aligarh, India
[2]Department of Commerce, Aligarh Muslim University, Aligarh, India

[1]nasir@amicusjuris.in, [2]musa.mfc@gmail.com, [3]samreena0@gmail.com

Keywords

Entrepreneurial intentions, companies act 2013, one person company, the companies (amendment) act (2020), dormant companies, minimum paid-up capital, the individual-opportunity nexus.

Summary

This paper endeavors to study the relationship between legal regulatory framework and entrepreneurship. Entrepreneurial intention is one of the most appropriate tools to gauge entrepreneurial behavior. Behaviour is the primary as well as the most significant aspect of the entrepreneurial process. The data used in this study had been taken from Global Entrepreneurship Monitor (GEM). The present data consists of the interviews of 19873 respondents between 2012 and 2017 from India. The GEM research program, initiated in 1998, assembles data from various parts of the world on an annual basis. The Companies Act 2013 couldn't develop venture creation among Indians up to the level which had been expected from it. But it proves the concept given by Scott Shane that entrepreneurship relies equally on environmental as well as individual factors.

Opportunity existence and opportunity recognition both equally explain the variance in entrepreneurial activities. The Companies Act 2013 emphasized completely providing opportunities which means it covers only one aspect of the two. To the best of our knowledge, it is among the initial studies, which have examined the impact of legal regulatory framework on entrepreneurial intentions. Among other existing studies, only a few have already been done in developing countries like India by using a large data set.

Understanding the Concept of *Work*: Exactly What It is and What It is Not

Sergey Ivanov[1]

[1] Department of Management, School of Business and Public Administration,
University of the District of Columbia, Washington, DC, U.S.A.

[1]sivanov@udc.edu

Keywords

Work, Concept of Work, Principles of Work in Organizations, Organizations, Work in Societies

Summary

Little is known what constitutes work in organizations and societies. Jaques (1998) investigated the concept and principles of work for over fifty-years, ultimately defining work as "the exercise of judgement and discretion in making decisions in carrying out goal directed activities." He then proceeded to describe and explain complexity of work in world's largest organizations.

However, I believe Jaques' definition of work is still ambiguous, and can be improved. Such questions as how to measure the work of an organization or society are still next to impossible to answer. This paper will attempt, preliminary, to define and explain the concept of work and provide various examples of what work is and what work is not. It will also describe the difference between real work and pseudo/fake-work. It will then, preliminary, analyze the work of the organization and society to see which organizations are focusing on real work vs. the ones that invest in pretend work.

The contribution of this paper is tri-fold. First, it hopes to improve and advance the theoretical knowledge of the concept of work in organizations. It would additionally offer various examples of work that people do. And third, it strives to help organizational leaders rethink their wok practices to eliminate waste from their organizational systems, or at least think through organizational and possible societal activities through a different analytical base.

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The Effect of Social Media Elements i.e. Electronic Word of Mouth (eWOM), Customization and Interaction on Consumer Brand Engagement with a Moderating Role of Consumer Buying Experience

Syed Shahwar Hussain[1], Tehniyat Bano[2]

[1,2]Shaheed Zulfikar Ali Bhutto institute of Science and Technology, Islamabad, Pakistan

[1]syed.shahwar@szabist-isb.edu.pk, [2]btehniyat@yahoo.com

Keywords

Electronic Word of Mouth (EWOM), Customization, Interaction

Summary

The foundation of the study was based on, the theory of planned behavior which was carved out from the theory of reasoned actions. The transmission of online information regarding experiences and opinions is called electronic word-of-mouth (EWOM) [2,5]. Electronic word of mouth (EWOM) is one of the foremost potent of knowledge on the web. It can be labeled as a positive or negative perception in the mind of the consumer which is shared with others through social media [1,5]. Customization is an important social media marketing element that describes as the extent to which the marketing efforts and services are tailored according to the personal preferences of the consumers [3]. Interaction is described as the degree to which the social platform of the brands allow for a dual channel of communication for the purpose of knowledge sharing [2]. The main objective to conduct this study was to examine the significant impact of social media elements (interaction, customization and electronic word of mouth) on consumer brand engagement with moderating role of consumer buying experience. Consumer brand engagement can be entailed as a psychological state of mind that involves the passion of a consumer for a particular brand that usually results due to a strong consumer brand relationship [4].

