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Processes, Examples and Experiences in Applying Kaizen Management Concept in Serbia

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Abstract—**Kaizen is a Japanese business philosophy that aims at permanent and continuous advancement in all business functions. Implementing Kaizen to advance standardized business activities and processes aims to eliminate waste in all aspects of the business process. The paper presents and describes the existing, real examples of Kaizen Environmental Management in Japan (Toyota) and in Serbia (JTI – Japan Tobacco International and Strauss Adriatic).**

Keywords – Kaizen, business, environmental management, waste

I. INTRODUCTION

Kaizen is a business philosophy where human resources are the most important capital of a company and it is based on continuous improvements in management, quality, technology, processes, company culture, productivity, safety and environmental protection. Kaizen originated in Japan after the Second World War, when it was necessary to revive the destroyed economy as soon as possible. War-ravaged Japanese companies had to start from scratch. The point of Kaizen is to create something out of nothing and to make the most of everything that is already there. In this situation, with new challenges every day and where the survival of the company was conditioned by his constant advancement, Kaizen became a way of life. Most Kaizen principles are universally applicable, and companies that live by the Kaizen philosophy and that are succeeding, should serve as an inspiration and example of how it should work. Of course, the rules of other companies and the techniques they apply should not be blindly adhered to, but rather adapted to own circumstances [1].

II. BASIC TERMS AND PRINCIPLES OF KAIZEN

Kaizen is a coin of two Japanese words: kai, meaning change or modification and zen, meaning good. When brought together, their meaning can be translated as constant, harmonious and continuous improvement, which is the essence of Kaizen philosophy. The goal is to achieve great success and quality with simple and small but continuous improvements. The nature of man, who is basically never satisfied with what he has achieved, is the basic driving force behind the development of society [3].

The term Kaizen is used in three ways. The first way involves Kaizen referring to the life philosophy according to which every aspect of life needs to be constantly improved. Kaizen also implies the management approach of a company, in which it seeks to continually improve all processes and thus achieve better results. The third way of defining Kaizen involves a set of

Figure 1. Japanese label for Kaizen [2].

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tools and techniques that make improvements. Kaizen focuses on small steps, which lead to big improvements. It is considered that no idea is too small, and that every, even the smallest move for the better contributes to the company. Kaizen solutions generally do not require large financial investments, they are not risky, and therefore it is expected to be more and more present [2].

Some basic Kaizen principles [1] are:

- Keeping things as they are, negatively affects the company. Everything is changing, and for a successful business it is necessary to adapt to these changes.
- Improvement should take place on a daily basis. Opportunities for improvements are limitless and should never stop.
- If something does not work, it must be repaired. The worst part is to ignore the mistake because the damage is only magnified.
- Everyone should be allowed to participate in the company's improvements. Each employee represents one part of the puzzle and only by working together the right results can be achieved.
- Kaizen boosts the company's economy. It forces solutions for which the implementation of the company does not have to spend a lot of money and which enable it to do better business.

III. Emergence of Kaizen

Although it originates from Japan's traditional value system and culture (from 17th to the mid-20th century), Kaizen is in fact a modern business philosophy. It originated and developed in Japan shortly after the end of World War II, in the late 1940s. The Japanese economy continued to recover from war operations and devastation and resources were scarce. The USA played a significant role in rebuilding Japan. As part of the overall assistance, Japanese experts and industrialists have had the opportunity to become familiar with modern American manufacturing concepts and efforts to improve work efficiency. Given that Japan's resources were minimal, the executives of leading Japanese companies realized that it was necessary to make the most of them and to organize the production process as better as possible in order to maximize savings and thus maximize profitability. Advancing production, they went a few steps further than American companies [4].

The philosophy, which originated in Japan, has been successfully applied worldwide. Most deserving for this is Masaaki Imai, the father of Kaizen philosophy, the founder and director of the Kaizen Institute Consulting Group. Masaki is also the author of the book: "Kaizen: The Key to Japanese Business Success", the first book in this field to popularize this term worldwide. The Institute was founded in 1986, with the aim of helping companies around the world learn about the concepts, systems and goals of Japanese business philosophy. Today, this institute has branches in over 30 countries worldwide and employs over 400 consultants who carry out projects in more than 50 countries around the world. In 2011, a merger with Gemba Research Company, was completed, further enhancing the company's professional capacity. It is a pioneer, innovator and leading consulting group providing services in the field of business process improvement and operational excellence. The Institute organizes on-site trainings, consultations, public events and seminars [5].

IV. Basic Terms and Implementation of Kaizen

Gemba (actual place) is where the process takes place. In production, it is a factory. In the case of the faculty, the gemba is an amphitheater. In Kaizen, going to the gemba is considered crucial to the success of a company. If managers rely solely on reports received from workers, this may result in wrong decision-making, as these reports may not be accurate [6].

Gembutsu (actual thing) means the equipment, material, product or any other physical object involved in the process. All these things should be properly maintained and taken care of. If there are any errors on them, they should be promptly removed [6].

Genjitsu (actual facts) means intangible (non-material) assets of a company. It refers to data, characteristics, facts, information, know-how, innovation, corporate culture, teamwork, image, etc. In today's context, these assets are of increasing value because this is a time when it is crucial to have the right information at the right time to successfully do the job. Therefore, companies are investing more and more profits in knowledge, training and ongoing learning [6].

Kaizen established 5 basic gemba principles. The first principle is - whenever something does not work or an abnormality occurs, one should

first go to the gemba. The second principle says that gembutsu needs to be checked - inventory, machines, tools. If one still cannot find the reason for what is wrong, one wonders why, not once, but five times. Often the first answer is not the root cause. The third principle is to take temporary countermeasures on site. The fourth principle is to eliminate the cause of the problem. The last, fifth principle is that once a cause has been identified, a standard should be made to prevent it from happening again.

Shojinka, Soikufu and Jidoka are Kaizen-related terms. Shojinka represents a flexible and universally trained workforce that is the main driver of all change. Soikufu means a system that supports creative thinking and innovative ideas that come from employees. Jidoka means autonomy and independence in terms of independent quality control and spotting of scarce products. This principle prevents a product of inadequate quality arriving from the previous process, to stop or slow down the subsequent operation [7].

When implementing Kaizen, one should keep in mind the environment in which the program is intended to be implemented. How well the company is suited to introduce changes, depends on corporate culture. Kaizen does not require large financial investments, but appropriate preparations must be made. Being ready to change one's mindset and eliminate prejudice, is the first step. This is done through education and training. Kaizen management's focus is on employees and they form the basis for the advancement and success of the company. It is very important that every member of a company is disciplined and that team spirit is in place.

For the introduction of Kaizen, the support of the top managers, followed by other employees, should first be provided. Business partners need to be persuaded as well, since they also need to be assured that stockless processes will not have a negative impact on their business. Just introducing and directing Kaizen should go from top to bottom, while suggestions should come from the bottom up, because the best suggestions for improvement usually come from the people closest to the problem.

The implementation of Kaizen implies following the next steps [8]:

1. Reject conventional old ideas.
2. Think about how to do something, not why it can't be done.
3. Do not make exceptions and look for excuses and justifications. Start by asking questions about current habits, practices and customs.
4. Do not seek or demand perfection.
5. If you make a mistake, do not hide it but try to correct it immediately, and if necessary, seek the help of colleagues.
6. Not to spend money on Kaizen, but to think.
7. Wisdom appears on the surface in difficult situations.
8. To look for the cause of all problems by asking the question "why" five times.
9. Seek the opinion of ten different whole people rather than just one.
10. Kaizen ideas are endless.

Kaizen is not a one-time phenomenon, implemented and delivered at once with superior results. It is a subtle, continuous process that involves small and continuous changes. When all employees - from the general manager to the janitor come to work thinking how to increase efficiency, what they can do to eliminate non-value-adding activities and how to improve their business with their creativity, the company is considered Kaizen "infected".

The Kaizen implementation methodology is described using the word PDCA (acronyms of the word: plan, do, check, act) [9]:

- Plan - Specific things need to be identifiedin order to be changed. Then a change plan should be created. After that, the steps that should be taken, must be defined and the results of those changes assumed.
- Do (do) - Execute the plan in a test environment. The change should be tested on a small sample or on a reduced scale and examined for the result of the proposed change. Small steps are taken in limited conditions. This step is primarily an attempt or a test of change.
- Check - Test the results of the test. If the change has positively affected and improved the business process, it applies to the business. If the change did not produce the desired results, you should try again with another change.
- Act - Apply change to the entire business. Introducing a change to standard operating procedures.

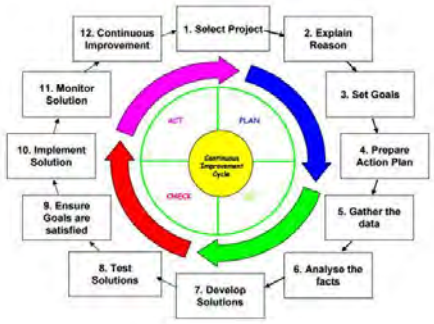

Figure 2. Deming Circle [11].

What is particularly important is clearly defining expectations in the first step. It is necessary to have a clearly defined goal, because in this way it is possible to determine whether it is progressing, tapping in place or falling back.

The PDCA is a continuous cycle that is constantly repeated and therefore improvements become part of daily life. These four steps are known as the "Continuous Improvement Circle" or the "Deming Circle", by Edwards Deming, who popularized it. Deming developed the PCDA cycle in the 1960s in Japan. This cycle contains the basic elements needed to understand quality management and the continuous improvement of all processes [10].

V. KAIZEN IN SERBIA

Japanese culture, their customs, religion, philosophy, the orderliness of the Japanese family, which are further reflected in the orderliness of the state, the social order and the orderliness of the education system, are fully in line with the Kaizen approach that is embedded in almost every human activity. Total quality management is more of a philosophy in Japan than a formal process [12]. The Japanese management system is heavily influenced by Japanese culture and its values and the basic concept is: to do better, to make better, to improve it even if it is not broken because if it is not done it is impossible to compete with those who do.

In Serbia, the proposals of lower level employees are not sufficiently stimulated by the management and in some cases are even undesirable due to the expressed vanity in business circles. There is a certain similarity to the situation in which Japan was after World War II and Serbia now. Japan has emerged from a difficult situation as a winner and today represents one of the most powerful economies in the world, that is, an example to be relied upon. International companies operating in accordance with Kaizen philosophy and beyond Japan are the best proof that its implementation can produce excellent results. The size of the company does not affect the ability to apply. Although large companies with stable demand are the pioneers in the development and implementation of Kaizen management, it is not only limited to them, but can also be successfully implemented in medium and small enterprises with limited human and material resources [1].

Although Kaizen was originally related to the automotive industry, its principles can now be implemented in all companies, regardless of the business they are engaged in. Kaizen is a process of constant and gradual change and is not conditioned by large financial investments and sophisticated technologies, which makes it quite suitable for application in the conditions in which the Serbian economy is located. This is one of its biggest strengths. All available resources are used and efforts are being made to maximize profitability and efficiency. In practice, each worker is expected to take responsibility for his work, his workplace and the end product. Employees need to make progress on a daily basis but their proposals and initiatives should be adequately rewarded, too. In this way, employees feel better about their jobs because they have an impact on improving them, which makes them interested in the work process [1].

In 2013, in cooperation with the Agency for Foreign Investment and Export Promotion (SIEPA) and the Japan Agency for International Cooperation (JICA), a program to improve production at Serbian companies was implemented in order to increase competitiveness in the foreign market through the transfer of knowledge and best practices from Japan. A consultant sent by the Government of Japan to contribute to the development of the Serbian economy with his experience and knowledge has helped management in 14 Serbian companies to get acquainted and implement the Kaizen system. The companies that have been involved in this program are from different industries: metal and electrical industries, transport and also companies dealing with products in the fields of visual communication and advertising. Thereafter, the efficiency of production increased, the number of workers on the production line decreased and the

system of documentation and control of workers improved. Within the project, the ways of working have changed but the awareness of the employees has also changed significantly [13].

Since it does not require large financial investments, the interest of Serbian companies in this type of enterprise management is increasing. The implementation of Kaizen in Serbian companies would bring faster progress and development of Serbian economy and society.

A. Japan Tobacco International inc. Senta

Promotion and introduction to Kaizen philosophy in Serbia is also due to JTI from Senta, which helps Serbian companies get acquainted with this philosophy by organizing visits where practical examples of implementation can be seen. The factory often organizes open-door days where JTI management gives employees from other companies the opportunity to personally see how Kaizen works. The aim is to attract small and medium-sized enterprises and to show them how, by applying this method, they can prosper and develop, increase profits and contribute to Serbia's economic development.

Kaizen's foundation at JTI is the 5S process that organizes workstations and improves efficiency at the micro level. Tidiness and precision are not only designed for visual impression, but the goal is not to spend more than 30 seconds searching for the necessary things and to prevent possible injury to workers. 5S, which involves organization, cleanliness, cleanliness, standardization and discipline, is the most easily implemented method that delivers significant improvements. The company-wide certification body (120 countries) awarded the Senta plant a silver 5S certificate, which means that 5 sectors of the Senta plant achieved 91% of optimal job organization and process control of 100%, indicating that JTI in Senta, it is achieving worldwide results [14].

In addition to the 5S principle that forms the basis, JTI has also added the 3R principle to further enhance Kaizen's efficiency. 3R means:

1. Right Object
2. Right position
3. Right quantity

JTI is the first company in Serbia to fully implement Kaizen management that is responsible for the success of Japanese companies. The basic motto of the employees of this tobacco factory is Move to Improve. One example of Kaizen application is a glass box and a form holder. Each worker has the opportunity to write his or her innovation idea on the form and put it in a box, which is reviewed once a week. In this way, workers become more involved in managing the company and become more loyal. In addition, the person who knows the machine and knows it has the disadvantages, can make quality suggestions for improving the production process. Employees whose proposals have been approved receive awards at the local level and are eligible to participate in the regional awards competition.

Pictures of tools and tools are hung on the walls and squares for mobile machines are drawn, in which they are indeed parked. This saves the time it takes to find the necessary things. Also, beside each machine, laboratory or office, names with pictures of employees responsible for a particular function are hung [15]. By applying the Kaizen philosophy, productivity was increased by 50% and production scrap was reduced by 46% [16].

Visual management is a technique that ensures that all workers in the company, through the information presented in a visual form, can understand the state of the process. It creates an environment where things are obvious from the moment of entry. Visual information should be relevant, useful and timely. In JTI in Senta, visual management is ubiquitous: in production, warehousing and offices.

During the production of cigarettes, one of the final stages is the packaging of packs by machine. Within the machine there is something like a tank, a funnel shaped through which the packets pass and go to pack. This funnel must be filled with packs to be ready for the next process. The funnel was white in color, so it was difficult for workers to notice when it needed replenishment. Because of this, it happens that the funnel replenishes only when it is completely emptied. The packaging process therefore had to be stopped. This, of course, led to a slowdown in production, low productivity and damage to the machine as it had a lot of idle time. The proposal was to paint the funnel. The lower part is painted red and when the level of the pack is in the red zone, it is necessary to top up the funnel immediately. Green means that the amount of packs in the funnel is optimal, while beige is a warning that says it will need replenishment

soon. This way, with a single glance at the machine, the worker knows a clear state of the tank and can react accordingly. There is no longer production downtime, packaging now runs smoothly without any hassle, and workers work with no extra workload. This is just another example of how one small change, which requires minimal financial investment, can contribute to improving the performance of the entire company.

Changes in the work environment lead to changes in the attitude of employees, which together affect the change and improvement of the business culture. Employees develop themselves, teamwork is established, which improves the atmosphere in the company and increases the motivation of employees. Good organization of work environment reduces unnecessary work, increases employee safety and productivity which all leads to lower costs.

A number of activities are organized for employees at JTI. One of them is a learning day, when employees have organized lectures in the field of business but also an opportunity to master a new skill, all with the aim of developing and improving communication. Also, there are internal trainings organized, such as: project management, communication skills, presentation skills and the like. Within the company there is a library with business literature that employees can use.

Kaizen applies to every employee of the company, it applies every day and in every place. Only in this way permanent and long-term progress is possible. Satisfied employees are important for the success of the company. JTI has this because 88% of employees would recommend them as an employer and as many as 94% would make the extra effort for the company to succeed. It is also important for employees to move forward, so job positions are always first advertised internally to evaluate potential candidates within the company [1].

B. Strauss Adriatic

Strauss Adriatic is a company known for its Doncafe brand, which has also started implementing the Kaizen business system. The company is part of the Strauss Group, a leading Israeli company and global food and beverage manufacturer, with 26 factories in 18 countries in Europe, Asia, South and North America. One of the leading coffee processors, one of the first in Serbia to start applying this philosophy in order to improve business. The implementation of Kaizen at Strauss Adriatic began in 2010, when the first trainings began and the application of the specific principles began after a visit to Japan Tobacco International in Romania in 2011. Like any innovation and application of Kaizen management, initially encountered resistance and concern among employees and it took an extraordinary amount of effort to get all employees involved. That accepting the application of Kaizen management though progress is the fact that in 2011, there were 58 proposals for improvement, one of which 31 was adopted. Although anonymously making proposals helped to overcome the feeling of insecurity because of the opinion that their proposal is not good, thanks to the provision of public proposals that are followed by specific people, the most valuable and creative proposers were rewarded for their efforts. The idea behind the introduction of Kaizen management in Strauss was to improve working conditions, increase productivity and safety, arrange space, but also to improve communication among employees. For the time being, Kaizen methodology is represented in production and most proposals relate to modification of working methods or certain procedures that employees have identified as a barrier to work. The equipment that was damaged was repaired and brought back into serviceable condition, and the one that was destroyed was replaced with a new one. For ease of reference, numerous instructions and panels have been put in place that clearly indicate how some piece of equipment is used, where it stands and who is in charge of a particular sector.

The use of coffee weed as biomass for heating is a proposal that came from one employee is an outstanding example of Kaizen application, which solves the problem of waste disposal and finds its new purpose. Although this proposal also required some investment, one year after the implementation of this heating system, the investment was fully paid off, so it can be said that the company now has drastically lower costs [17].

C. TETRA PAK

Tetra Pak has been present in Serbia for over 40 years. The first dairy to start working with Tetra Pak was the Agricultural Institute

Belgrade, which, thanks to modern equipment, produced 120,000 liters of milk a day. Production of packaging under the Tetra Pak license in Gornji Milanovac was started in 1966, and the factory became part of the Tetra Pak company in 1997, and thus Tetra Pak Production was established with headquarters in Belgrade. Since then, the plant has been constantly modernized, thanks to investments, and continues to be invested in it. Today, Tetra Pak Production is one of the largest Serbian exporters [18].

Tetra Pak uses Kaizen tools. At different stages of implementation they faced different challenges. The first challenge of any organization looking to implement a new business process is how to ensure that all employees embrace change in the right way. Top management plays a key role here. If top management has a 1% doubt about success then manufacturing employees will have 50% doubt and the program will not be successful. The second challenge was how to keep the program active and further improve in conditions of production growth, increase in production complexity and increase in the number of employees. The proper set up of the process improvement system, the quality of the achieved standards and, above all, the quality of training of newly hired colleagues in order to enable them to get involved in the program as quickly as possible and to contribute, played a major role here.