For this purpose a quantitative research was conducted and for data collection a questionnaire technique was adopted to collect data from 150 consumers that shops on various online brands on the basis of convenience sampling. The data was analyzed which includes correlation, regression, and moderation analysis. The results showed some amazing results EWOM, customization and Interaction positively influenced consumer brand engagement. It was revealed after the analysis that consumer experience does not moderate with EWOM, Customization and Interaction. Based on the significant results key conclusions were drawn for managers. Managers should pay special attention towards social media platforms to enhance consumer experience in future. They should consider the vast and considerable use of social media elements in their marketing efforts while launching new products, promoting existing services and products. This would help them gain maximum reach and awareness towards the intended target audience.

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Interactions of Entrepreneurship, Economic Growth and Employment in Developing Countries

Ali Badrak Nejad[1], Mohsen Mohammadi Khyareh[2], Baqer Adabi Firoozjaei[3]

[1,2,3]Gonbad Kavous University, Gonbad Kavous, Iran

[1]alibadraghnezhad@gmail.com, [2]m.mohamadi@gonbad.ac.ir, [3]bagheradabi@gmail.com

Keywords

entrepreneurship, economic growth, employment

Summary

Entrepreneurship in economics was first emphasized by Schumpeter in his 1911 book, The Theory of Economic Development. He noted that economic processes are interdependent and that mechanisms of change emerge from within the economic system. Entrepreneurship is one of the main mechanisms of economic change [1-3].

When entrepreneurship is considered as the engine of economic growth, an environment is created in which opportunities for entrepreneurial activities are formed and the successful entrepreneur is rewarded. Human and physical capital, despite being inputs to the production process, cannot lead to economic growth. In fact, the institutional environment that is conducive to entrepreneurship can attract physical and human capital. This shows the reason for the correlation between investment and economic growth. When it comes to entrepreneurship, it is clear that market institutions should be emphasized instead of production-inputs. Although the importance of market institutions is recognized in practice, the general trend of economic growth theory is not integrated [4-6].

Entrepreneurship and employment rates are expected to interact and employment changes are expected to affect entrepreneurship. Unemployment rate can affect the level of necessity entrepreneurship. In this way, entrepreneurship will increase due to the lack of employment opportunities [7]. He emphasized that while the effects of short-term employment on starting a new business may be small and insignificant, its effects are far more important for long-term growth.

Compared to previous studies that have often used the relationship between variables as two variables, this study has considered all three variables together and as a two-way causality. It will also use panel data studied in developing countries, which has not been considered in previous studies and is considered a gap in the literature.
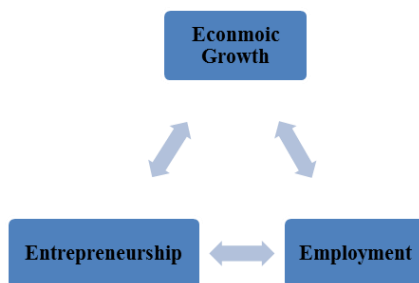

Figure 1. Research conceptual model

The purpose of this study is to analyze the dynamic effects between entrepreneurship, economic growth and unemployment through a vector auto regression model (VAR) panel for selected developing countries in the period 2009-2019. Secondary data related to entrepreneurship were extracted from the Global Entrepreneurship Monitor (GEM) and data related to economic growth and employment were extracted from the data of the World Bank.

The results show that there is a positive relationship between the three variables of entrepreneurship, economic growth and employment and this relationship is reciprocal and dynamic. Employment responds positively to GDP growth over 10 periods. Also, impulse response functions show that the economic growth of countries responds positively and significantly to entrepreneurial activities. Entrepreneurial activity also responds to economic growth in a positive and significant way. Also, our results indicate that entrepreneurial activities are affected by the capacity and business environment of a country (which is reflected in the per capita growth of GDP and employment rates of countries).

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Dual Effect of Social Capital on Indian Women Entrepreneurs

Mohd Yasir Arafat[1], Ahmed Musa Khan[2]

[1]Centre of Distance Education, Aligarh Muslim University, Uttar Pradesh, Aligarh, India
[2]Department of Commerce, Aligarh Muslim University, Uttar Pradesh, Aligarh, India

[1]yassarafat@gmail.com, [2]musa.mfc@gmail.com

Keywords

Social capital, developing nations, global entrepreneurship monitor, women entrepreneurs, India.

Summary

Social capital has extensively been studied in entrepreneurship literature in mature economic context, but we know little about its dual aspect (negative and positive). This paper explores the negative and positive influence of social capital in the context of developing nations where religious and cultural norms may create hindrances. Data set of more than 1600 Indian women entrepreneurs extracted from the Global Entrepreneurship Monitor had been analysed by the help of logistic regression.

Findings show that social capital has both the positive and negative influence on the women entrepreneurs of India. This study contributes to the literature by confirming the dual nature of social capital.

Determination of Type and Amount of Organic Agricultural Waste using Image Processing

Emina Petrović[1], Ana Momčilović[2], Gordana Stefanović[3]

[1,3]Faculty of Mechanical Engineering Niš, Aleksandra Medvedeva 14, Niš, Serbia
[2]The Academy of Applied Technical Studies Belgrade, Serbia, Katarine Ambrozić 3, Belgrade, Serbia

[1]emina.petrovic@masfak.ni.ac.rs, [2]ana.momcilovic@masfak.ni.ac.rs, [3]gordana.stefanovic@masfak.ni.ac.rs

Keywords

Image processing, organic waste, circular economy, modeling

Summary

Inadequate organic waste management known as linear economy leads to the generation of new amounts of waste and immobilization of nutrients and chemical energy which, by being excluded from the natural processes of matter circulation, become inaccessible for reuse. The application of the concept of "circular economy"(CE) in an integrated organic waste management system on one territory enables the return of nutrients to nature and energy utilization with minimal generation of new quantities of organic waste. [1] Within this research, detection and classification methodology of potential sources of organic waste will be developed, based on satellite images obtained by Google Maps and the Republic Geodetic Bureau, which are publicly available. Image processing algorithms, machine learning methods, as well as deep learning will be used in developing systems for organic waste resource classification.

The first step in successful classification is to divide the image into various parts called segments. Grouping together the pixels that have similar attributes is called image segmentation. By dividing the image into segments, processing the entire image at the same time is avoided as there will be regions in the image which do not contain any information. Segments are related to certain shapes, textures, spectral, and spatial characteristics that can be further grouped into objects. These objects can then be grouped into classes that are represented by measurable properties or characteristics – features. [2,3].

The intention of the proposed research will be computation of the amount and type of organic waste resource by joining the classification results and data obtained from the Republic Geodetic Bureau and the data from the map. Based on this, it will be possible to estimate quantities of organic waste that can be further introduced into CE flows.

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Role of Income and Asset Diversification on Bank Performance and Risk-Taking-Behavior: An Empirical Case Study of SAARC Banks

Shumaila Zeb[1], Sidra Sheikh[2]

[1]Shaeed Zulfikar Ali Institute of Science and Technology, Islamabad, Pakistan
[2]Allied Bank of Pakistan, Islamabad, Pakistan

[1]shumaila.zeb@gmail.com, [2]sidraisbpk@gmail.com

Keywords

asset diversification, income diversification, bank performance, banks

Summary

Banking sector holds a pivotal role in stabilizing any economy. Different financial regulations and strategies are devised by the central bank to sustain the stability and performance of financial institutions including banking sector. Thus, a healthy banking sector is important for a stable economy.

Following the Global Financial Crisis (GFC) (2008), performance of the banking sectors all around the world declined. So central banks around the globe devised different strategies and regulations to overcome the issue of the reduced performance of the banking sectors. Therefore, introduction of various diversification strategies during the post crisis period was the basic remedy to increase the banking sector's performance [1]. These diversification strategies not only helped the banking sector to increase their performance but also helped to mitigate their risk., Hence, making the banking sector more profitable, stable, and efficient [2]. Moreover, the diversified and efficient financial system was more influenced by financial reform policies to save the banking sector from financial shocks [3,4].

The purpose of this study is to empirically examine impact of income diversification on the bank performance and impact of income diversification on risk-taking-behavior of 113 banks of the South Asian Association for Regional Cooperation (SAARC). Two step dynamic panel generalized method of moments (GMM) is applied to the panel data for 2006 to 2017. The control variables used in the study are capital ratio, Size, and asset growth. The findings reveal that asset diversification help to increase the performance and while income diversification helps the banks to decrease the risk faced by them. The findings are helpful to the regulatory authorities and policymakers to further improve the performance and risk faced by the banks keeping in mind income and asset diversification.