Kaizen also has an impact on the financial perspective and innovation, which are two very important aspects of business. By increasing productivity and efficiency of production and business processes, as well as by reducing waste, it directly influences profits, partly through savings generated in manufacturing processes and partly through innovations in the field of new products and services, as well as innovations in improving the quality of existing products and services [19].

VI. Conclusion

The business environment is changing rapidly and the old ways of running a business are no longer working. Flexibility and proactiveness are no longer the characteristics by which competitive advantage is gained, but a necessary means of survival. As a result, new concepts in management are being developed. One of them is Kaizen, a Japanese business philosophy, based on the pursuit of continuous improvement. It is based on the fact that nothing is perfect and needs to be constantly improved and updated. The basic philosophy of Kaizen is fixed, while the tools and techniques to implement this philosophy can change over time, supplement and perfect. Kaizen is a philosophy whose implementation can achieve better business results and above all improving the quality and increasing productivity is the general hypothesis that the work demonstrated by analyzing a company in which Kaizen is applied.

The techniques and tools used in Kaizen do not require big financial investments, they are not invasive and improvements, even the smallest ones, should happen on a daily basis, as this proves that small and continuous improvements, in the long term, achieve great savings and great improvements in all processes in the company. In addition to requiring minimal financial investment, Kaizen is also credited with the many savings that can be made from its implementation. Unnecessary and wasteful activities in the business process are first identified and then eliminated, and attention is focused only on what creates value, thus proving that activities that do not add value should be eliminated. An obstacle to the wider application of the Kaizen business concept in companies is the pronounced individuality and competition of employees, which is characteristic of the American managerial approach. Employee involvement in implementing Kaizen increases their motivation to work.

References

1. Gigic, S. (2014). *Kaizen kao poslovna filozofija uspešnih lidera*. Master thesis, University Singidunum, Belgrade, pp. 9; 61-62.
2. Masaaki, I. (2017). *Kaizen: ključ japanskog poslovnog uspeha*. Makart, Belgrade, pp. 2; 54.
3. Papić. Lj. (2011). *Menadžment kvalitetom*. Istraživački centar za upravljanje kvalitetom i pouzdanošću, Prijevor, pp. 78.
4. Radosavljević, G. (2013). Svakog dana u svakom pogledu. *Exporter, SIEPA*, *22*, pp. 17.
5. www.kaizen.com/about-us/kaizen-institute.html (Accessed: 27.09.2019.)
6. www.economist.com (Accessed: 27.09.2019.)
7. Vasiljević, D. (2011). Implementacija Kaizen poslovne filozofije-program kontinuiranog unapređenja poslovnog procesa. *Ekonomski horizonti, Ekonomski fakultet Univerziteta u Kragujevcu*, Kragujevac, pp. 28.

8. Vojteški, D., Kljenak, D., Stanković, R. & Kvrgić, G. (2011). Kaizen koncept kao savremeni pristup obračuna troškova kompanije. *Conference proceedings, May conference in strategic management*, Technical faculty in Bor, University in Belgrade, pp. 161.
9. Pešić-Đokić, S. & Đokić, I. (2010). Kaizen projekti u sedam koraka. *Festival kvaliteta*, Mašinski fakultet, Kragujevac.
10. Rentzhog, O. (2000). *Temelji preduzeća sutrašnjice: procesima usmerena poslovna filozofija*, Prometej, Novi Sad, pp. 13.
11. https://www.universalclass.com/articles/business/adopting-pdca-cycle-in-kaizen.htm (Accessed: 12.10.2019.)
12. Janićijevic, N. (2004). *Upravljanje organizacionim promenama*, Centar za izdavacku delatnost Ekonomskog fakulteta, Belgrade, pp. 184.
13. http://www.ekapija.com/website/sr/page/785666/Srpske-kompanije-unapre%C4%91uju-proizvodnju-na-japanski-na%C4%8Din-Primenom-kaizen-sistema-godi%C5%A1nja-u%C5%A1teda-i-do-18-000-EUR (Accessed: 27.09.2019.)
14. http://www.ekapija.com/website/sr/page/599726/Japanski-recept-uspe%C5%A1an-i-u-Senti-Uz-Kaizen-menad%C5%BEment-produkivnost-u-fabrici-JTI-porasla-52 (Accessed: 27. 09. 2019.)
15. www.prekoramena.com (Accessed: 27.09.2019.)
16. www.politika.rs (Accessed: 27.09.2019.)
17. Jokić, O. (2012). Kaizen menadžment. *Doncafe revija*, *19*, pp. 14.
18. http://www.mcb.rs/blog/sa-kaizenom-se-lakse-dise-jovan-gligorijevic-supply-chain-director-see-factory-director-gornji-milanovac-factory-tetra-pak/ (Accessed: 27.09.2019.)
19. https://www.slideshare.net/JovoStoki/cm10-kaizen (Accessed: 27.09.2019.)

Innovative Applications of Quantum Theory in New Evolving Notions of Order in Management and Economics: Some Reflections in Honor of David Bohm

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Abstract—**Fundamental concepts of David Bohm's seminal scientific work are extended to the social science domain and in so doing the author unfolds unique concepts of innovative thinking in terms of which economics and management may potentially benefit from this approach. Advantages and opportunities of David Bohm's method are shown by interpreting wholeness and implicate order in both classical and quantum theories. Special emphasis is placed on phenomena of space-time and entanglement which evolved into his hidden variables and nonlocality theories. Finally, discussed are some observed implications for creativity and artificial intelligence in the financial sector and how firms can learn from business experience thus proving the totality of mutual enfoldment and unfoldment in social and natural sciences.**

Keywords – fragmentation, wholeness and implicate order, quantum innovativeness, quantum creativity, quantum intelligence

I. INTRODUCTION

Professor David Bohm (1917-1992) unquestionably remains one of the leading world scientists. He has not only confronted the ordinary interpretation of quantum theory, questioning his own findings, but has incited many other scientists to revise what their own approaches and findings in science are.

His work incited his fantasy, profound scientific interest and originality of approach [1]. Besides ground breaking discoveries in theoretical physics living in the real world and the way it functions in fact excited him the most. He spent a great deal of his career in the development of the theory of creativity, communication, meaning of thought, language and dialogue called 'flowing meaning' needed for an orderly life [2, 3]. In developing original quantum theory concepts [4] and his 1952 stochastic interpretation of hidden variables theory he worked closely with Luis De Broigle and Jean-Pierre Vigier. He developed Bohmian trajectories with Basil Hiley and the Aharonov-Bohm effect with Yakir Aharonov. He had many other cutting edge discoveries in special relativity theory [5], wholeness and implicate order [6] and in the hidden variables theory [7].

His joint discoveries on the holonomic brain model with Karl E. Pribram [8] were an important part of the research on the nature of intelligence and human consciousness [9]. He described human thought as a complex system which functions in each human being and in the world we have created through our mechanical use of thought. Instead of being something of extraordinary significance as made by man, he suggested that the overwhelming majority of human thinking is actually a collection of reflexes which function automatically. He also explained that thought has artificially and wrongly divided itself from the physical body and human emotions [9]. Here we discuss possibilities to overcome mechanical thinking [10] through innovative applications [11, 12] of quantum theory, coupled with David Bohm's interpretation of relativity [5] and subsequent contributions of other prolific authors who realized the limitations of relativity [13, 14].

II. BOHM'S CONCEPTIONS OF METHODOLOGY IN SCIENTIFIC RESEARCH

A. The Science of Interconnectedness

To see more clearly what is implied here it might be said that proposed is not only to learn

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from existing theories in physics, psychology and other sciences, which are all interconnected, but to go on assimilate what is valid in these theories, then do something original, and yet go beyond this work in qualitatively new ways questioning everything.

B. Interconnectedness is coherently optimized through hidden variables

Some laws exist independently of whether we know about them. Also the moment we discover them, they are contested and new unknowns appear infinitely. At the present moment our computation is based in space and time which the author considers a limitation in terms of the hidden variables wholeness theories developed by Bohm. However, quantum computers seem to obey physical laws more gently. Now the word gently, suggests that physical laws may in fact change and what if they are not the same from one region or space to another and what if the change takes place with a different time derivative? If this turns out to be so, then this assumption may hold against Einstein's equivalence principle, according to which the laws of physics are the same everywhere. One of the first scientists to suggest this was V.A. Fock who indirectly supported Bohm's hidden variables theory by pointing out that the equivalence principle may in fact have a non-local validity [14].One can similarly question Heisenberg's uncertainty and Pauli's exclusion principles and all other laws.

III. On Newton's Heritage among Mechanics and Researchers

Newton's laws of motion imply that the future behavior of a system of bodies is determined totally symmetrically and eternally in terms of the initial positions and velocities of all the bodies at a given instant of time, and of the external or internal forces acting on the bodies. Possible future motions of the bodies are simply the positions and velocities of the bodies at a given instant of time. Therefore, they constitute a set of "one-to-one" cause and effect relationships with subsequent positions and velocities of each body established exclusively. The theory of relativity, and then especially Bohm's unique interpretation of quantum theory, corrected Newton's laws of motion, and thus helped to define their validity in a way which is significantly different. Nevertheless when mechanics and researchers explore perfectly symmetrical (explicate) bodies the relationship between mass and energy or momentum and position, produces puzzles in their minds, as these relationships are in conflict with various "invisible" suppositions concerning the general system of the world. Hence it is helpful, for everyone to go more deeply into our implicit common sense assumptions to prove and demonstrate that they are not unavoidable and to show quantum theory is really different and realize there is no paradox involved in mentioned relationships. Clearly, based on Bohm's experiments, we do not anticipate that any symmetrical relationship will represent any absolute truth because to achieve this it would have to hold everywhere, under all conditions, unequivocally, limitlessly and without any restriction.

IV. Fragmentation Versus Wholeness

As on symmetricity we first point out the Bohm identified problem of fragmentation of human consciousness. The widespread and pervasive distinctions between, induction and deduction on one side, analysis and synthesis on the other side, which are sometimes preventing researchers from seeing the totality, or indeed, even wholeness of the research question, have one of the key factors of their origin in a kind of thought that approaches *things* as fundamentally split, disconnected, and 'broken up' into yet smaller constituent necessarily independent and self-existent parts.

Fragmentation revealed the need for new forms of research insight different from atomic theories of Democritus. This can be accomplished and some made such changes in their approach. For example, Einstein [15], realized that issues dealing with space and time and the particle nature of matter, produced confusing assumptions that had to be dropped, and he came forward to ask new questions leading to radically different concepts.

In order to see the forest from the trees, in business management for example, it seems useful to make inferences consisting of a particular topic and making a series of explorations not only related to a particular issue but to everything else at the same time because all questions are related. Clearly, if we understand one question rightly, all questions

are answered, which really means, when doing a particular research the question is do we know how to ask the right holistic question?

V. Space and Time

We are that is we exist, this is an actuality, but is it in time-space or not? Has the human brain the capacity to see in what it is doing now - being caught in the notions of space and time? Instead, can one say that being and movement simply have no form? Bohm emphasized how man has taken a wrong direction and got caught in this kind of Decartes' theory of knowledge that 'I think therefore I am', which is dominated by space and time which became our psychological knowledge. He stressed that time is limited to a certain psychological direction or area, and beyond that, it has no value. It is not clear to say that human brain is of space and time, but rather that it has developed in such a way that it is in both time and space. Can the mind operate without time if the brain is not able? The brain is mainly dominated by space and time, which is measurement through thought, although that doesn't necessarily mean it couldn't change. It seems necessary to deny the very notion of space and time in the sense of looking forward to the present, and deny all the future and all the past as time concepts. Can we deny that space and time exist independently? It seems we just have the impression that time and space exist independently of us. In reality human beings are caught in the stream of space and time, and therefore it would seem absurd for us to deny them because that is unfortunately what we are. However, it should be vice versa and if we are successfully out of the stream of space-time, then we find it as a post-quantum hidden variable limit with imaginary time rather than as a classical limit? If time is a dimension of space then is space also imaginary?

A. Entanglement

The question whether entanglement also occurs across time seems to produce misunderstanding and remains significant. It should be stressed that the quantum theory implies that elements which are separated in space represent non-causally and non-locally [7] connected projections of a higher-dimensional order. Quantum theory implies non-continuity, non-causality and non-locality [6]. Therefore it derives that moments separated in time also represent such projections of this reality. The non-causal connection of elements that are distant from each other was first brought out in the highly debated, perhaps even controversial, 1935 experiment of Einstein, Podolsky and Rosen (ERP) later well contradicted by Bohm [4]. Different particles should be taken literally as projections of a higher dimensional order which cannot be elucidated in terms of any force of interaction between them. Clearly if a molecule is forced to disintegrate and then its atoms are observed after they have separated and are quite distant from each other, they no longer interact and or have causal connections any more. But Bohm showed how they correlate at a still higher implicate or enfolded order [6].

VI. New Dimensions between Mind, Matter and Microelectronics

Micro-electronics industry is evidently the fastest developing business sector steered primarily by the expansion of the computer and telecommunications markets, as well as the fast growing automobile industry, industrial electronic markets and military. The production of extremely small and ever tinier microelectronic components is contributing for a great pressure for the development of mentioned and many other business sectors, given the extreme high quality demanded by their producers and consumers. Bohm extensively discussed mind and matter with Pribram [8], Krishnamurti [9], and others. In that context author's main points suggest five great business potentialities for consciousness:

1. Identify and exploit the differences and similarities between brain and micro-electronic accumulation.
2. Identify and exploit the differences and similarities between artificial and natural intelligence.
3. Identify and exploit the role of material processes in the brain and of matter in the mutation of brain cells.
4. See and exploit a problem-solution: Advantages of wave properties of the mind in development and/or defense from micro-electronic accumulation.

5. Exploit insight, imagination, creativity and innovation in Bohm wave like micro-electronic enfolded implication.

Observed similarities resonate far more than differences. The space surrounding the center of mechanical knowledge in the brain and in microelectronics is practically unlimited for both the mind and artificial intelligence which is where consciousness resonating along the different congruent field theories (Fig. 2) becomes significant. In Fig. 1 author illustrates the impact of going *beyond* consciousness:

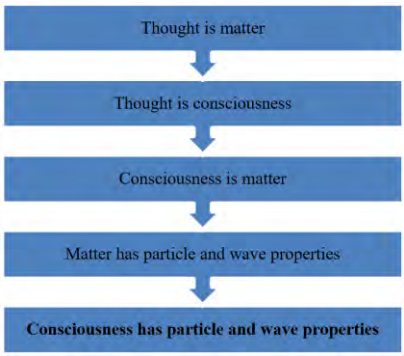

Figure 1. Unfolding Properties of Consciousness (Source: Author's interpretation)

A. Space Time and Consciousness

In Table I the author interprets space time entanglement very differently from the older and classical theories.

TABLE I. FIELDS OF SIMILARITY AND DIFFERENCE (SOURCE: AUTHOR'S INTERPRETATION)

Space	Time	Consciousness
Transience	**Transience**	**Transience**
Wholeness	Fragmentation	Unity
Implication	Explication	Intentionality
Sensitivity	Insensitivity	Sensitivity

Simply, the concept that there is one unique universal order and measure of time is only a habit of thought built up in the limited domain of Newtonian mechanics. Nevertheless identified was transience as one common denominator of space, time and consciousness because of their state of lasting only for a short time. There may be others. If time exists and as a notion it is accepted then it consists of the past, the present and the future which is a movement made up of fragments. But, this is also a criticism of the existence of time and transience because it tends to give the observer [6] a rather fragmentary impression of the logical and conceptual structure of physics as a whole and therefore suggested is an unlimited approach with wholeness. With transient time we are often not able to observe the unpredicted negative consequences, which cannot always be dealt with in terms of a fragmentary mode of thought. For example, by studying environment and nature in a transient and fragmentary manner, man has depleted the ozone layer and farm land, dried out lakes, and even changed climate. It seems that abandoning transience and fragmentation in the space time entanglement allows for quantum wholeness and an unlimited interpretation of physical reality. Landau's physics [13], is also an excellent example of a non-relativistic space-time mathematical model that fuses n–dimensional space and m–dimensional time into a single continuum other than the (3+1) model used in relativity theory. The question is can the single continuum be replaced by multiple unlimited number of Bohm's hidden non-local continua? Beside the aspect of speed of computation can a quantum algorithm then be the first step towards limitless potential of computation without time and space?

B. Universe and Consciousness

An interpretation of the original Latin word 'conscientia' has several directions: a group of people who know something or have knowledge of something together with others; a group of people co-participating with another or others. It can also imply self-consciousness, feeling and in a figurative sense a conviction. The universe means whole or all one. It is a kind of an order. In response to the questions posed in the previous section it seems that the key derived meaning is whether the universe, which is orderly and consisting of all forms of matter and energy possesses the faculty of knowing or coparticipating. Various interactions between matter and energy in the observable and non-observable space seem to confirm that this is so and different significant theories have hypothesized and provided some evidence in this direction. Particularly valuable are the electromagnetic and gravitational fields theories (Maxwel, Lorentz, Einstein and others), morphic resonance and morphic fields theory (Sheldrake) all leaning on Bohm's

implicate and explicate order theory. Therefore, it does seem logical to agree that consciousness is a very special structural quality of the mentioned fields and an actual medium through which the universe subtly communicates within itself and with us.

VII. Role of Quantum Computers in Connecting the Classical and the Quantum World

Let us consider whether and how the quantum computers may clarify the connection between the quantum and classical worlds. While it is indeed impossible to use a classical computer to study the quantum-to-classical transition let us consider the quantum-to-classical relationship as various levels of subtlety in mind. Instead of asking what is the transition of relationship of these two processes there is perhaps a different approach which suggests mutual participation of the two poles. The answer that is suggested here is that there are not two separate or parallel processes. But instead, proposed is that both are essentially the same. This really means that that which we experience as classical, in its movement through various levels of subtlety, will, in a natural way ultimately move the relationship by reaching the level of the quantum potential. There is no unbridgeable gap of barrier between any of these levels. Rather, at each stage some kind of information can serve as the enfolding bridge and this represents the real potential for quantum computers. To explain what is meant here, one may consider the analogy of the poles of a magnet. And while the magnetic poles are only abstractions, proposed here for convenience of thinking about what is going on in the quantum-to-classical relationship, this whole emerging evolution has a much a deeper reality—an undivided magnetic field that is present over all space.

For the purpose of the suggested transition there arises the study of the question: How close is a quantum system to behaving classically? To answer that question we should not be reducing the quantum pole to a mere function or aspect of the classical or vice versa (e.g. as is done in idealism and materialism). The central issue in the suggested classical quantum non-transition is, however, that before the emergence of the quantum theory, our knowledge of matter was obtained from the study of physics which often led us to reject that it could have a mental pole, which would allow it to participate with a mind and with a quantum computer in the quantum-to-classical relationship. We can now say that this knowledge of matter (as well as of mind and the quantum computer) has evolved in such a way as to support the approach that has been illustrated here. To develop this approach further might perhaps enable us to extend our knowledge of both the classical and the quantum poles into new horizons leading to a more consistent interpretation of such questions than is possible in the usual dualistic and reductionist approaches to the quantum-classical relationship.

A. Whether a quantum computer will ever be able to usefully read the human mind

The discovery of an answer depends on whether a computer can offer a satisfactory simulation of human intelligence. This essentially means that the computer would have to be able to become “aware” of implicit assumptions of the human mind, and to question them when necessary. This, additionally, would require that the computer be able to reveal and question the whole tacit and largely “unconscious” basis of the society in which it was constructed. To the degree that human intelligence is able to face up to such questions sufficiently, there is similar to “child-initiated” thought and a corresponding free movement of imagination in awareness and attention, which enables the development of creative intelligence. The question is really how could this be simulated by a computer? One potentiality is to excite or perturb random changes in some of its software and operational strategies as projected in quantum field theory. Further questions are would such simulations be inappropriate and destructive and would it be feasible to handle such software and programs in a way that optimally fits the human environment? If AI itself is arguably to be called intelligent, then it would have to consist of its own internal standards as to what is useful or fits best. These standards, resembling scattered DNA corrections in quantum fields would obviously require an own standard for flexible readjustment and reprogramming in

itself. As we shall see this assumption has indefinite options in economics and finance.

VIII. Quantum Innovativeness and Creativity Presupposes Innate Entrepreneurial Intelligence

Is there any interconnection and similarities among Innate Intelligence, Innovativeness and Creativity? As in Bohm's method, let us first share the meaning of these terms [3], all of which have Latin origin. Innate originates from the Latin word 'innatam' which means inborn and natural. Intelligence originates from the Latin word 'intelligentia' suggests the power to understand and reason while it actually means ability to have insight or to read between the lines and is therefore not a product of thought or reason. Innovativeness originates from the Latin word 'innovo'. Innovativeness is therefore something new and unusual that does not allow the traditional usage, for example it is a new product or service. Creativity originates from the Latin word 'creator' which means originator and creator. In contrast to innovativeness and innovation, creativity means bringing into being something that was not there before. It seems that there is interconnection, rather than similarity, in the sense that intelligence is the space provided between the old and the new brain, the space between the synapses for some new thing to happen which allows for innovativeness and creativity to take place in that space. If an economic phenomenon is just something new it would be innovativeness. If it never existed before it would be creativity. But, understanding the logic of creativity, intelligence and innovativeness does not in itself make one more creative, more innovative or more intelligent and this is where the key word innate becomes really very significant.

If the innate intelligence originates from the old or reptilian brain and poorly connects with the limbic brain and neocortex then the innate intelligence is very limited by the qubits. This ends up in quantum decoherence. If the synapses between the three brains function or make use of quantum multibits then it's a completely different entrepreneurial potential of coherence and not relativistic decoherence.

A. Creative Output in Entrepreneurship

Creative output is neither obvious nor easy and involves an element of fantasy with intelligence, unexpectedness and mystery [16]. It is a kind of creative thinking involving changing concepts and perceptions. Great business ideas are produced and one doesn't always know how they came about. And while one can try to observe the origin and appearance of creativity among successful businessmen this will tell very little because such people are often unaware of the sources of their creativity. Creativity can be used in business problem solving if that implies solutions that were not there before, if it means a search for differing alternatives. Therefore creativity cannot really be guided for problem solving because then it would be mechanical and unintelligent. But rather, in a creative and coherent approach one can look at the problem as an enfolding whole to see if there is another way, what are the alternatives or what else can be done to address the economic issue at hand.

IX. Main Opportunities for Artificial Intelligence in the Financial Sector

It seems to be an opportunity to discover whether a computer can read the brainpower of a financial market which does not portray a financial trend. That again depends on whether a computer can offer a satisfactory upgrade of human intelligence. As indicated in Section VII the computer would have to be able to become "aware" of implicit financial assumptions of the market brain and the related human mind, and to question both when necessary. This, additionally, would then require that the computer be able to reveal and question the whole tacit and often "unconsciously ruthless" basis of financial markets for which it was constructed. To the degree that artificial intelligence is able to face up to such questions sufficiently, there is an opportunity similar to "child-initiated" consciousness involving free movement of financial imagination in markets. This opportunity seems to have potential to allow development of creative financial sector quantum intelligence. The question is really whether and how could this be simulated? One potentiality is to incite or excite random changes in some of the financial market software and operational strategies as projected in quantum field theory. Are such simulations

appropriate or destructive? Would it be practically achievable to handle such software and programs in a way that optimally fits financial markets? If AI in the financial sector is really to become resourceful, then it would have to consist of its own internal processes as to what is useful or fits best. These financial standards and criteria, similar to occasional DNA corrected perturbations in quantum fields would obviously require an own standard for flexible financial market monitoring. These are just hypotheses but there may be an indefinite number of other ways of approaching artificial intelligence in economics and finance.

X. Inertial versus Mindful Repetition of Previous Entry Mode Choices: do Firms Learn from Experience

These are indeed two of the key words explaining mindfulness and not only in relation to firms. However, it must be emphasized that repetition has really ceased to be regarded as an insight into business, into a deep way of looking at business. Firms no longer regard as an absolute truth the notion that the whole of business reality is actually constituted of just 'atomic business building blocks', all working together more or less mechanically. Innovative and creative firms do not follow on each other relatively mechanically from experience, or through association determined by habit and conditioning of company managers. Also, at least when it comes to innovative and creative firms, seeing the *reason* for entry mode choices is not a mechanical activity of this nature based on experience. But rather, a company management is aware of each aspect as assimilated within a single whole, all of whose parts are both inwardly and outwardly related (as are, for example, in the systems theory) folding and unfolding. Here, a company management has to stress that the act of logic is really a kind of perception through an entrepreneurial mind of the managers, similar in certain ways to an artistic perception, and not merely the associative mindful repetition of previous entry mode choices that are already mechanically known. Now, proceed from the meaning of 'inertia' - or a business tendency to do nothing and remain unchanged in relation to competition and stakeholders, or when a company continues with uniform business development. Unless that state is changed by an external stakeholder it seems, speculatively at least, that when it comes to innovative and creative firms, the *reason* for entry mode choices is not an inertial activity of this nature based on experience. Suggested is non-inertia.

XI. Discussion of Significance of Results

Many possibilities remain for further development of notions with new quantum based intelligence in both social and natural sciences which is not a reaction of the conscious mechanical mind. It involves an action in which not only qubits move, because they are really quantum mechanical binary simple two possible states, but rather allowing quantum non-mechanical hidden variables. Now this is really where it seems possible to make a breakthrough in the quality of human observation: with the *non-mechanical* application of the de Broglie–Bohm theory, which also postulates an actual configuration that exists even when unobserved [17, 18]. Learning about this through the unconscious mind is obviously closely related to both brain and mind. It is important here that we be clear in our presentation techniques, analysis and synthesis. Fig. 2 provides one interpretation of how energy is meditatively organized for the benefit of a holonomic brain, as a sort of unique range of metaphors, energy and information. The concurrent, rather than successive, existence of different powerful fields as well as continuous enfoldment-unfoldment processes should be noted. In a way, these can be looked on as translated measures (actions instructed by knowledge and reason) which are tacitly taken by man to try to attain the measureless to man [19] and that which is seen and that which is not seen [20], which seems to be a state of mind in which he loses a sense of separation between himself and the whole of reality which Bohm called holomovement. Indeed, such notions are uncontradicted. For what is measureless to man is only that which cannot be incited in classical limits defined by man's knowledge or reason, which also extends into economics [10]. Clearly, Bohm's hidden variables in a superimplicate order reveal innumerable potentialities in both natural and social sciences and their interaction therefore becomes ever more significant.

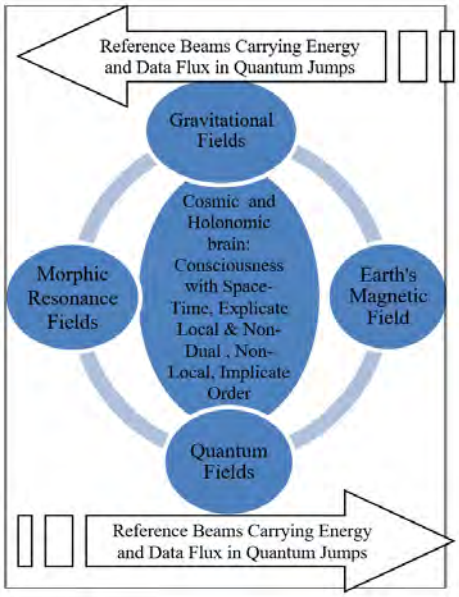

Figure 2. A holographic interpretation of main stream congruent field theories in a concurrence order (Source: Author's interpretation)

B. Similarities between quantum physics, economics and management

We summarize our three main inferences:

1. At quantum level interaction in the domain of nuclear dimensions has some correlation with the macroscopic level [10]. Rational economists make informed micro and macro judgments, also by applying calculus and on the basis of marginal and opportunity cost while at management level there is correlation between leading, performance and people development.
2. At quantum level the wave function is only a statistical correspondence with the actual behavior of matter. In economics markets are an optimal way to perform and regulate economic activity and can also be understood with uncertainty or stochastic processes and nonlinear dynamics. At management level motivation can be unstructured involving indeterminism and probabilistic interpretation [12].
3. Superimplicate transformations [10] between wave and particle aspects of matter have potential to explain all forms of behavior with matter. Economic, trade / business cycles take a downward or upward trend and are better/faster understood with quantum computing and quantum finance. In management leading can also be unstructured involving indeterminism and probabilistic interpretation.

XII. CONCLUSION

It seems to be wrongly felt that if there is to be any finding or conclusion that it should be taken as the 'received' and 'final' notion concerning the nature of the observed scientific phenomenon. A more objective attitude is that our notions concerning the raised dilemma of research findings and related conclusions are in a continuous process of development, and that one may have to start with concepts that are just some sort of improvement over what has thus far been discovered, and then to go on from there towards more developed concepts. It is subjectivity to consider any finding or conclusion as final. A more objective approach is that our concepts and theories concerning any phenomenon are in a continuous flux or movement. There is obviously no reason to suppose that there is or ever will be a final kind of insight or absolute truth about anything. Indeed to take findings in any research and related conclusions as final would gravitate to obstruct the free flux of the human mind required by clarity of perception. Any fixed truth in relation to findings and conclusions would only serve distortion and confusion, thus stretching subjectively into all aspects of scientific research and discovery. We have to be ready to discover new limits of the relatively autonomous structure of subjectivity in order to look for new or hidden laws that will allow yet broader autonomous discoveries. Clearly, as we continue the research, we have to remain open for new fundamental changes and emerging discoveries. Our conclusion is that there are no limitations on applying quantum theory, wholeness and implicate order in economics, finance and management; and we see that numerous other potentialities are opened for all sciences because the notion of infinity of wholeness and implicate order implies that the development of science will lead to an inexhaustible diversity [21] of both known and unknown (Bohm's hidden) new discoveries in an undivided universe [22].

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REFERENCES

1. Peat, F. D. (1997). *Infinite Potential: The Life and Times of David Bohm.* Basic Books.
2. Bohm, D. (1996). *On Creativity.* Routledge, London
3. Bohm, D. (2003). *On Dialogue.* Routledge, London
4. Bohm, D. (1951). *Quantum Theory*. Prentice-Hall Inc, New York
5. Bohm, D. (1965). *The Special Theory of Relativity.* W.A. Benjamin Inc
6. Bohm, D. (1980). *Wholeness and Implicate Order.* Routledge & Kegan Paul, London
7. Bohm, D. & Hiley, B.J. (1975). On the Intuitive understanding of Nonlocality as implied by the quantum theory. *Foundations of Physics, 5*, pp. 93/109.
8. *P*ribram*,* K. (1991). *Brain and perception: Holonomy and structure in figural processing.* Hillsdale, Lawrence Erlbaum Associates*,* N.J.
9. Krishnamurti, J. & Bohm, D. (1985). *The ending of time. The future of humanity.* Krishnamurti Foundation Trust Limited.
10. Bohm, D. & Peat, F. D. (1987, 2000). *Science, Order, and Creativity.* Routledge, London
11. Senge, P., Kleiner, A., Roberts, C., Ross, R., Roth, G., Smith, B. & Guman, E. C. (1999). The dance of *change: The challenges to sustaining momentum in learning organizations*. Currency Doubleday.
12. Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization*. Crown Pub.
13. Landau, L.D. & Lifshitz, E.M. (1965). *Quantum Mechanics: Non-relativistic Theory*. Pergamon
14. Fock, V. A. (1964). The Theory of Space, Time and Gravitation. Macmillan.
15. Einstein, A. (2004). *Relativity. The Special and the General Theory*. The Folio Society, London
16. De Bono, E. (1995). *Serious Creativity*. Harper Collins Business.
17. Bohm, D. (1952). A Suggested Interpretation of the Quantum Theory in Terms of Hidden Variables I. *Phys, Rev. 85(2)* pp. 166-179.
18. Bohm, D. (1952). A Suggested Interpretation of the Quantum Theory in Terms of Hidden Variables II, *Phys. Rev. 85 (2)* pp. 180-193.
19. Coleridge, S.T. (2015). *Kubla Khan.* Harper Perennial Classics, New York
20. Bastiat, F. (1863). *Sophismes économiques.* Guillaumin, Paris
21. Bohm, D. (1957). *Causality and Chance in Mondern Physics.* Routledge & Kegan Paul, London
22. Bohm, D. & Hiley, B.J. (1995). *The Undivided Universe: An ontological interpretation of quantum theory.* Routledge, London

Resolving the Local-global Paradox in Business Organizations

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Abstract— **The paper addresses the problem of the global-local paradox in business organizations. The source of this problem lies in the differences between functional operations of subsystems, and most importantly the global and local level of organization. The existing approaches that address this problem emphasize mediation and amelioration of these differences. By contrast, this paper suggests the ways in which differences between the global and local level can be used by business organizations for value creation and growth.**

Keywords - the global-local paradox, systemic conflicts, systems theory, multiplication of differences

I. INTRODUCTION

Business organizations are complex systems. Their survival, like the survival of all complex systems, depends on constant evolution that involves fundamental changes [1]. The imperative to evolve is what makes business organizations complex systems. Business organizations also have an intricate internal structure with a variety of subsystems—such as, management, operations, marketing, sales, etc.—which adds to their complexity.

The subsystems that constitute the internal structure of business organizations perform very different and distinct functions; they have their own specific ideal goals and incentives. Differences among subsystems are a frequent source of tensions, frictions and even conflicts.

Systemic conflicts attract a great deal of attention. There is a growing body of literature that deals with conflicts in business organizations [2,-10,17]. They are an important subject at numerous conferences, seminars, webinars, and workshops.

Systems theory is an important tool in studying conflicts in business organizations. Those who use this approach argue that the very complexity of business organizations is the principal source of conflicts. They maintain that the pursuit by subsystems of ideals goals—that is, the pursuit of their best performance—is what brings subsystems in conflict with each other. As Louis Pondy argues, "differentiation in the participants' goals for the organization" is the major source of conflicts in companies [2].

One particular functional differentiation in business organizations stands out as perhaps the most important cause of systemic tensions and conflicts. It represents a fundamental division between two principal orientations that exist in business organizations—local and global. The local orientation is characteristic for subsystems that deal with operations, while the global orientation is an exclusive preserve of management.

Hal T. Rabbino and James L. Ritchie-Dunham offer a perceptive discussion of this subject in their article "Managing the Global to Local Paradox" [10]. The authors see the paradox as reflecting the difference between "management's desire to continually grow global output at an increasing rates for the shareholders" and "operation's need for local stability to maximize assets use, provide predictable returns from investor's capital, and continually satisfy worker's personal needs."

According to Rabbino and Ritchie-Dunham, conflicts between the local and the global level operations cannot be avoided. For this reason, the recommendations they include in their article are not about eliminating the global-local paradox but only about mitigating its harmful

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effects by building bridges between principal stakeholders and reaching an optimal consensus that would work best for the organization as a whole. They recommend that company personnel should be more aware of the systemic causes of conflicts that are due to the local-global paradox and make more use of systems theory. They also recommend engaging representatives of the principal subsystems in business organization and its shareholders in building a dynamic business simulator based on the map of cause-effect interactions among them.

A close analysis of these recommendations raises some doubts as to whether they will have a significant effect. First of all, it is worth pointing out once again that the two authors do not seek a permanent solution to the local-global paradox but only ways of mitigating its effects. In other words, the paradox, in their view, will persist no matter what. Their recommendations also do not affect the specific practices, ideal goals and incentives that are characteristic for each particular subsystem. As a result, with the best intentions of maximizing their performance, subsystems are likely to continue pursuing their ideal goals, which means that the consensus they may reach among themselves will always be unstable.

II. Differences, Conservation, and Evolution

Systemic problems--like the global-local paradox--have their roots in system's functional operations. As Andrade and her co-authors stress, "fundamental properties of complex adaptive systems are the source of much organizational conflict" [5]. A brief discussion of the way systems operate will certainly help to address the issue of the global-local paradox.

The principal function of any system is to sustain itself. Resources are critical. Since resources are always finite, systems must be frugal and use their resources efficiently. However, no matter how frugal a system is, no matter how efficiently it uses its resources, these resources are still limited. Frugality does not solve the fundamental problem of the finitude of resources. The only way to solve this problem is through access to new resources.

In order to gain access to new resources, a system must expand its range of possibilities—its ways and capacities to act. Such expansion requires new properties that are different from the properties that the system already has. In order to expand its range, a system must create new possibilities, which can only be achieved by including and conserving differences, not suppressing them.

Inclusion of differences is a creative act that changes the system. It leads to the creation of new and more powerful levels of organization and to the evolution of the system as a whole. Conservation is the engine of evolution. A system that does not evolve cannot conserve itself and begins to disintegrate [11,1].

All systems have a mechanism that regulates operations and interactions of their subsystems. This mechanism represents the system's global level of organization. Since this mechanism regulates all functional subsystems, it has more power, that is, its range of possibilities is broader than that of each individual subsystem or their sum total. It derives its power from multiplying, rather than adding all the possibilities that subsystems offer.

Conserving a system requires conservation of both its local and global level of organization and their functional operations. Operation is a form of action; and action can only be conserved through enactment. The more an operation is used, the better it is conserved. Therefore, the more operations at each level are enacted, the better they and the entire system are conserved.

Interactions among subsystems keep them active. The more they interact, the better they are conserved. Therefore, the better a system is integrated, the more its subsystems interact with each other, the better they are conserved. Hence conservation of a system requires its integration. Integration combines differences and leads to the creation of new and more powerful levels of organization.

The most important differences that exist in a system are those between the local and the global level of organization. Therefore, the integration of these two levels contributes the most to the creation of new and more powerful levels of organization with new and more

powerful possibilities, which ensures the survival of the system as a whole.

Since the global level of organization is the most powerful level in a system, it is capable of assimilating all the subsystems and their interactions—that is, integrating them into its own functional operations. Once integrated, subsystems adapt to the global level. Donald Campbell points to this phenomenon in his discussion of the so-called "downward causality" that describes changes in the local level operations and their interactions caused by global operations [12]. When the adaptively modified subsystems interact with each other, they combine their new properties and contribute to the creation of a new and more powerful level of organization—that is, to the system's evolution.