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Competition and Collaboration in the Workplace: Deming Revisited

Sergey Ivanov[1], Paula Avellan[2]

[1,2]Department of Management, School of Business and Public Administration, University of the District of Columbia, Washington, DC 20008, U.S.A.

[1]sivanov@udc.edu, [2]paula.avellan@udc.edu

Keywords

Competition, collaboration, organizations, W. Edwards Deming, leadership

Summary

This paper discusses cooperation and competition in the workplace. The paper argues that it is not possible for employees to cooperate and compete at the same time, revisiting the old Deming [1,2] ideas that competition is destructive in the workplace.

The paper proceeds to analyze employee behavior in the enterprise, discusses teamwork, and provides recommendations to management to improve the organization for better performance.

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Economic Complexity and Entrepreneurship in Developing Countries

Fatemeh Qelich Lee[1], Mohsen Mohammadi Khyareh[2], Masoud Khayandish[3]

[1,2,3]Gonbad Kavous University, Gonbad Kavous, Iran

[1]ghlichlifateme@gmail.com, [2]m.mohamadi@gonbad.ac.ir, [3]ecomkh@gmail.com

Keywords

Economic complexity, entrepreneurship, ubiquity, diversity

Summary

Economic complexity is an issue that has received a great deal of attention over time. In recent decades, this has been the focus of researchers, academics, and policymakers with the introduction of the ECI sophistication approach, which quantifies the amount of knowledge gained in a country's productive structure [1,2].

In the existing literature, some effective and important factors of economic complexity such as institutions, Internet access and foreign direct investment have been studied [3,4]. In this regard, [5] have a positive effect of demographic intelligence on the quality of export products. The results of [6] show the positive effect of the number of patents and the combined effects of financial development. However, the potential determinants of economic complexity are still unknown. Thus, understanding the determinants of economic complexity will not only make a significant contribution to the literature, but will also have fundamental policy implications. It is also important to cite evidence of the effects of economic complexity on economic development.

Complexity and entrepreneurship are interrelated in different ways [7]. Scientifically, the connection between these issues began in 1989 with Bygrave's article [8], in which he theorized entrepreneurship using chaos theory. While many researchers have been studying the relationship between entrepreneurship and economic growth [9], some have proposed a new approach to predicting countries' economic growth, called economic complexity. At the economic level, some economies are more entrepreneurial [10] because they provide more opportunities to start and run a new business. Complex economies with broad exchanges and interactions are expected to create more opportunities, while countries with few interactions are less complex and less entrepreneurial. Given the above, the main question of this research is how economic complexity affects entrepreneurship.

In summary, the main idea we want to explore in this article is to focus on interaction networks as a network of knowledge in which many entrepreneurial opportunities have been acquired. In addition, we argue that complex economies, through knowledge and interconnected networks, offer more opportunities than simpler countries. Thus, we examine the impact of economic complexity on entrepreneurship using 25 selected developing countries from 2008 to 2016. The secondary data are extracted from the Atlas of Economic Complexity in which the Economic Complexity Index (ECI) is calculated for each country. Moreover, we use the Total early-stage to assess

the level of entrepreneurial economy. Using dynamic panel data, our results show a significant Granger causality from economic complexity to entrepreneurship density. That is, an increase in economic complexity facilitates entrepreneurial activities in developing countries.

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Analysis of the Remote Working due to Covid-19 in Serbian Public Services, a Case Study of Telecom Serbia

Borislav Kolarić[1]

[1]Faculty of management, University Union – Nikola Tesla, Belgrade, Serbia

[1]kayak@mts.rs

Keywords

COVID-19, public services, organizational design, organizational performance

Summary

Name COVID-19 has been creating challenges for business activities worldwide. As a result, all the business strategists must develop practical problem-solving mechanisms as they must make their employees cope with the rapid changes and challenges occurring in the work and social environment. In this article, we discuss some of these challenges, focusing on the implications COVID-19 has for human resource management (HRM) as organizations help their workforce cope with and adjust to their newly altered work environment.

One of the most salient HRM challenges stemming from the COVID-19 pandemic involves adjusting employees to drastically altered work conditions, such as shifting to remote work environments or implementing new workplace policies and procedures to limit human contact.