The integration of the global and the local level of organization and the subsequent re-equilibration of the subsystems create a new frame that has sufficient power to include both the local and the global level of organization as its particular cases. The emergence of this new frame marks the beginning of a new stage in the evolution of the system. Since this frame combines all differences, its potential power is greater than what the system has been capable of before its emergence. In other words, the system evolves into a new and more powerful state with new possibilities that are capable of providing access to new resources. The differences between the local and global levels of organization are not suppressed; they are conserved. Thus, the entire system conserves itself by evolving into a new state with a greater range of possibilities [1,13].

III. The New Business Practice: Using Differences for Growth

The strength of subsystems in business organizations is in their best performance in pursuit of their ideal goals--that is, in their differences, not commonalities. Consensus seeks to minimize or even suppress differences. Differences, not commonalities, have the most to contribute to the creation of new possibilities and thus survival and growth of business organization. The efficient operation of business organizations requires that the potential that differences offer be used to the fullest extent possible, rather than reduced or suppressed. Several researchers have pointed out that organizational conflicts are not only creating problems; they also offer opportunities for innovative solutions and growth. Henkin and Singleton, for example, recognize the utility of conflicts as a stimulus for productive problem solving. In their view, conflicts may lead to "creative solutions" that "enhance operational effectiveness" [14]. Lawrence Kahn, the owner of the company Strategic Resolutions with years of experience in conflict management, also points out that conflicts hold "the opportunity for creating improved processes and developing innovative procedures" [15].

Maximum efficiency requires that business organizations should use differences in a positive way as a stimulus to growth, rather than neuter them in search of a compromise. Andrade and her co-authors emphasize that differences are "the fuel that drives system growth and enables learning and adaptive behaviors, making innovation possible." Therefore, they conclude, differences must be used, rather than reduced or eliminated [5].

In order for business organization to function efficiently and achieve maximum possible growth, all its subsystems, not just some, should engage in creating maximum value. Their differences are essential for achieving this goal, not an impediment to it.

The survival of business organization, like the survival of any other system, depends on the conservation of its two principal levels of organization—local and global. Integration is the only way these two levels can be conserved. Such integration allows those involved in local interactions to adapt to the global level. The adaptation of local operations to the global level enriches them, enhances their possibilities, and makes them more powerful. The subsequent equilibration of their acquired new properties contributes to the creation of a new and more powerful level of organization.

Agents involved in local interactions cannot initiate such integration. Due to power differential between the two levels, they cannot access the global level. In order to provide such access, global level operations should be expressed in terms of local interactions [16,13]. Only those who operate at the global level can perform this task since they have access to both

the global and the local level. Implementing this task involves combining differences. Therefore, actions of those who perform it are essentially non-hierarchical in nature. The result of this creative act is the emergence of a new and more powerful frame that combines both levels of organization as its particular cases and is an essential condition for the evolution of business organization as a whole.

In order to be efficient and achieve maximum growth, business organizations must efficiently use their strategic resources. The most valuable resource that a company has is the creative potential of its employees. The utilization of this potential is what makes business organization efficient and ensures its survival.

Human creative potential is infinite. Unlike any other resource, human capacity to create does not depreciate when used. It can achieve infinite growth. That is why business organization must strive to utilize the creative potential of all its employees to the maximum degree possible. All its subsystems, not just some of them, must engage in the creation of value. Growth should not be the exclusive preserve of management. All subsystems should contribute to company's growth. All of them must engage in the process that creates new possibilities. All subsystems must function in the manner that generates new possibilities and allows access to new resources. They should all strive and pursue their ideal goals. No doubt these goals will be different. However, these differences are an asset, not a liability. They should not be suppressed or mitigated. Rather, they should be combined to create new possibilities and achieve growth of the entire business organization.

In this new practice, all subsystems are fundamentally equal partners. As equal partners, they should all bring their differences into the common process of creating new opportunities. The process of creation is the main organizing principle of the new practice that will lead to continued and constant creation of new and increasingly more powerful levels of organization. This practice will allow using differences as the fuel for innovation and future growth of business organizations.

REFERENCES

1. Shkliarevsky, G. (2019). Conservation, Creation, and Evolution: Revising the Darwinian Project Revising the Darwinian Project. *Journal of Evolutionary Science, 1*(2), pp. 1–30. https://doi.org/10.14302/issn.2689-4602.jes-19-2990.
2. Pondy, L. R. (1966). A Systems Theory of Organizational Conflict. *Academy of Management Journal*, *9*(3), pp. 246–56. https://doi.org/10.5465/255122.
3. Pondy, L. R. (1967). Organizational Conflict: Concepts and Models. *Administrative Science Quarterly*, *12*(2), pp. 296–320. https://doi.org/10.2307/2391553.
4. Afzalur, R. M. (2002). Toward a Theory of Management Organizational Conflict. *International Journal of Conflict Management*, *13*(3), pp. 206–35. https://doi.org/10.1108/eb022874.
5. Andrade, L., Plowman, D., Duchon, D. (2008). *Getting Past Conflict Resolution: A Complexity View of Conflict.* Management Department Faculty Publications. https://digitalcommons.unl.edu/managementfacpub/62.
6. Gallo, G. (2013). Conflict Theory, Complexity and Systems Approach. *Systems Research and Behavioral Science*, *30*(2), pp. 156–75. https://doi.org/10.1002/sres.2132.
7. Afzalur, R. M. (2011). *Managing Conflicts in Organizations*. Routledge, New York.
8. Raza, S. A. (2011). A Systemic Model for Managing and Evaluating Conflicts in Organizational Change. *Systemic Practice and Action Research*, *24*(3), pp. 187–210.
9. Wils, O., et al. (2006). *The Systemic Approach to Conflict Transformation: Concept and Fields of Application*. Berghof Foundation for Peace Support, Berlin.
10. Rabbino H. T., Ritchie-Dunham, J. L. (2016). Managing the Global to Local Paradox. *The Systems Thinker*. https://thesystemsthinker.com/managing-the-global-to-local-paradox/.
11. Shkliarevsky, G. (2015). Squaring the Circle: In Quest for Sustainability." *Systems Research and Behavioral Sciences*, *32*(6), pp. 629-49.
12. Campbell, D. (2013). Downward Causation in Hierarchically Organized Biological Systems. *ECO*, *15*(3), pp. 139–51.
13. Shkliarevsky, G. (2017). Understanding the Process of Creation: A New Approach. *Management: Journal of Sustainable Business*

and Management Solutions in Emerging Economies, *22*(3), pp. 1–13. https://doi.org/10.7595/management.fon.2017.0021.

14. Henkin A. B., Singleton, C. A. (1984). Conflict as an Asset: An Organizational Perspective. *International Review of Modern Sociology*, *14*(2), pp. 207–20.
15. Kahn, L. (2003). Fundamentals of Conflict for Business Organizations. Mediate.com. https://www.mediate.com/articles/kahnL.cfm.
16. Shkliarevsky, G. (2017). *The Civilization at a Crossroads: Constructing the Paradigm Shift*. Glasstree Publishing, Raleigh, NC.
17. Turkalj, Ž., et al. (2007). Conflict Management in Organization. Paper written in the scope of the project: Regiona University (No.010-0101427-0837).

The Role of Commercial Law in the Conduct of Business

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Abstract—**The legal aspects of business are governed by commercial law. Commercial law is a branch of law that governs the position of companies, other legal entities or persons which appearing as legal entities and regulates legal transactions between entities of commercial law.**

Keywords - contract, incoterms, business, law

I. INTRODUCTION

One of the important functions of law in any society is to provide stability, predictability, and continuity so that people can know how to order their affairs [1]. If any society is to survive, its citizens must be able to determine what is legally right and legally wrong. They must know what sanctions will be imposed on them if they commit wrongful acts. If they suffer harm as a result of others' wrongful acts, they must know how they can seek redress. By setting forth the rights, obligations, and privileges of citizens, the law enables individuals to go about their business with confi dence and a certain degree of predictability. The stability and predictability created by the law provide an essential framework for all civilized activities, including business activities.

What do we mean when we speak of "the law"? Although the law has various definitions, they are all based on the general observation that law consists of enforceable rules governing relationships among individuals and between individuals and their society. These "enforceable rules" may consist of unwritten principles of behavior established by a nomadic tribe. They may be set forth in a law code, such as the Code of Hammurabi in ancient Babylon (c. 1780 B.C.E.) or the law code of one of today's European nations. They may consist of written laws and court decisions created by modern legislative and judicial bodies, as in the United States. Regardless of how such rules are created, they all have one thing in common: they establish rights, duties, and privileges that are consistent with the values and beliefs of their society or its ruling group.

International law is law set up by states and applicable to these states and in most cases their nationals [2]. It is laid down in rules referred to as Treaties, Conventions, Regulations and Declarations. Most states around the world have signed up to several thousand of these rules in which case that state is referred to as a Contracting State of this Treaty or Convention. The effect of signing a Treaty can vary from Treaty to Convention. The states that sign a Treaty or a Convention wish to be bound to this set of rules. Sometimes states reserve the right to determine the effect of this Treaty or this Convention on their state or their nationals at a later point in time.

International law can be divided into International Public Law and International Private Law. International Public Law concerns itself with such issues as the set-up of international institutions (United Nations, European Community, and European Human Rights Court), human rights (European Convention on Human Rights) and the extradiction of nationals from another country to their home country.

The aim of International Private Law is to solve legal problems arising out of different legal systems that apply to international, legal relationships. As every country has its own legal system, so a legal relationship f.e. arising out ota contract of sale may have links with at least two national legal systems. In the event the legal conflict only involves two parties living in the same country, no such choice for a legal system exists. International Private Law provides a set of rules to either decide on the matter, or refer the

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litigating parties to a national legal system where the answer lies.

II. European Law

European Law in itself is also International Law. One of the main differences is the fact that all EC law is based on one Treaty, the EC-Treaty, instead of numerous Treaties on various subjects [2]. Another difference is that several institutions and forms of legislation are based on this EC-Treaty, and this does not happen with Treaties in the field of International Private Law very often. European Law is more important than we often realise since European Law must be applied over the national laws of the countries that have signed the EC-Treaty. Because European Law does not cover all areas where competition takes place between Member States or between undertakings that are or are not of the same Member State, other international rules and also national Regulations still play their role.

Undertakings that operate within one country that is a Member State of the EC, or operate within several EC countries, have to be aware of the rules of European Law. They have to operate within the borders set by the EC-Treaty. The European Commissio~ investigates and decides whether or not the conduct of such an undertaking is, for example, in conflict with the rules of Art. 81 of the EC-Treaty. Is there an agreement that restricts the competition within the EC, or does the undertaking abuse the dominant position they have according to Art. 82 of the EC-Treaty? If so the European Commission is known to have imposed heavy fines on several undertakings for breaking the rules on competition law issued by the EC.

The main objective of the EC is to achieve a general economic integration through the use of a common market where goods, persons, capital and services can circulate freely.

III. International Business Law

International Business Law as a part of International Private Law is a specific field in itself [2]. Until recently every country had its own 'international private law'. Various treaties to cover larger areas of International Private Law were drawn up to offer some guidance as to the use and development of International Private Law. First, here are some examples of topics with which International Private Law is concerned. Every act or conflict in national private law also has an international component.

IV. Legal Systems

Foreign attorneys or legal scholars unfamiliar with the American law or with the Anglo-Saxon legal system in general may be surprised at the constant references [3]. This focus on cases may be especially foreign to legal practitioners of Continental Europe, where cases are viewed as the mere application of the law, and not as a binding source of the law. In France, for example, jurisprudence is viewed as only a persuasive source of the law. Similarly, in Spain, with the exception of statutory interpretation pronounced at least three times by the Supreme Court, a judge is not bound by the interpretations of other courts.

In the United States, in contrast, judges not only interpret the codes that have been enacted, but also, when the legislature has not acted, they may determine the law by elaborating a judicial decision that becomes binding on other judges. The judge's role is thus not limited to applying an abstract legal code. Rather, he has the authority to develop abstract rules that are derived from specific cases. Accordingly, when a judge decides a case presented before him, he not only interprets legislative codes, but also, interprets and applies "case law," which is comprised of decisions made by other judges in former cases sharing facts similar to the case before him.

V. Legal Systems

A business organization is a legal entity through which investors and entrepreneurs provide goods and services and engage in trade and other wealth-generating activities [3]. Traditionally, the menu of American business organizations was comprised of the general partnership and the corporation. Other entities, such as limited liability companies and limited liability partnerships, are in many ways hybrids or statutorily-created variations of partnerships or corporations.

Although a company may appear to be one business association, it may in reality prove to be a multi-tiered conglomerate comprised of many corporations, partnerships, and other business entities. This is in fact the case of many large corporations and other organizations. In

order to circumvent limitations as to the kinds of activities they may undertake, many such companies are organized with very general corporate charters whose language is articulated such that they may engage in "any lawful activity," thus allowing them to serve as umbrella organizations of a large and diverse set of subsidiary companies.

Traditionally, there has been a tension between entrepreneurs, who have long sought to expand the menu of business forms available, and governments, which have resisted such efforts by limiting the available menu. In the United States, the entrepreneur nonetheless has a wide variety of business organizations from which to choose, from small, closely held firms to large, public corporations.

The management practices of business organizations can be as diverse as the forms that business organizations can take. While in small firms, owners and managers are generally the same group of people, in large organizations, a large number of generally passive stockholders which is distinct from the managers usually owns the company. Thus, in small firms, where a small number of managers own the business, decisions are usually made by consensus. In large organizations, in contrast, there may be tens of thousands of shareholders, thus rendering decisions by consensus impractical. In these organizations, policy is generally developed through majority voting.

VI. CONTRACT

Contract law developed over time, through the common law tradition, to meet society's need to know with certainty what kinds of promises, or contracts, will be enforced and the point at which a valid and binding contract is formed [1].

Agreement is required to form a contract, regardless of whether it is formed in the traditional way, through the exchange of paper documents, or online, through the exchange of electronic messages or documents. In today's world, many contracts are formed via the Internet.

An essential element for contract formation is agreement—the parties must agree on the terms of the contract and manifest to each other their mutual assent (agreement) to the same bargain. Ordinarily, agreement is evidenced by two events: an offer and an acceptance. One party offers a certain bargain to another party, who then accepts that bargain. The agreement does not necessarily have to be in writing. Both parties, however, must manifest their assent, or voluntary consent, to the same bargain. Once an agreement is reached, if the other elements of a contract are present (consideration, capacity, and legality—discussed in subsequent chapters), a valid contract is formed, generally creating enforceable rights and duties between the parties.

Because words often fail to convey the precise meaning intended, the law of contracts generally adheres to the objective theory of contracts. Under this theory, a party's words and conduct are held to mean whatever a reasonable person in the offeree's position would think they meant.

A contract is merely a legally enforceable agreement [4]. People regularly make promises, but only some of them are enforceable. For a contract to be enforceable, seven key characteristics must be present.

- Offer. All contracts begin when a person or a company proposes a deal. It might involve buying something, selling something, doing a job, or anything else. But only proposals made in certain ways amount to a legally recognized offer.
- Acceptance. Once aparty receives an offer, he must respond to it in a certain way.
- Consideration. There has to be bargaining that leads to an exchange between the parties. Contracts cannot be a one-way street; both sides must receive some measureable benefit.
- Legality. The contract must be for a lawful purpose.
- Capacity. The parties must be adults of sound mind.
- Consent. Certain kinds of trickery and force can prevent the formation of a contract.
- Writing. While verbal agreements often amount to contracts, some types of contracts must be in writing to be enforceable.

The central principle of contract law that emerged from this period was freedom of contract [5]. Freedom of contract is the idea that contracts should be enforced because they are the products of the free wills of their creators, who should, within broad limits, be free to determine the extent of their obligations. The proper role of the courts in such a system of contract was to enforce these freely made bargains but otherwise to adopt a hands-off stance. The freedom to make good deals carried with it the risk of making bad deals. As long as a person voluntarily entered a contract, it would generally be enforced against him, even if the result was grossly unfair. And since equal bargaining power tended to be assumed, the courts were usually unwilling to hear defenses based on unequal bargaining power. This judicial posture allowed the courts to create a pure contract law consisting of precise, clear, and technical rules that were capable of general, almost mechanical, application. Such a law of contract met the needs of the marketplace by affording the predictable and consistent results necessary to facilitate private planning.

Contract law evolved to reflect these changes in social reality. During the 20th century, there was a dramatic increase in government regulation of private contractual relationships. Think of all the statutes governing the terms of what were once purely private contractual relationships. Legislatures commonly dictate many of the basic terms of insurance contracts. Employment contracts are governed by a host of laws concerning maximum hours worked, minimum wages paid, employer liability for on-the-job injuries, unemployment compensation, and retirement benefits. The purpose of much of this regulation has been to protect persons who lack sufficient bargaining power to protect themselves.

Courts also became increasingly concerned with creating contract rules that produce fair results. The precise, technical rules that characterized traditional common law contract gave way to permit some broader, imprecise standards such as good faith, injustice, reasonableness, and unconscionability. Despite the increased attention to fairness in contract law, the agreement between the parties is still the heart of every contract.

The legal issues inherent in domestic commercial contracts also arise in international contracts [6]. Moreover, additional issues, such as differences in language, customs, legal systems, and currency, are peculiar to international contracts. Such a contract should specify its official language and include definitions for all the significant legal terms used in it. In addition, it should specify the acceptable currency (or currencies) and payment method. The contract should include a choice of law clause designating which law will govern any breach or dispute regarding the contract, and a choice of forum clause designating whether the parties will resolve disputes through one nation's court system or through third-party arbitration. (The United Nations Committee on International Trade Law and the International Chamber of Commerce have promulgated arbitration rules that have won broad international acceptance.) Finally, the contract should include a force majeure (unavoidable superior force) clause apportioning the parties' liabilities and responsibilities in the event of an unforeseeable occurrence, such as a typhoon, tornado, flood, earthquake, war, or nuclear disaster.

VII. INCOTERMS

The responsibilities of the buyer and the seller should be spelled out as they relate to what is and what is not included in the price quotation and when ownership of goods passes from seller to buyer [6]. Incoterms are the internationally accepted standard definitions for terms of sale set by the International Chamber of Commerce (ICC) since 1936. The Incoterms 2000 went into effect on January 1, 2000, with significant revisions to reflect international traders' growing reliance on intermodal transport and the increased use of electronic communications. The new Incoterms also clarify the loading and unloading requirements of both buyers and sellers. Although the same terms may be used in domestic transactions, they gain new meaning in the international arena.

Incoterms include thirteen trade terms plus variations on them [7]. They are classified into four groups—E, F, C, and D—according to the relative responsibilities of each party and to the point at which the risk of loss passes from seller to buyer. The terms are grouped in Exhibit 5.5.

Exhibit 5.5 arranges the terms with the minimum responsibility of the seller and the maximum responsibility of the buyer appearing at the top; the minimum responsibility of the buyer and maximum responsibility of the seller appear at the bottom. International salespeople, export managers, and world traders benefit from a working knowledge of these terms. Incoterms are not automatically part of a contract for the sale of goods. To ensure that the Incoterms definitions will be applied to their contract, parties should include a clause such as "This contract is to be interpreted in accordance with Incoterms."

VIII. ETHICS

A business has a huge assortment of responsibilities [8]. Each responsibility involves a relationship with other people in the community. Some of the responsibilities are more obvious than others. Firms have a responsibility to devote their energies to fulfilling the interests of their owners, certainly. In addition, they owe safe working conditions to the employees who make it possible for the firm to thrive.

Other responsibilities are just as real but perhaps less obvious. A business firm must obey the laws in the countries where it offers its products and services. This course spells out many of those responsibilities, and the list is quite extensive. In addition, firms have a much more abstract ethical responsibility to obey the standards of conduct consistent with prevailing ethics and expectations in the communities where they practice their trade.

Business ethics is a subset of ethics: no special set of ethical principles applies only to the world of business [9]. Immoral acts are immoral, whether or not a businessperson has committed them. Lately, countless business wrongs, such as insider trading, fraudulent earnings statements and other accounting misconduct, price-fixing, concealment of dangerous defects in products, and bribery, have been reported almost daily.

Ethics can be defined broadly as the study of what is right or good for human beings. It attempts to determine what people ought to do, or what goals they should pursue. Business ethics, as a branch of applied ethics, is the study and determination of what is right and good in business settings. Business ethics seeks to understand the moral issues that arise from business practices, institutions, and decision making, and their relationship to generalized human values. Unlike legal analyses, analyses of ethics have no central authority, such as courts or legislatures, upon which to rely; nor do they follow clear-cut universal standards. Nonetheless, despite these inherent limitations, it still may be possible to make meaningful ethical judgments. To improve ethical decision making, it is important to understand how others have approached the task.

Some examples of the many business ethics questions may clarify the definition of business ethics. In the employment relationship, countless ethical issues arise regarding the safety and compensation of workers, their civil rights (such as equal treatment, privacy, and freedom from sexual harassment), and the legitimacy of whistle-blowing. In the relationship between business and its customers, ethical issues permeate marketing techniques, product safety, and consumer protection. The relationship between business and its owners bristles with ethical questions involving corporate governance, shareholder voting, and management's duties to the shareholders. The relationship among competing businesses involves numerous ethical matters, including fair competition and the effects of collusion. The interaction between business and society at large presents additional ethical dimensions: pollution of the physical environment, commitment to the community's economic and social infrastructure, and depletion of natural resources. Not only do all of these issues recur at the international level, but additional ones present themselves, such as bribery of foreign officials, exploitation of lessdeveloped countries, and conflicts among differing cultures and value systems.

In resolving the ethical issues raised by business conduct, it is helpful to use a seeing–knowing–doing model. First, the decision maker should see (identify) the ethical issues involved in the proposed conduct, including the ethical implications of the various available options. Second, the decision maker should know (resolve) what to do by choosing the best option. Finally, the decision maker should do

(implement) the chosen option by developing and implementing strategies.

IX. Cyber Space

Cyber space and e-commerce have become a driving force for the globalization of the world economy, and countries that do not engage in e-commerce may put the competitiveness of their economies at risk [10]. As a result, many firms and organizations in developing countries have become integral parts of global networks of production supply chains that increasingly use e-commerce mechanisms. Through these networks, entities in more developed countries induce developing-country enterprises to adopt new information technologies, organizational changes, and business practices.

The diffusion of cyber use in developing/emerging economies is relatively low. The main stumbling blocks are associated with regulatory, cultural, and social factors, including (1) the lack of regulations dealing with data messages and recognition of electronic signature; (2) the absence of specific legislations protecting consumers, intellectual property, personal data, information systems, and networks; (3) the dearth of appropriate fiscal and customs legislation covering electronic transactions; and (4) the absence and/or inadequacy of laws dealing with cyber crimes.

Today's technological advances are faster (Moore's law) and more fundamental (breakthroughs in genetics). They are driving down costs (computing and communications) at a pace never before seen. Leading these transformations are the accelerated developments in ICT, biotechnology, and just-emerging nanotechnology. Information and communications technology involves innovations in microelectronics, computing (hardware and software), telecommunications, and optoelectronics – microprocessors, semiconductors, and fiber optics. These innovations enable the processing and storage of enormous amounts of information, along with rapid distribution of information through communication networks. Moore's law predicts the doubling of computing power every 18–24 months due to the rapid evolution of microprocessor technology. Gilder's law predicts the doubling of communications power every six months – a bandwidth explosion – due to advances in fiber optic network technologies.

X. Cyber Crime

There is no doubt that the technology utilized by a large number of businesses, including financial institutions, noticeably in developing and emerging countries, is becoming more and more varied, advanced, and innovative [10]. When measuring the gap between financial institutions that are technology centric and those that are not, one finds a notable difference.

The International Telecommunication Union (ITU) has identified five key factors to the success of a cyber security program at the national level; these are: (1) a national strategy; (2) collaboration between government and industry; (3) a sound legal foundation to deter cyber crime; (4) a national incident management capability; and (5) a national awareness of the importance of cyber security.

Attacks and unauthorized uses on businesses and institutions include malicious acts such as theft or destruction of intellectual property, abuse by insiders, and unauthorized access to information that results in a loss of data integrity and confidentiality, as well as malware threats such as viruses, spyware, worms, and Trojans. These cyber attacks affect the trust of cyber users and, as such, lead to apprehension about using the Internet as a means to conduct transactions.

XI. Conclusion

Every legal business starting from certain assumptions. Legal transactions for which the above assumptions is not filled are invalid. Invalid are legal transactions that do not produce legal effects that they would produce under the assumption that they are valid. Invalidity shall be effective from the time of the conclusion of the legal transaction.

References

1. Clarkson, K. W., Miller, R. L. & Cross, F. B. (2012). *Business Law - Text and Cases - Legal, Ethical, Global, and Corporate Environment, Twelfth Edition*. South-Western, Cengage Learning, Mason, USA, pp. 2.; 222.
2. Keizer, J. & Wevers, H. (2010.). *A Basic Guide to International Business Law*. Noordhoff Wolters, Groningen, The Netherlands, pp. 13–17.

3. Balouziyeh, J. M. B. (2013.). *A Legal Guide to United States Business Organizations - The Law of Partnerships, Corporations, and Limited Liability Companies , Second Edition*, Springer-Verlag Berlin Heidelberg, Berlin, Germany, pp. 4–5.
4. Beatty, J. F., Samuelson, S. S. & Bredeson, D. A. (2013.). *Business Law and the Legal Environment, Sixth Edition, Standard Edition*. South-Western, Cengage Learning, Mason, USA, pp. 231.
5. Mallor, J. P., Barnes, A. J., Bowers, T. & Langvardt, A. W. (2013.). *Business Law - The Ethical, Global and E-Commerce Environment, Fifteenth Edition*. McGraw-Hill/Irwin, The McGraw-Hill Companies, Inc., New York, USA, pp. 317.
6. Czinkota, M. R., Ronkainen, I. A. & Moffett, M. H. (2011.). *International Business, Eight Edition*. John Wiley & Sons, Inc., Hoboken, USA, pp. 551.
7. Schaffer, R.; Agusti, F. & Earle, B. (2009.). *International Business Law and Its Environment, Seventh Edition*. South-Western, Cengage Learning, Mason, USA, pp. 178.
8. Kubasek, N., Browne, M. N., Herron, D. J., Dhooge, L. J. & Barkacs, L. (2016.). *Dynamic Business Law - The Essentials, Third Edition*. McGraw-Hill Education, New York, USA, pp. 14.
9. Mann, R. A. & Roberts, B. S. (2011.). *Business Law and the Regulation of Business, Tenth Edition*. South-Western, Cengage Learning, Mason, USA, pp. 14–15; 1016.
10. Shalhoub, Z. K. & Al Qasimi, S. L. (2010.). *Cyber Law And Cyber Security In Developing And Emerging Economies*. Edward Elgar Publishing Limited, Cheltenham, UK, pp. 11; 30.

The Effects of Innovation on the Competitiveness of Southeast European Countries

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Abstract—**New trends in technology create a constant need for innovation both in this industry and in other fields. The speed of acceptance and implementation of innovations has a significant impact on increasing the competitiveness of the enterprises and the state in general. The aim of the paper was to determine whether the innovation impact the competitiveness of Southeast European countries (SEE). Therefore, data for the Global Innovation Index (GII) and the Global Competitiveness Index (GCI) for eight Southeast European countries for the period between 2013 to 2019 were analyzed using the Autoregressive Distributed Lag model. The results showed that there is no long-run relationship between variables, while there is a short-run relationship between innovation and competitiveness in the Southeast European countries.**

Keywords – innovation, competitiveness, SEE countries, ARDL approach

I. INTRODUCTION

The importance of innovation in modern business for the competitive advantage of both businesses and the state is enormous. The new reality that businesses and countries face is seeking new approaches, new skills and knowledge that will help them respond adequately to changes in the environment and create changes that will bring them a competitive advantage. With the development of information technologies, the expansion of markets, their liberalization, the source of competitive advantage changes and it all comes down to transformations and innovations [1]. Therefore, the aim of the paper was to determine whether the innovation impact competitiveness of Southeast European countries (Serbia, Bosnia and Herzegovina, Montenegro, Albania, Croatia, North Macedonia, Romania, and Bulgaria). The hypotheses of the research are Hypothesis 1: There is a long-run relationship between innovation and competitiveness in SEE countries; Hypothesis 2: There is a short-run relationship between innovation and competitiveness in SEE countries.

Paper is structured as follows. Besides the introduction and concluding remarks, there are three sections. Section 2 explains the Global Competitiveness Index and the Global Innovation Index and give a brief literature review. Section 3 gives an overview of the model and methodology used for estimation. Section 4 presents empirical results and discussion.

II. THEORETICAL BACKGROUND

From micro-enterprises to countries, everyone is competing for a globally competitive position in different ways. With the development of information technologies, the expansion of markets, their liberalization, the source of competitive advantage changes and it all comes down to transformations and innovations [1]. Competitiveness is the ability of a country to achieve sustained high rates of economic growth, that is, the ability of a country to create a favorable environment for growth in profitability, productivity and other factors relevant to long-term economic growth. [2] defines the competitiveness of a country as the ability of a country to generate innovation in key industries in order to achieve or maintain an advantage over other countries in many supporting industries. The Global Competitiveness Index (GCI) is a measure of national competitiveness and is published annually by the World Economic Forum.

The competitiveness of an economy speaks of a country's ability to achieve faster economic growth than other countries and to increase prosperity so that its economic structure changes

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and adjusts as effectively as possible to the movement of international exchange [3]. In doing so, each country must improve the competitiveness of its economy in order to enable a higher standard of living, employment opportunities and a better position in the international context.

The Global Competitiveness Index (GCI) deals with the measurement of the average of multiple microeconomic and macroeconomic components, which are individually evaluated on a scale of 1 to 7 [4]. All measured indicators are grouped into twelve pillars.

The most commonly used measure of innovation is the Global Innovation Index (GII) published by the World Intellectual Property Organization (WIPO), American Cornell University and INSEAD Business School in Paris. GII measures the innovation capacities of countries across the world. It provides comparative analyses which facilitate the understanding of the differences in innovation capacities [5]. The Global Innovation Index provides detailed indicators of innovation performance based on 81 indicators that explore visions of innovation including institutions, human capital and research, business sophistication, infrastructure, market sophistication, knowledge and technology outputs, and creative outputs.

In [6] the relationship between innovation and competitiveness in 29 European countries using the Innovation Union Scorecard (IUS) and International Institute for Management Development (IMD) World Competitiveness Yearbook (WCI) is examined. The results showed that innovation has a direct positive impact on national competitiveness.

In [5] the effects of innovation on competitiveness using panel data analysis are examined. The results showed that two determinants of innovation, knowledge and technology output and creative output positively affect competitiveness.

New trends in technology create a constant need for innovation both in this industry and in other fields. The speed of acceptance and implementation of innovations has a significant impact on increasing the competitiveness of the enterprises and the state in general. Therefore, it is necessary to assess whether innovation affects the competitiveness of countries.

III. Data and Methodology

Annual data for Global Competitiveness Index (GCI) and Global Innovation Index (GII) are used for the period from 2013 to 2019 for eight SEE countries (Serbia, Bosnia and Herzegovina, Montenegro, Albania, Croatia, North Macedonia, Romania, and Bulgaria). Data were retrieved from Global Competitiveness Reports 2013-2019 and Global Innovation Index Reports 2013-2019.

The following equation set the model:

$$GCI = \int (\mathrm{GII}). \tag{1}$$

Therefore, the following long term (2) and short term (3) equations will be estimated simultaneously:

$$GCI_{it} = \alpha_1 + \sum_{l=1}^{p_{i-1}} \beta_{il}^{*} GCI_{i,t-1} \sum_{l=0}^{q_i} \delta_{il}^{*} GII_{i,t-1} + e_{it}, \tag{2}$$

$$DGCI_{it} = \varphi \mathrm{ECT}_{\mathrm{i,t\text{-}1}} + \sum_{l=1}^{p_{i-1}} \beta_{il}^{*} DGCI_{i,t-1} + \sum_{l=0}^{q_i} \delta_{il}^{*} DGII_{i,t-1} + \alpha_2 + e_{it}. \tag{3}$$

Where β_{il}^{*}, δ_{il}^{*}, β_{il}, δ_{il}, are short-run coefficients; GCI_{it} is Global Competitiveness Index of country i in period t, a proxy for competitiveness; GII_{it} is Global Innovation Index of country i in period t, a proxy for innovation, $t = 2013,\ldots 2019$.

Levin, Lin and Chu (LLC) [7] and Phillip-Perron (PP) unit root tests were applied to determine whether the data are integrated of the same order. Kao test of cointegrations was used to determine whether there is cointegration between variables. Auto-Regressive Distributed Lag (ARDL) approach was used to determine whether there are a short-run and long-run relationship between competitiveness and innovation.

IV. Results and Discussion

Tab. I shows the descriptive statistics of the variables included in the model. The average value of GCI in the period from 2013 to 2019 was 4.14, while the minimum was 3.71 (Bosnia and

Herzegovina in 2015) and the maximum was 4.54 (Romania and Bulgaria in 2019). The average value of GII in the observed period was 36.56, while the minimum was 28.40 (Albania in 2016) and the maximum was 42.80 (Bulgaria in 2017).

TABLE I. DESCRIPTIVE STATISTICS

	GCI	GII
Mean	4.14	36.56
Standard Deviation	0.20	3.99
Minimum	3.71	28.40
Maximum	4.54	42.80
Number of observations	56.00	56.00

Source: Author's calculation in EViews 10

Levin, Lin and Chu (LLC) (2002) and Phillip-Perron (PP) unit root test were used to determine the order of integration between variables. Tab. II shows the results of the LLC and PP unit root tests. Since it is concluded that there is no trend in the data, only LLC and PP unit root tests with individual intercept were used. The results show that data are not integrated of the same order; variable GCI is not stationary at level, I(1), while variable GII is stationary at level, I(0). Therefore, the Auto Regressive Distributed Lag model can be used to determine the relationship between variables [8].

TABLE II. RESULTS OF LLC AND PP UNIT ROOT TESTS

	LLC unit root test	PP unit root test
Variable	t-statistic	t-statistic
GCI	-0.91	9.54
D(GCI)	-4.60*	26.35**
GII	-5.92*	33.85*

* statistically significant at 1% level
** statistically significant at 5% level
Source: Author's calculation in EViews 10

Kao test of cointegration [9] was used to test the null hypothesis that there is no cointegration among variables when GCI is the dependent variable. The results of Kao test showed that the null hypothesis must be rejected and that there is cointegration among variables ($t=-0.35$, $p<0.05$). Since the variables are not integrated of the same order, panel ARDL model developed by [8] may be applied to determine whether there are a short-run and long-run relationship between competitiveness proxied by GCI and innovations proxied by GII.

The optimal lag length is determined using the Akaike Information Criterion (AIC) and found to be ARDL (1, 1). Tab. III shows the model estimation results for the long-run and short-run relationship between GCI and GII.

TABLE III. ARDL MODEL ESTIMATES

Variable	Coefficient	Std. Error	t-Statistic	p
Long Run Equation				
GII	0.06	0.01	9.68	0.00
Short-run Equation				
CointEq	-0.27	0.19	1.39	0.18
D(GII)	-0.03	0.01	-2.96	0.01
C	0.59	0.39	1.51	0.14
Mean DV	0.03	S. D. DV		0.09
S. E. of regre.	0.07	AIC		-1.99
Sum sq. resid	0.14	Schwarz criterion		-1.09
Loglikelihood	80.81	Hannan-Quin crit		-1.64

Source: Author's calculation in EViews 10

The results showed that there is a long-run relationship between competitiveness (GCI) and innovation (GII). There is a positive long-run relationship between these variables. The results are in line with the results obtained by [6] for EU countries. The error correction term for both EU is negative and statistically non-significant, so it cannot be concluded how much of the disequilibrium caused by a shock in the short run will be corrected in the long run. The results showed that there is a short-run relationship between GCI and GII and that this relationship is negative. The results for the short-run relationship are opposed to the results for the long-run relationship. Furthermore, short-run coefficients for individual countries: Serbia, Albania, Romania, Bulgaria, North Macedonia, Croatia, Montenegro, Bosnia and Herzegovina, were examined. Tab. IV shows the results.

TABLE IV. SHORT-RUN COEFFICIENTS FOR INDIVIDUAL COUNTRIES

Country	CointEq	D(GII)	C
Serbia	-0.088**	0.001**	0.255
Bosnia and Herz.	-0.866*	-0.036*	1.692*
Montenegro	0.068	0.011*	-0.119
Albania	-0.073	-0.045*	0.193
Croatia	0.486*	-0.008*	-0.879*
North Macedonia	-0.226*	-0.033*	2.580*
Romania	-0.022	-0.063*	0.079
Bulgaria	-0.436*	-0.048*	0.904

* statistically significant at 1% level
** statistically significant at 5% level
Source: Author's calculation in EViews 10

The error correction term for Serbia, Bosnia and Herzegovina, North Macedonia, and Bulgaria is negative and statistically significant. It shows how much of the disequilibrium caused by a shock in the short run will be corrected in

the long run. Error correction term shows that that in response to a shock the speed of adjustment towards equilibrium is 86.60% annually in Bosnia and Herzegovina, 43.60% in Bulgaria, 22.60% in North Macedonia, and 8.80% in Serbia. Therefore, convergence to the long-run equilibrium will be faster in the Bosnia and Herzegovina than in other countries (Tab. IV). Results also showed that there is a short-run relationship between GCI and GII in all countries and the relationship is negative and statistically significant in all countries except Montenegro and Serbia where the results showed a positive and statistically significant relationship. Results for Montenegro and Serbia are opposed to the results obtained for all SEE countries (Tab. III).

V. CONCLUSION

The research is examined whether there is a relationship between innovation and competitiveness. Auto-Regressive Distributed Lag model was used to test the model. The results showed that there is a positive long-run relationship between innovation and competitiveness, so hypothesis 1 that there is a long-run relationship between innovation and competitiveness in SEE countries is confirmed. The results also showed that there is a short-run relationship between innovation and competitiveness, so hypothesis 2 that there is a short-run relationship between innovation and competitiveness in SEE countries is also accepted. The results for short-run coefficients for individual countries also showed that there is a short-run relationship between innovation and competitiveness.