Creating a business environment that implies the increasing application of remote work, the question arises and the debate as to whether employees in organizations are able to take on a new business role and continue to provide quality work that will maintain the efficiency of the entire organization.

In that context, focus of the research was on analyzing of the remote working due to COVID-19 in an elected representative of public enterprises - Telecom Serbia.

The purpose of the research on the title topic was to examine the level of preparedness of employees in relation to different business activities, which involved working from home. Given that this is a new role of the employee, which involves distancing from other colleagues and individual work, the research was based on determining the quality level of several personal characteristics, which are important factors for successful business under the new rules of the game: work experience, independence, self-discipline, and ethical responsibility.

The research was realized through a questionnaire. The sample consisted of 100 employees who did their job from home in 2019/20, as well as their first managers. In addition to the subjective attitudes of employees, it was necessary to consider the opinion of their managers regarding personal characteristics that are necessary for the new way of doing business.

The results of the research showed that employees believe in their abilities and knowledge, that they have sufficient independence, self-discipline, and ethical responsibilities. These attitudes of employees were confirmed through the analysis of responses by managers. They believe that employees mostly have the quality of all 4 personal characteristics at a satisfactory level, so that they successfully accept their new role and realize business obligations no less efficiently than doing business in the office.

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Drivers of Self Employment Intentions among Indian Females

Mohd Yasir Arafat[1], Ahmed Musa Khan[2]

[1]Centre of Distance Education Aligarh Muslim University, Uttar Pradesh, India
[2]Department of Commerce, Aligarh Muslim University, Uttar Pradesh, India

[1]yassarafatt@gmail.com, [2]musa.mfc@gmail.com

Keywords

Indian Women, Self-Employment, Human Capital, Intellectual Capital, Cognitive Framework, Global Entrepreneurship Monitor, Opportunity Recognition, Entrepreneurial Intentions, Risk Perception, Social Legitimacy

Summary

Since, both women and self-employment are important for growth of economy, hence, it is particularly important to understand what leads women to become self-employed. Understanding of this would help proper utilize women's human capital and as a result better living standard and implementation of economic and effective policies. This study explores the significance of intellectual capital and cognitive framework in explaining the self–employment phenomenon among the Indian women.

The data used for the analysis has been extracted from the Global Entrepreneurship Monitor (GEM) database. In this study the researchers have found that the opportunity perception increases the entrepreneurial intentions while the risk perception reduces the entrepreneurial intentions. The social legitimacy also has a positively significant relationship with the entrepreneurial intentions.

Sustainable Development Using Big Data in Converting Cities to Smart Cities

Anilambica Kata[1]

[1] Adikavi nannaya University, MSN Campus , Kakinda , India

[1]hranilambica@gmail.com

Keywords

Smarty city, Big Data , IoT, AI, Sensors, ICT, sustainable development

Summary

The nations around the globe are adopting to newer, safer and advanced technologies for the rapid and sustainable development of the people and the nation. In this context many nations are showing their ease in converting conventional methods to modern methods which imbibes safe, inclusive and sustainable development using appropriate technologies.

Therefore, meeting these sustainable development goals means, meeting the needs of the present without compromising the ability of future generations to meet their own needs. To serve this purpose many governments around the globe are re-engineering their present strategies by rethinking and redesigning processes to step ahead forward towards sustainable development by adopting appropriate technologies.

The Appropriate technology means making use of skills and technologies that are available in the respective local communities to streamline basic human needs, such as gas and electricity, water, food, waste disposal, transportation, education, health, safety and security needs made accessible to every citizen. While the idea of converting cities to smart cities is a part of the sustainable development goals using appropriate technologies like big data, by not disturbing the harmony of the earth's eco-system.

The applications of big data and analytics has unknowingly occupied a commendable place in everyone's life say from detecting traffic areas through mobile GPS, google search engine by tracking taste and preferences of the customers and presenting the relevant ads, tracking nearest shopping centers, health services, education, food etc. what not it is being used everywhere and at every instance of satisfying individual needs. The paper reviews the tools, applications, opportunities, benefits and challenges in adopting big data in converting cities to smart cities In addition, it explores the applications and tools of Big data that supports in building smart cities with the help of some real-life examples of cities who have greatly benefited from it.