Future research should include more countries, depending on the availability of the data, and to perform better analysis over a more extended period. Besides, it is also possible to include countries with higher levels of development to highlight differences between developed and developing countries.

REFERENCES

1. Jovičić, M., & Mirković, M. (2016). Innovation and competitiveness in the global level. *Novi ekonomist*, 64-72, DOI: 10.7251/NOE1620064J
2. Porter, M. E. (1990). *The Competitive Advantage of Nations*. London: Macmillian
3. Bienkoski, W. (2006). How much are studies of competitiveness worth? Some critical theoretical reflections on the issue. *The Second Economic Forum On "New Europe"*. pp. 88-103.
4. Schwab, K., & Porter, M. (2008). The global competitiveness report 2008-2009. *World Economic Forum*. pp. 1-63
5. Dogan, E. (2016). The effect of innovation on competitiveness. *Ekonometri ve İstatistik Sayı, 24*, pp. 60-81.
6. Ciocanel, A. B., & Pavalescu, F. M. (2015). Innovation and competitiveness in European context. *Procedia Econ. Finan.,* pp. 728–737.
7. Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: *Asymptotic and finite-sample properties, Journal of Econometrics, 108*, pp. 1–24.
8. Pesaran, M. H., Shin, I., & Smith, R. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association, 94*, pp. 621-634.
9. Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics, 90*(1), pp. 1-44.

The Impact of Oil Price Change on the GDP of OPEC Countries

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Abstract—**Petroleum economics is the field that studies human utilization of petroleum resources and the consequences of that utilization. Petroleum use allows the production of energy. Resources can be regarded as renewable or depletable; petroleum falls into the latter category, which can have an effect on pricing strategies. Crude oil is one of the main natural feedstocks used to meet energy demands and price variation has a significant influence on the society development. A large amount of research suggests that oil price fluctuations have considerable consequences on economic activity. These consequences are expected to be different in oil importing and in oil exporting countries. Whereas an oil price increase should be considered positive news in oil exporting countries and negative news in oil importing countries, the reverse should be expected when the oil price decreases. The paper investigates the co-movements and causality relationship between oil prices and GDP of selected oil exporting countries. Our assumption is decreasing oil prices has a negative impact on the GDP of such countries.**

Keywords - oil price, GDP, relationship, export, impact

I. INTRODUCTION

The causality testing is based on the Granger-causality concept [1]. Earlier studies assumed a symmetric relationship and generally found causality running from oil prices to GDP. The asymmetric specification which is based on [2] oil price increase and decrease and also Hamilton's [3, 4] net oil price increase specifications significantly improved model specification of the oil price-economics. [5] identified the changes in the causality relationship between oil prices and GDP while searching for a statistically stable specification. The works of Hooker [5, 6] and Hamilton [3, 4] has played a very important role in establishing a stable statistical relationship between oil price changes and GDP. Generally, the interaction of the oil price-GDP relationship with the models of transmission channels has improved the understanding on how oil prices might influence a macroeconomic aggregate such as GDP. [3, 4] was the first to report the weakening statistical relationship between oil prices and GDP.

According to [7], these specifications did not entirely settle the question of whether a stable, long-term relationship between oil prices and other macroeconomic variables existed. Finn's [8] specification of a similar aggregate model reveals that an oil price shock causes sharp, simultaneous decreases in energy use and capital utilisation. Using bivariate and multivariate VAR specifications, [9] examined the stability of the oil price GDP relationship over the period 1954-1995. [10] found that terms of trade volatility are significantly related to increased oil price volatility, as opposed to fluctuations in exchange rates. [11] examined how oil prices affect the output growth of selected countries that are considered either net-exporters or net importers of oil using time-series technique. [12] analysed the effect of oil prices on real macroeconomic activity employing both linear and non-linear specifications. The paper describes evidence of both linear and non-linear impacts of oil price shocks on real GDP.

The purpose of the analysis is to investigate the impact of the change in the price of oil on the GDP per capita (pc) of three country-specific groups.

II. MATERIAL AND METHODS

To answer these questions, the 13 OPEC countries were selected, whose GDP pc values were examined through the 16-year data series (2002-2017).

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The estimated GDP pc (thousand USD) was abbreviated as GDP pc during the analysis.

During the analysis, general statistical methods (descriptive statistics, regression, correlation calculations, etc.) were used and the results were illustrated by appropriate types of graphs.

III. FINDINGS

Country groups (including abbreviations) in the study were as follows:

(OPEC Countries)

1. Saudi Arabia (SAU)
2. United Arab Emirates (ARE)
3. Iran (IRN)
4. Iraq (IRQ
5. Kuwait (KWT)
6. Venezuela (VEN)
7. Nigeria (NGA)
8. Qatar (QAT)
9. Angola (AGO)
10. Algeria (DZA)
11. Indonesia (IDN)
12. Ecuador (ECU)
13. Libya (LYB)

First of all, let us examine the oil price changes per country between 2000 and 2018 (Fig. 1) [13].

Fig. 1 clearly shows that oil price changes can be divided into 3 phases. The first period (2002-2008) shows a relatively steady increase in oil prices. During the period under review, oil prices were almost quadrupled and annual average growth rate was 25.4% while the average annual growth rate was USD 12.04.

The following part will analyze the impact of oil change on OPEC Member States.

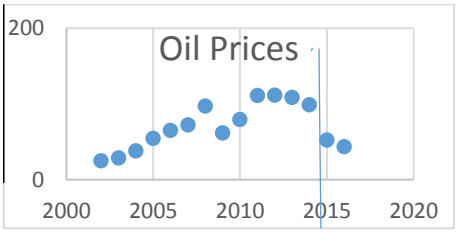

Figure 1. Oil price changes 2000-2018.
Source: authors' own editing, 2019

Based on the descriptive statistics it can be stated that QAT with high GDP pc shows a balanced moderate growth and thus can be characterized by a small relative scattering value. With the decline in its stronger GDP pc (Fig. 2), ARE follows with relatively high relative scattering (s% = 20.6%), while the relative deviation of KWT's moderate GDP pc fluctuation is also more moderate (s = 13.4 %).

The relative scattering of the other countries with a relatively low GDP pc range widely (from 7% to 26.5%). There is no clear link between the GDP pc and the relative scattering value.

Fig. 2 above clearly shows that the decline in the oil price did not affect the growth of the GDP pc value of the most advanced country, QAT. Two advanced oil exporting countries experienced a decline in GDP pc in the years prior to the decline in oil prices: KWT and ARE. VEN and SAU with a much smaller GDP pc also did not react sensibly to a relatively stable change in oil prices for the average value of $ 13 (VEN) and US $ 19 (SAU), with a moderate increase over the period under review. The annual average growth per person is approximately USD 262 (SAU) and USD 329 (VEN).

TABLE I. THE DESCRIPTIVE STATISTICS OF GDP PC

Countries	SAU	ARE	IRN	IRQ	KWT	VEN	NGA
mean	19785.35	45332.63	6089.14	4539.48	40878.53	13078.73	2153.35
s	1379.03	9320.15	505.07	845.61	5467.48	1591.87	379.99
s%	**6.97**	**20.56**	8.29	18.63	**13.37**	**12.17**	17.65
Countries	QAT	AGO	DZA	IDN	ECU	LBY	QAT
mean	66606.11	3143.06	4420.55	3107.77	4717.31	9138.57	66606.11
s	3238.75	690.20	302.01	609.02	529.47	2420.78	3238.75
s%	**4.86**	21.96	6.83	19.60	11.22	26.49	**4.86**

Source: authors' own editing, 2019

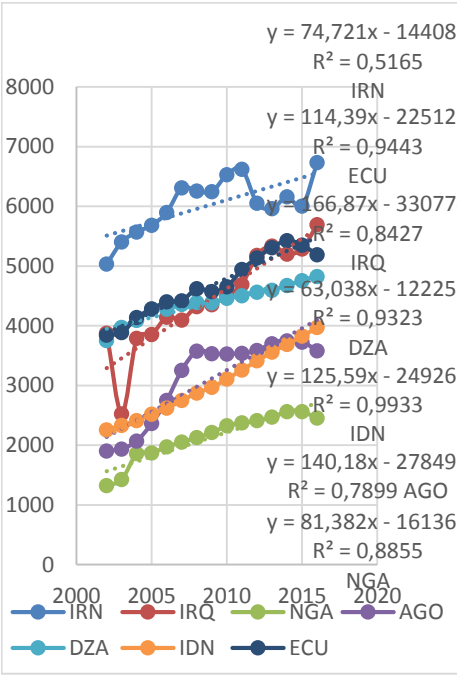

Figure 2. Changes in GDP pc values for the 7 lowest GDP pc values per country in time (2002-2016). Source: authors' own editing, 2019

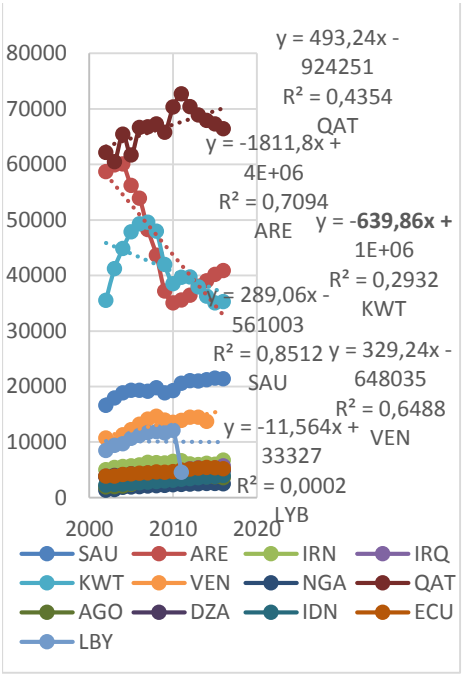

Figure 3. Changes in GDP pc values in time (2002-2016). Source: authors' own editing, 2019

LBY, which is still in the middle of the B country group, has reacted sensibly to the decline in oil prices, GDP pc significantly decreased.

The other 7 countries in Group B have low GDP pc (less than USD 10,000 / person). Of these, two countries showed moderate RDA (s% = 8,2%), DZA (s% = 6,8%) while the other more pronounced fluctuations (11% to 21% relative scattering values, respectively) over the period under review for GDP pc (Fig. 3).

The countries with the 7 lowest GDP pc figures are illustrated in a separate graph so that the GDP pc values can be better seen in time. (Group B- Fig. 4).

The figure shows that almost all countries have experienced a decline after the oil price decline. Only one country is the exception: IDN, where the GDP pc has been growing steadily

The figures above (Fig. 3 and Fig. 4) present the relationship between oil price and GDP pc. It is conspicuous that in a country (ARE) the relationship is negative (r = -0.72), i.e. the change in GDP pc is contrary to the oil price change. There are probably other (economic) background

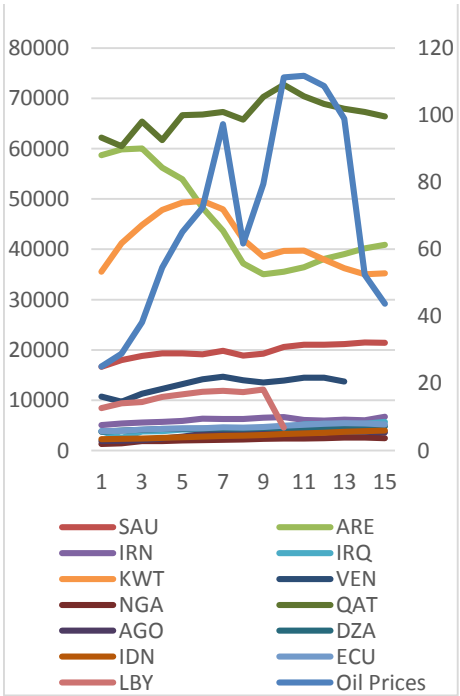

Figure 4. Development of oil prices and GDP pc in time (2002-2016). Source: authors' own editing, 2019

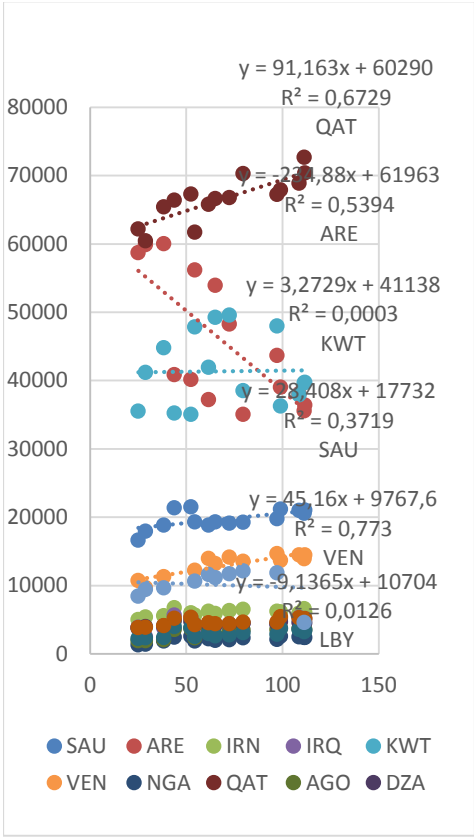

Figure 5. The main correlations between oil price and GDP pc (Part 1).
Source: authors' own editing, 2019

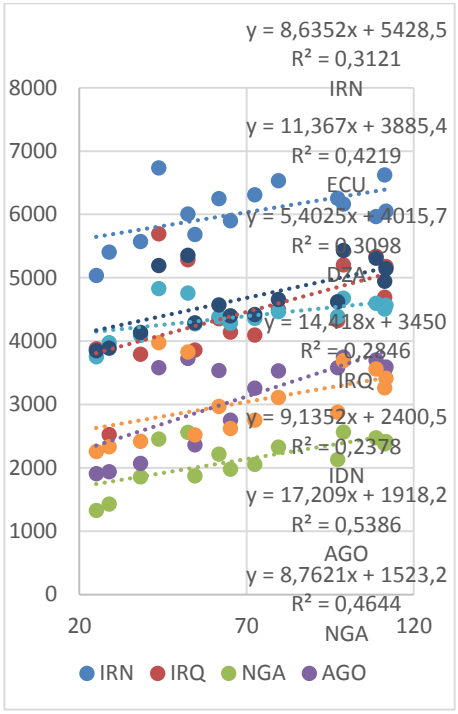

Figure 6. The main correlations between oil price and GDP pc (Part 2).
Source: authors' own editing, 2019

variables, and we do not measure the effect of oil change directly.

It can be seen from the figures (Fig. 5 and Fig. 6) that the GDP pc's stronger dependence is due to the yearly effect (changing the general economic environment) and oil price change is not clearly detectable. In some cases, the relationship can be statistically verified, such as in QAT, where oil and GDP pc relationship are tight (r = 0.82), while in the case of KWT, oil price change does not show a significant relationship with GDP pc.

When looking at the data of Tab. II it can be concluded that the yearly effect (general economic environment) had a significant effect on each county.

TABLE II. COMPARISON OF THE TIGHTNESS OF CORRELATION BETWEEN GDP PC VALUES AND OIL PRICES AND THE YEARLY EFFECT

Group B	r (oil)	r (year)
SAU	0.57	0.90
ARE	-0.72	-0.80
IRN	0.43	0.77
IRQ	0.45	0.93
KWT	0.07	-0.61
VEN	0.88	0.81
NGA	0.64	0.92
QAT	0.82	0.57
AGO	0.70	0.85
DZA	0.47	0.97
IDN	0.37	1.00
ECU	0.58	0.96
LBY	0.00	-0.53

(Critical value on 5% significance level r=0.497)
Source: authors' own editing, 2019

IV. Conclusions

The values indicated by the yellow are not significant, so in these cases there is no correlation between the effect of the affecting factor (in our case the oil price) and GDP pc.

It is worth mentioning that it had the least impact on the most developed country (QAT). (A stable economy is less affected by changes in other economic environments.)

We also had a smaller and negative effect on LBY due to the deteriorating economic situation.

The impact of oil price change on GDP pc in 7 of the 13 countries was significant and there were no verifiable links in 6 cases.

In general, it can be stated that the yearly effect (general economic environment, including oil price) has a greater role to GDP pc than just oil price change.

Countries with a more stable economy or not only relying on oil export are less exposed to oil price fluctuations.

References

1. Granger, W. J. (1969). Investigating Causal Relations by Econometric Models and Cross Spectral Methods. *Econometrica, 36*, pp. 424-438.
2. Mork, K. A. (1989). Oil and the Macroeconomy when Price Go Up and Down: An Extension of Hamilton.'s Results. *Journal of Political Economy, 97*, pp. 740 -744.
3. Hamilton, J. D. (1996a). This is What Happened to the Oil Price-Macro economy Relationship. *Journal of Monetary Economics, 38*, pp. 215-220.
4. Hamilton, J. D. (1996b). Analysis of the Transmission of Oil Price Shocks through the Macroeconomy. Paper presented at the DOE Conference, International Energy Security. Washington D.C.
5. Hooker, M. A. (1996a). What Happened to the Oil Price Macroeconomics Relationship? *Journal of Monetary Economics, 38*, pp. 195-213.
6. Hooker, M. A. (1996b). This is What Happened in the Oil Price Macroeconomics Relationship: Reply. *Journal of Monetary Economics, 38*, pp. 221-222.
7. Rotemberg, J., Woodford (1996). Imperfect Competition and the Effect of Energy Price Increases on Economic Activity. *Journal of Money, Credit and Banking, 28*, pp. 549-577.
8. Finn, M. G. (2000). Perfect Competition and the Effect of Energy Price Increase on Economic Activity. *Journal of Money, Credit and Banking, 32*, pp. 400-416.
9. Hooker, M. A. (1999). *Oil and the Macroeconomy Revisited. Federal Reserve Board*. Washington, D. C.
10. Backus, D., & Crucini, M. (2000). Oil Prices and the Terms of Trade. *Journal of International Economics*, *50*, pp. 185-213.
11. Bercement, C. (2009). The Impact of Oil Price Shock on the Economic Growth of MENA Countries. *The Energy Journal*, Vol. 31, No. 1.
12. Aliyu, S. U. R (2009). *Oil Price Shocks and the Macro economy of Nigeria: A Non-linear Approach*. MPRA Working Paper, Bayero University, Kano.
13. Federal Reserve Economic Data (2019) https://fred.stlouisfed.org.

E-learning: Analysis, Advantages and Disadvantages

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Abstract — **The paper is focused on e-learning overview: from plurality of definitions to distinction in between e-learning and distance learning, classification, time frames and levels of e-learning. Furthermore, pedagogical aspect and characteristics of e-learning process are presented and basic concept of quality of e-learning. The paper also summarizes overview of advantages and disadvantages with summary and the anticipated development of e-learning as a form of learning.**

Keywords - e-learning, pedagogical, advantages, disadvantages

I. INTRODUCTION

For several decades, information technologies have been represented in education. Due to fascinating development of the Internet in the current decade (in terms of number of users, connection speed, and development of devices that can be connected to the Internet and the availability of various, even educational materials on it), usage of e-learning is increasing around the globe. The classical methods of education can now be supplemented with various multimedia content and interactive features that make this activity of higher quality and more interesting (especially for younger generations) [1].

E-learning is a process of education or supplementation of the classical form of education, which is carried out with the help of the Internet and various multimedia content and interactive elements. Furthermore, e-learning also includes the enrichment of traditional teaching, and a common example of how e-learning is performed is to visualize the teaching theme with the help of a projector, a computer, and a projection screen or display. Technology has become involved as an important factor in the process of knowledge transfer [1].

While online learning, as the dominant form of distance learning, as its name implies, is necessary to be online, e-learning is a broader term that does not just mean teaching and learning through networks [2]. This is to make a distinction between the two terms mentioned, as they are often identified in public. So, for participating e-education it is not necessary to be connected to the Internet, although e-learning usually involves learning through the Internet with the help of multimedia units and a lot of interaction, which the learner attends during the class.

This learning model has become possible because there is a large amount of different data on the network (also from almost all the world's famous libraries and archives), as well as the possibility of sharing it. In student-content-teacher relations, digital technology became an important factor in the process of knowledge transfer. In multimedia education, each individual medium can maximize its overall performance by making full use of its characteristics. Teaching thus becomes more experiential, rational and effective, giving full effect by combining written text with video, music and sound effects, animations, etc., which is suitable for students who are comfortable with different types of learning [3]. “E-learning is an interactive and two-way process between teachers and students with the help of electronic media with the emphasis on the process of teaching while the media are only the tool that completes the process” [4].

The number of programs and platforms that provide opportunities for children and young people to acquire adequate knowledge through the Internet is increasing every day.

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II. Classification and Time Frame of E-learning

E-learning as a form of education exists as a completely independent form, but also as an integral or complement to classical education. Depending on the intensity and usage of information technology, there are several forms of e-learning [1]:

- Learning with the help of information technologies
- Learning that uses technology to improve knowledge transfer
- Hybrid or mixed learning - a combination of classroom teaching and information technology learning
- Online (distance) learning - learning that is fully organized with the help of information technologies, so that the participants do not meet in person.

E-learning is taught in accordance with the technology of delivery of teaching content, and can be divided into asynchronous and synchronized in the literature.

Asynchronous learning is one in which teacher-student interaction occurs from time to time, hence with a delay of time. The teacher and the student communicate, while their activities are not synchronized in time.

Synchronous learning involves the interaction of teachers and students in real time, and activities are carried out according to a predetermined plan that ensures synchronization.

III. Levels and Implementation of E-learning

There are two basic types of e-learning: mixed-hybrid learning, which involves the combination of classical classroom teaching and information technology teaching and "pure" e-learning, a form of learning in which students learn independently and online. E-learning is a process that cannot be activated at once. It is accepted in four cycles [5]: the first stage of e-learning is improving traditional teaching with new materials and tools, but without changing teaching methods (for example, using Power Point presentations in teaching, using the Internet for research purposes, the use of e-mail in teacher- students communication, etc.). In the second stage of e-learning, new tools for managing (such as software for the distribution of teaching materials and tests that can provide electronic communication between teachers and students, processing and monitoring of learning outcomes, etc.) are introduced in teaching. The third level of e-learning involves creating, sharing and using reusable learning objects that are made upon a declared standard. These learning objects can be different in nature - from purely textual metadata documents to complex learning platforms that provide a large amount of different content and a high level of student interaction with the curriculum. The highest level of implementation of e-learning refers to the new program configurations that arise when teachers and educational institutions completely redesign learning activities and teaching to reap the full benefits of new technologies, without any admixture of traditional teaching.

We have to keep on mind that the introduction of e-learning in an environment is not an instant process. On the contrary, in order to efficiently introduce e-learning in teaching we have to meet some basic requirements. Three basic preconditions for the introduction of e-learning in the classroom are: existence of appropriate standards; strategic equipment of educational institutions for the introduction of information and communication technologies in the educational process; and support to e-learning [6].

"A synonym for modern education today is e-learning, but the introduction of this system of education is not a simple process. For the effective implementation of e-learning in the educational process it is necessary to fulfill three basic conditions: the existence of appropriate standards, strategic equipment of educational institutions for the introduction of ICT in the education process and support e-learning" [7].

IV. Pedagogical Aspects and Characteristics of E-learning

It is well known that the average student notices only ten percent of what he has read, 20 percent of what he has heard, 30 percent of what he has seen, 50 percent of what he has heard and seen at the same time, 70 percent of what he can dramatize and write himself and 90 percent of what he designed and wrote. That is why such concept of learning should be applied in which pedagogical situations would engage the whole personality of the student, all his mental, affective and conative capacities. These situations are most successfully produced by

multimedia learning [3]. Contemporary pedagogy has been rapidly embracing the development of technology that can be used in all e-learning, developing a multitude of theoretical and practical models. Due to its flexibility, e-learning is becoming increasingly popular as it offers the learner an opportunity to work independently, engage and progress according to individual needs, abilities and interests. The multiplicity of ideas and the ability to exchange them quickly improves quality, and there has been an interest in using new learning processes [1].

The changes and opportunities that e-learning brings in pedagogical sense are [2]:

- Flexibility of time and place of attendance. While traditional education means a place where teaching and the transfer of knowledge are carried out, today it is no longer necessary. Therefore, not all participants in the education process need to be in the same place and at the same time. There are several types of teaching that can be distinguished here by time and place: same time and place (classic classrooms with multimedia presentations), same time and different places (videoconferences), different times and same place (electronic forums and tests), different times and different places (emails, online forums, video conferences, etc.).

- Interactivity in communication: student - student; student - teacher; students - teacher. Successful e-learning must enable multiple modes of communication. It is most commonly used in various forms of discussion forums, e-mail, audio communications and various forms of simulations and animations.

- Individual access to students. This element implies a high level of focus on the student (which makes it extremely suitable for adult education), insists on developing opinions and acquiring new skills. Therefore, the pace and dynamics of work of each level of e-learning can be adapted to each student individually, and external disturbances are minimized. Therefore, there is no disruptive factor in the case of classical group and teaching where it generally happens that group members are progressing at a different pace when acquiring knowledge. As a result, psychological, didactic and methodical circumstances are different.

- Possibility to increase the level of motivation for teaching and education. By applying the different elements and strategies of e-learning, especially older students and employees can be motivated to learn or continue.

- Global knowledge reflected through access to learning materials from different educational systems and countries, as well as access to digital databases, libraries, cultural and other centers.

- Cost-effective (the cost of distance education is lower because fewer teachers work with more students, the cost for students is lower because they can study in the place of residence, they do not have to go to classes, except for consultations and exams).

V. Advantages and Disadvantages of E-learning

Based on the literature, we will try to summarize the basic advantages and disadvantages of eLearning.

Among the main benefits of e-learning are [1]:

a) Time and space flexibility

E-learning is tailored to the individual needs of the user (anytime and / or anywhere). Thus, students have the opportunity to learn independently of time and position, making education accessible to those who would not be able to come to the classroom, e.g. due to geographical distance, inability to fit work responsibilities with traditional teaching, health difficulties, etc. Furthermore, e-learning enables continuous learning, i.e. the concept of lifelong learning.

b) Student-teacher interaction

As communication takes place with the help of IT and the Internet (e.g. e-mail, forums), e-learning can be more intense, better measured, and often more meaningful than communication in traditional teaching. In this form of teaching, questions are often asked more freely, without fear of the authority of teachers, which is extremely important for people with poorly developed live communication.

c) Communication and group work

Discussion with other participants (e-mail, forum, chat, teleconferences, etc.). Teamwork on collaborative projects through e-learning can develop social and communication skills.

d) Global access to educational content

E-learning has provided access to materials from all over the world, which is usually not possible in classical teaching.

e) More up-to-date and up-to-date educational materials and easier professional development

Learning content can be tailored to individual students, e.g. content can be added for those with poorer start knowledge, as well as for more advanced students who want to learn more. Because of its concept of accessing more material than conventional teaching, e-learning makes it easier to get further training or retraining.

f) Interactive learning content

E-learning uses a variety of media (text, photography, display, sound, video, animation, etc.), which, according to many studies, makes it easier to acquire knowledge.

g) Temporal openness

Content availability can be 24 hours every day of the week.

h) Unlimited students

An unlimited number of students in the e-classroom are enabled.

i) Easier assessment and monitoring of students

With e-learning, the teacher has the opportunity to test each student's knowledge in many ways and at different time intervals, and to more easily monitor each student's acquisition of knowledge.

j) High level of individuality and personalization

Students learn independently, at their own pace, in a place and time that they choose, at different levels of interaction.

E-learning has its disadvantages as well:

a) Certain knowledge and skills are required for e-learning

Without some technical literacy, higher levels of e-learning are sometimes difficult to track.

b) Greater responsibility and motivation of users

E-learning brings greater responsibility to students. They often have to motivate themselves, which can lead to questionable results and poor progress in the learning process. Also, according to some studies, e-learning has a large number of students dropping out of the program.

c) Lack of live contact between the student and the teacher

Due to lack of live contact with the teacher, students may experience a sense of loneliness and distance, which can have a disincentive to the motivation to learn. Loss of human contact and body language (non-verbal communication) can be modeled by a lack of understanding. Also, this counts for the absence of oral exams and proficiency tests.

d) Conditionality of technology available

For technically demanding programs, all students need to have the appropriate technology at their disposal, such as a computer with an adequate version of a web browser, programs for displaying multimedia records, high-speed Internet connection, etc. The technology used for a course can be very demanding (for example videoconferencing), and thus preventing the attendance of those students to whom the technology is (to a sufficient extent) not available.

e) The equipment is not 100% reliable

Even the highest quality e-learning equipment is not 100% reliable. If technical problems lead to interruption in e-learning, there will certainly be a decrease in motivation and concentration of users, and consequently a decrease in the quality of e-learning.

f) There are areas that cannot be studied exclusively electronically

When it comes to e-learning in form of distance learning, there are limitations to certain programs that include lab work, demonstration exercises, etc. This is especially pronounced in the field of medical and technical sciences, as well as in traditional arts disciplines.

VI. CONCLUSION

The modern age imposes the imperative of IT and Internet in almost every sphere of life, including education. This was reflected in the rapid development of different forms and models of e-learning. Due to its flexibility, this learning model is becoming increasingly popular as it offers the learner ample opportunity to work independently, engage and progress according to individual needs, abilities and interests. The multiplicity of ideas and the ability to exchange them quickly improves quality, and there has been an interest in using new learning processes.

New technology enables teachers and students to raise their learning to a higher level of thought, to engage in analysis, synthesis, inference. Instead of repetition, drill (exercise) and playback, teaching can focus on discovering and solving problems. The teacher can devote more time to interaction in the classroom, relationships in the teaching process, individual approach to students [8].

It is certain that the presented forms and models will continue to evolve, just as researchers and practitioners in this field will seek to innovate. In this endeavor, technology will play important role in creativity of designing teaching process that makes the most of all the benefits of information technology, while minimizing their disadvantages [1].

Leading e-learning organizations and institutions around the World are working to focus on developing and refining e-learning standards. The basic starting point is the need for knowledge management. Therefore, the development of technology and standards will play an important role in the further development of e-learning. Basic direction is creation of platforms (or upgrading of existing ones) that will allow easier access and implementation of teaching content, but also facilitate the exchange of teaching materials and communication between different e-learning platforms. E-learning as such is the present and the inevitable future, which will eventually take on an increasing number of students of all ages.

REFERENCES

1. Perić, N. & Rašević, J. (2017). E-learning: global analysis. [E-učenje: globalna analiza]. *Obrazovna tehnologija, 2,* pp. 145-152.
2. Aničić, O. & Barlovac, B. (2010). Distance learning – E-education, [(Učenje na daljinu – E-obrazovanje]. In Proceedings of the third international conference – Technics and informatics in education. Technical faculty Čačak.
3. Vilotijević, M. & Mandić, D. (2016). *Information-developing teaching in an efficient school, [Informatičko-razvijajuća nastava u efikasnoj školi].* Serbian Academy of education, Teacher Education faculty, Belgrade.
4. Simović, D. & Čukanović-Karavidić, M. (2010). E-education, [E-obrazovanje]. In *Proceedings of the third international conference Technics and Informatics in education.* Technical faculty Čačak.
5. Zemsky, R. & Massy, W. F. (2004). Thwarted Innovation: What Happened to e-learning and Why? A Final Report for The Weatherstation Project of The Learning Alliance at the University of Pennsylvania in cooperation with the Thomson Corporation.
6. Fallon, C. & Brown, S. (2002). *E-learning standards, A Guide to Purchasing, Developing, and Deploying Standards-Conformant E-Learning*, CRC Press, Boca Raton.
7. Bešić, D., Radovanović, V., Bešić, S. & Bešić, C. (2015). Certain Aspects of Quality in Education Management, *Journal of Engineering Management and Competitiveness*, *5*(2), pp. 108-111.
8. Vilotijević, M. & Vilotijević, N. (2016). *Models of developing teaching I, [Modeli razvijajuće nastave I].* Teacher education faculty, Belgrade.

The Influence of Personality Traits on Teamwork Performance

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Abstract—**In today's dynamic workplace and knowledge economy, organizations are increasingly recognizing the importance of teamwork to achieving sustainable competitive advantage. Team performance has become a major focal point of new management approaches, such as autonomous work units and full quality management (TQM). Another factor that created the need for teamwork is the rapid increase in emerging information and the need to solve problems and tasks, which are increasingly complex and multidisciplinary in nature. Although teamwork in modern organizations is recognized as one of the essential components in the effort to develop high quality workers with good social competencies, there are insufficient research which explain the link between team performance and personality. This paper provides an overview of previous research in order to gain a better understanding about relationship between key personality traits and teamwork performance.**

Keywords - personality traits, teamwork, teamwork performance, Big-Five model

I. INTRODUCTION

Teamwork and bringing individuals together for better effect is a phenomenon as old as work itself. Teamwork and the relationships that are created as a result of the interaction of team members have gained a more significant place in theory and practice since the more serious approach to studying work organization and organizational behavior began.

Teamwork is based on a set of values that foster successful group behavior such as the ability to listen and engage in constructive conversation, a high degree of tolerance for the views of others, and support for co-workers. Team and teamwork encourage both the success of the organization and the development of the individual.

The growing competition in the global market has caused Western companies such as General Motors, IBM, General Electric and others to seek strategies for continuous quality improvement [1]. Along with the increasing changes in the world, there has been an increasing interest in the performance of work teams [2]. Successful businesses have discovered the potential and contribution of teamwork to reducing costs, higher quality products and higher productivity. Teamwork promotes creativity and originality because the best way to get a good idea is to have lots of ideas. The fact that professionals focus on specific areas increases the need for the collaboration of experts in different fields, thus utilizing all relevant information necessary to solve the problem. Interpersonal/ collaborative skills such as negotiation, organizational efficiency, leadership and social skills are recognized as essential skills for working in contemporary organizations.

II. PERSONALITY TRAITS

According to one of many definitions, personality is defined as a unique combination of characteristics of a person that results from the way an individual behaves and interacts with others [3].

Almost all definitions of personality take into account the fact that a unique profile or combination of traits distinguishes a personality from others in its environment. Also, all definitions of personality point to the fact that personality is formed and expressed in interaction with other people. The interactions that a person engages in during his or her life shape his personality, but also, it is only at the

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base of those interactions that one can see what kind of personality he really is.

Most personality research focused on discovering personality traits. Personality traits are defined as enduring characteristics that describe personality behavior. It is assumed that if we know the personality traits of an individual, we are likely to predict and often control his or her behavior. Thus, numerous studies have focused on classifications of personality traits [4].

Reference [5], one of the most prominent personality theorists, criticizes typology because it abstracts certain segments of personality and gives them general importance and because it represents artificial divisions about the existence of other nomothetic lines that exist in all or most people and are considered by the people they can. On the other hand, there are individual or personal dispositions that characterize only one individual.

Numerous research over the last few decades in the field of the psychology of individual differences (contemporary personality psychology) has led to findings that describe personality with five major traits or basic dimensions. Each of these basic dimensions involves lower specific personality traits and preferences for particular patterns of behavior. These dimensions are: neuroticism, extraversion, openness, collaboration and conscientiousness. Creator of the Big Five model is Godberg [6]. This author considered five factors to be optimal number to adequately describe the personality space [7]:

- Openness – the tendency to appreciate new art, ideas, values, feelings and behaviors.
- Conscientiousness – the tendency to be careful, on-time for appointments, to follow rules, and to be hardworking.
- Extraversion – the tendency to be talkative, sociable, and to enjoy others; the tendency to have a dominant style.
- Agreeableness – the tendency to agree and go along with others rather than to assert one's own opinions and choices.
- Neuroticism – the tendency to frequently experience negative emotions such as anger, worry, and sadness, as well as being interpersonally sensitive.

In modern organizational psychology, the Big Five model has been widely accepted as a typology of personality, with its theoretical assumptions. Some earlier research has confirmed that these five factors influence employees' attitudes toward work [8], work behavior [9], and work performance [10].

In contemporary literature beside the Big Five Theory, Myers-Briggs typology of personality is represented. According to their model, there are four different dimensions of personality, namely: interaction with the world, information gathering, decision making, and behavioral organization [11]. According to this model there are the following traits:

- Introversion vs. extroversion - refers to how person-oriented he or she is, where he or she manages to function better, more easily, individually or in a wider environment.
- Intuition vs. sensing - refers to two different ways by which an individual receives and collects information. An intuitive person is orientated to new possibilities and hidden meanings, while sensing means that a person focuses on reality and facts.
- Thinking vs. feeling - refers to two essential attitudes in relation to the environment. The thinking type prefers to make decisions and conclusions based on logical analyzes and objective criteria. Feelings means that a person uses the values, emotions and motives to make decisions.
- Judges vs. observers - the judging type is organized by following the rules, sticking to the plan. On the other hand, the type of observer is oriented to react spontaneously, and is prone to flexibility.

The focal point of industrial and organizational psychology was on the theory of personality traits and therefore on a static point of view. But, in today's age of the knowledge economy research and theories become much more sophisticated as dynamic criteria are incorporated and tested for the impacts of other relevant determinants of work performance such as knowledge, interests, employee interactions [12].

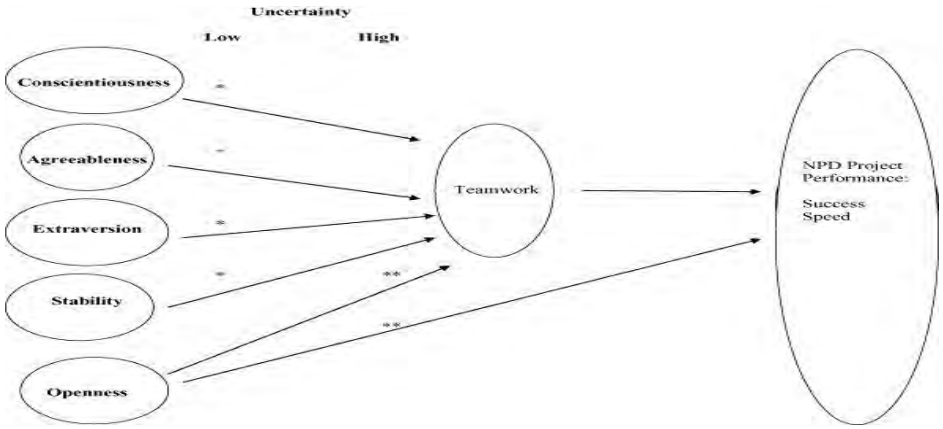

Figure 1. Model: impact of leader personality on new product development teamwork and performance for high and low uncertainty condition [4].

III. Personality and Teamwork Performance

Some earlier research has found the link between personality traits and teamwork performance. For example, [13] found that amenity and emotional stability predicted peer evaluations beyond skills and ability in a study of human resources teams. In addition they showed that average measures of agreeableness and emotional stability at the team level also predicted supervisors' ratings of team performance, accuracy, and work performed in their study of human resource teams.

Using Fisher personality types (explorer, builder, negotiator, director), [14] have found that in such teams there are fewer conflicts and a greater degree of satisfaction than in self-selected teams.

The most common pattern of education and teaching in traditional schools is frontal teaching, where students compete with each other for teacher attention and as good grades as possible. An alternative to this type of education is individual learning, which excludes interaction with other students. The third learning pattern is cooperative learning, which is based on several parallel activities that are directed towards a specific goal. Learning is most effective when students are actively involved, learned lessons apply in practice and learn in the context in which knowledge is used.

Reference [15] examined the influences of personality traits on teamwork performance in a multidisciplinary student sample. They found several significant findings. According to their research there are negative correlation between student's perception about equally shared responsibilities in group and emotional stability. The conflict was positively correlated to his or her GPA (Grade Point Average) and negatively correlated to the mean agreeableness score of the group members. Self- and peer-assessments of individual performance, which were focused on engagement, leadership, and communication, were in a large degree correlated.

Reference [16] investigated the impact of leader personality on new product development (NPD) project performance under different conditions of uncertainty. For the purposes of research they have developed the model shown in Fig. 1.

As can be seen from Fig. 1, in this model teamwork plays a mediating role between leader personality and NPD performance. Authors found that openness of leaders has a remarkable impact on the performance of new product development projects and a significant indirect impact through teamwork under conditions of high uncertainty. Also the results of the research show that the conscientiousness, extroversion and emotional stability of the leaders have a significant indirect impact on the performance of new product development through teamwork, but this influence was more intense in the conditions of less uncertainty. Further, in their research [16] conclude that, depending on the degree of uncertainty, different leadership traits and styles lead to a different degree of teamwork efficiency and new product development.

Reference [17] in his study proved that extroversion and openness to experience as personality traits has positive impact on politeness and relation communication indicators. On the other hand, the agreeableness has negative correlation with these measures. Furthermore, author indicated that professional knowledge and coordination behavior markers are correlated with neuroticism and conscientiousness. As effect of team process, team performance is directly determined by the conscientiousness and the extraversion.

Reference [18] show that there is no direct connection between the team extraversion and performance. Furthermore, authors investigated communication as mediating variable between the extraversion of the team's members and the overall team performance. Regarding the team communication as sum of utterances, words, and duration for the team, only duration mediates team performance. Regarding the communication at the individual level as an intermediate variable appears utterances by the Defense Counter Aircraft which role is to identify unknown aircraft. Depending on the model. Every communication value plays a role in mediating the personality and performance relationship.

Empirical study [19] showed that Big Five personality traits, respectively agreeableness, conscientiousness, extroversion, neuroticism, and openness to experience, affect the strengthening teamwork and interpersonal skills among higher education graduates.

IV. Conclusion

Modern business conditions dominated by the challenges and dynamic changes of the environment, as well as the demands for high work and other performance, increasingly determine companies to introduce teams as flexible organizational forms in their work and business processes. The experience and practice of teamwork contribute to reducing hierarchical relationships in the company, affirming the role, knowledge and expertise of individuals and their work, creating a positive organizational climate and a higher degree of humanization of employee relationships. Experience shows that in organizations where teams and teamwork are introduced, higher levels of productivity and efficiency are achieved and, of course, higher quality results due to group synergy. The presence of synergy in teamwork means that pooled resources within the team produce better and better results than individual ones. Individuals in the team also achieve personal benefits, goals and interests through teamwork.

One of the most important reasons for introducing teams to an organization is better business results, better quality, productivity and, of course, higher profits.

This study makes an important contribution toward building harder theoretical insight and knowledge about the relationship between personality traits and teamwork performance. The team performance has several relationships with personality traits [4]. Team management is a new philosophy of approaching people and work in the context of the increasing use of information technologies and increasing attention to the human factor of the work process. Numerous studies have shown that teams work more efficiently if there is a proper combination of team roles. Only through careful division of roles, proper and professional selection of members aligned with the personality traits of the team members is it possible to ensure a quality and stable team, which will be able to successfully achieve team purpose and goal.

References

1. Garvin, D. A. (1987). Competing on the eight dimensions of quality. *Harvard Business Review* (November–December), pp. 101–109.
2. Arnold, J. H., Feldman, D. C. & Hunt, G. (1992). *Organizational behaviour: A Canadian Perspective*. McGraw-Hill Ryerson, Toronto.
3. Scharmerhorn, J., Hunt, J. & Osborn, R. (2005). *Organizational behavior*. Jon Wiley & Sons, New York
4. Zimanji, V. & Štangl-Čučnjar, G. (2005). *Organizaciono ponašanje.* Ekonomski fakultet, Subotica
5. Allport, G. W. (1961). *Pattern and growth in personality.*
6. Goldberg, L. R. (1990). An alternative "description of personality": The Big-Five factor structure. *Journal of Personality and Social Psychology, 59*(6), pp. 1216–1229.
7. Diener, E. & Lucas, R. E. (2019). Personality traits. In R. Biswas-Diener & E. Diener (Eds), *Noba textbook series: Psychology.* DEF publishers, Champaign, IL. Retrieved from: https://nobaproject.com/modules/personality-traits.

8. Judge, T. A., Heller, D., & Mount, M. K. (2002). Five-factor model of personality and job satisfaction: A meta-analysis. *Journal of Applied Psychology, 87*(3), pp. 530- 541.
9. Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: a meta-analysis. *Personnel Psychology, 44*, pp. 1-26.
10. Hurtz, G. M. & Donovan, J. J. (2000). Personality and job performance: The big five revisited. *Journal of Applied Psychology, 85*, pp. 869-879.
11. Myers, I.B. (1995). *Gifts differing*. Consulting Psychologists Press, Palo Alto, CA
12. Borman, W. C., Ilgen, D. R. & Klimoski, R. J. (2003). *Handbook of psychology - Volume 12, Industrial and Organizational Psychology*. John Wiley & Sons, Inc., Hoboken, New Jersey
13. Neuman G.A. & Wright J. (1999). Team effectiveness: beyond skills and cognitive ability. *J Appl Psychol*, *84*(3), pp. 376-389.
14. Hutto A, Black G.S. & Frontczak, N.T. (2011). Matchmaking in marketing class: using Fisher's personality profiling to form student teams. *Mark Educ Rev*, *21*(1), pp. 43-48.
15. Rhee, J., Parent, D. & Basu, A. (2013). The influence of personality and ability on undergraduate teamwork and team performance. *SpringerPlus*, *2*(1), pp. 16.
16. Aronson, Z. H., Reilly, R. R. & Lynn, G. S. (2006). The impact of leader personality on new product development teamwork and performance: The moderating role of uncertainty. *Journal of Engineering and Technology Management*, *23*(3), pp. 221-247.
17. Juhász, M. (2010). Influence of personality on teamwork behaviour and communication. *Periodica Polytechnica Social and Management Sciences*, *18*(2), pp. 61-74.
18. Macht, G. A., Nembhard, D. A., Kim, J. H. & Rothrock, L. (2014). Structural models of extraversion, communication, and team performance. *International Journal of Industrial Ergonomics*, *44*(1), pp. 82-91.
19. Ali, F. M. A., Ahmad, N. & Othman, A. R. (2017). The antecedents effect of the big five personality traits on strengthen teamwork and interpersonal skills among Yemeni higher education graduates. *Asian Journal of Multidisciplinary Studies*, *5*(11), 19-33.

The Genesis of Innovation in the Italian Innovative SMEs

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Abstract—**In a globalized economy companies can compete on the international market, if they manage to escape the risk of a standardizing and homologating offer, preserving the uniqueness and originality of the business idea, through continuous innovation.**
This research investigates the importance of innovation in business realities, by legislative definition, most innovative in the Italian context: innovative SMEs. The study wants to understand which are the main determinants of innovation of these companies, identifying statistical correlations that can be tested empirically in future research. The results demonstrate that human capital is the main direct innovative factor on which it is convenient to continue investing to create development paths with high innovative content.

Keywords - Italian SMEs, innovation, intellectual capital, human capital

I. INTRODUCTION

Entrepreneurship, the ability to innovate, risk and seek new paths of development, is the main prerequisite for innovation [1].

In the current global, hyperconnected and hyper-competitive economy, innovation becomes a mandatory choice for survival [2]. For this purpose, it should not represent a discontinuity, having rather to manifest itself in its dynamic dimension as process of innovation [3].

The theme attracted the interest of several scholars of economic and managerial disciplines, also in consideration of the competitive, economic and financial implications connected to the implementation of innovative processes. Moreover, the phenomenon has been studied both in relation to large companies and about smaller companies. The distinction, in countries like Italy characterized by the clear and influential prevalence of SMEs [4], is fundamental and affects considerations and results. In particular, in Italy the phenomenon of successful companies that were born through innovation, which grow by innovating and living over time continuing to innovate, is so widely present that the legislator created sections of the Business Register specifically dedicated to innovative start-ups and SMEs. innovative.

In light of the results of a recent study on innovative start-ups [5] which found high levels of profitability of young entrepreneurial initiatives, in line with previous studies on the major potential for rapid expansion, of the so-called gazelles or high-growth firm [6, 7] this paper believes it can assess the following virtuous circle: higher productivity translates into greater profits, which should then be the basis for the growth of the company and, therefore, of its evolution from start-up to SMEs.

Therefore, the present work aims to carry out an exploratory analysis on a specific population of innovative Italian SMEs with the aim of highlighting the main determinants of their innovation.

The study is placed in that research perspective according to which the ability to innovate depends above all on internal drivers [8, 9] focusing the innovative effort of SMEs in Italy as deriving from a culture and an innovation routine [10] promoted starting from the company management.

For SMEs, the availability of skills, human and financial resources, organizational and relational skills is less obvious than for large companies [11, 12], a circumstance that can slow or preclude virtuous innovative paths. The difficulty of assessing the presence of such tangible and intangible resources tends to underestimate its weight in innovation surveys. This paper seeks to overcome this limitation, providing the conceptual premises for further

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empirical research on the importance of internal drivers for innovation in small-medium size companies.

II. Literature Review

The economic literature proposed different approaches to the study of innovation.

Schematizing, the approach of international bibliography reflects the evolution of economic thought on the concept of value creation.

Immediately after the war and up until the early 1970s, business systems based primarily on the production function and the "handyman" figure developed, especially in Italy [13]. In the 1950s and 1960s in particular, the process of developing new products was a linear and sequential process with a limited number of phases [14]. In this model the role of research and development, and of the related innovative processes, is predominant within the company.

Subsequently, with the first phase of ICT expansion, there was a development of the marketing function, albeit late in Italy compared to what had already happened in the Anglo-American world.

In this "market pull" model, the company tried to reach the connection between the internal process of innovation development and the positioning of the product on the market [15].

Today, the evolution of innovation models has reached the definition of a modern concept of continuous innovation, born from the Resource Based View theory developed in international management studies since the 1980s.

It is certainly Schumpeter [16] the first author to develop a theory of innovation, focused on the figure of the innovative entrepreneur able to disturb the market balance with new production combinations, sources of monopoly rents and extra profits for the company, until the coming of a new innovative action of other economic agents.

Schumpeter's intuitions constitute the premises for a further research perspective concerning entrepreneurship [17, 18, 19] understood as the ability to combine three orientations:

- ability to identify profit opportunities on the market;
- risk appetite;
- ability to obtain adequate resources to achieve the objectives [18].

The following Tab. I shows some of the most important and complete definitions of innovation with the related key concepts.

TABLE I. Main Definitions of Innovation

Author	Definition of innovation	Tag
Schumpeter (1934) [16]	uncontrollable phenomenon that constantly disturbs the endogenous equilibrium of the economy, a destructive force that constantly creates progress thanks to the action of innovative entrepreneurs	discontinuity, process, entrepreneurship
Thompson (1965) [20]	acceptance and implementation of new ideas, processes, products or services	novelty, implementation, process, success, different types
Schumpeter (1971) [21]	introduction of new production combinations	novelty, product
Freeman (1982) [22]	marketing process of an invention at product, process or system level	process, market, novelty, different types
Porter (1990) [23]	introduction of a new technology or a new way of doing things	implementation, novelty
Henry, Walker (1991) [24]	set of activities that allow a new product or process to enter the market or become common use	novelty, process, market
Rogers (1998) [25]	application of new ideas to a product, process or any other aspect of the business activity	ideas, process, different types
Drucker (2002) [26]	specific entrepreneurship's function, the entrepreneur creates values through new or pre-existing resources	function, value, resources

Source: Author's elaborations

Although most of the scientific studies are reserved for large companies, there is no shortage of contributions extended to the reality of SMEs, including in Italy (Tab. II).

[27] studied the characteristics of large global companies, highlighting eight attributes of excellence. [28] considering successful medium-sized companies, identified nine factors at the basis of competitiveness. [29] developed a "decalogue of the small strong company".

TABLE II. CHARACTERISTICS OF THE WINNING COMPANY

Peters-Waterman, 1982 [27]	Simon-Zatta, 2007 [28]	Preti-Puricelli 2007 [29]
proneness to action	ambitious goals	target of maximization in the medium-long term
proximity to the customer	proximity to the customer	challenging comparisons
autonomy and entrepreneurship	continuous innovation	innovating
key value of the activity	focus on the market	from cost reduction to quality and service
concentration on the core business	strong competitive advantages	do what is always done better
elasticity / rigidity checks	global orientation	flexible borders
simple structure, reduced staff	reliance on one's own strength	manage the size
productivity through people	motivated staff	make a difference thanks to organization and human resources
	strong leadership	strong entrepreneurship
		rootedness in the territory

Source: [30]

From the comparison it can be understood that the factors considered essential for the competitiveness of companies focus on the capacity for innovation deriving from the cultivation of distinctive skills and good organization [30]. Furthermore, the emphasis on workers' potential is transversal, which should be "organized", "motivated" and "productive".

Reference is made to the professional and moral characteristics of human resources, to the learning processes and to the ability to extract the maximum possible value from knowledge [31]. Therefore, the intellectual capital available to the company determines its innovative potential. However, the reflection on the role of intellectual capital in the dynamics of economic growth arises and develops from a macroeconomic perspective. It is, in fact, the theory of economic growth of [32] that opens the reflection on the link between human capital, intellectual capital in a broader sense, innovation, productivity and growth. The Solow model, however, fails to explain the dynamics of factors connected to the cognitive capital of companies because, in the macroeconomic context, these factors are considered exogenous variables. It will take years to progressively get closer to an endogenous concept [33, 34, 35, 36].

III. PURPOSE, HYPOTHESES AND RESEARCH QUESTIONS

This paper aims to provide a preliminary analysis of the determinants of innovation of a sample of small and medium-sized Italian companies in the period from 2010 to 2018, considered "innovative" by Italian legislation.

Considering this population makes it possible to investigate the companies that should constitute a substantial part of the national innovation reality most oriented towards innovation and with the greatest potential for rapid expansion. Moreover, given the homogeneous young age, they should enjoy a more open and sensitive mentality towards the theme of innovation; while the dimensional, operational and sectoral heterogeneities make them, in this exploratory phase, representative of the orientations of domestic entrepreneurship.

Therefore, the hypotheses to be verified are:

- H_1: there is a positive relationship between the innovative potential of SMEs and economic performance;
- H_2: in innovative SMEs, where people with high skills are normally employed, the decisive driver of innovation is human capital.

Given these considerations, the following research questions arise:

- RQ_1: what are the determinants of innovation in Italian SMEs?
- RQ_2: is it possible to measure the contribution of the factors underlying the innovative capacity of SMEs on economic performance?

To answer these questions, starting from the financial data of a significant sample of Italian SMEs, the study proposes a quantitative analysis with exploratory purposes to explore research spaces for subsequent empirical analyzes.

After describing the methodological approach and the research design, the paper presents the theorized regression models and the first correlation results between variables. Then, based on these empirical outcomes, the study presents the final reflections, the implications, the limitations, as well as the possible future developments of the research.

IV. RESEARCH METHODOLOGY

A. Data collection

The present study, of an exploratory-explanatory type, according to the definition of [37], aims to establish causal relationships between variables.

The empirical analysis uses data taken from the AIDA database - Computerized Analysis of Companies (update 270, software version 103.00) (https://aida.bvdinfo.com) of the company Bureau van Dijk. The dataset collects balance sheet data of 550 small and medium innovative companies belonging to different sectors of Italian production with a turnover exceeding € 800,000. The survey refers to the 2010-2018 period.

With the help of the 2007 Ateco codes, it is possible to identify the sectors most frequently controlled by the companies in the sample.

TABLE III. SECTORS OF THE SAMPLE

Sector	Frequency	%
Mines and manufacturers and building	102	18,54 %
Consumer goods, trade and services	187	34,00 %
Communication and IT	244	44,36 %
Other	17	3,10 %
Total	**550**	**100,00 %**

To answer the research questions, a quantitative analysis based on descriptive statistics, correlation analysis and regression methods is used, with the aim of finding the significant impact or influence of independent variable on dependent variable. Variables used in the study are as below (Tab. IV).

In a purely cost-based perspective, it can be assumed that the adoption of innovations involves high sacrifices of financial resources not compensated by similar immediate benefits. For this reason, in addition to the return on equity, which may be of little significance in the short term, the return on assets is also used as the dependent variable, measured as ratio of net income to book value of total assets [38, 39]. It is a valid indicator of the company's efficiency in making profits from its total assets. The third dependent variable is the sales growth [38, 40].

To obtain information about the efficiency of tangible and intangible assets using public accounting data, the Value-Added Intellectual Coefficient ($VAIC$) developed by [41] was considered:

$$VAIC = \mathrm{HCE} + \mathrm{SCE} + \mathrm{CEE}. \quad (1)$$

HCE and CEE indicate the added value produced by one euro of human capital (HCE) and physical capital (CEE) inputs, while SCE is the fraction of Added Value to be charged to Structural Capital.

To give the model more robustness and therefore greater reliability to the results, two control variables are used: according to previous studies, financial leverage and firm size have been added as control variables which can influence firms' performance [40, 42, 43].

B. Regression models

To answer the research questions, three regression models are provided which can test separately the three dependent variables representative of the company performance and understand the relationships with the independent variables, in order to prevent multicollinearity and autocorrelation problems. In all three models both control variables are always present.

$$ROA_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$ROE_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$GROWTH_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t}. \quad (4)$$

TABLE IV. DEFINITION OF VARIABLES

	Description	Model	Expected sign
Dependent variables			
$ROA_{i,t}$	Financial performance measured as firms' profitability proxied by Return on Assets (Operating income/total assets)	1	
$ROE_{i,t}$	Financial performance measured as firms' profitability proxied by Return on Equity (Net income / Equity)	2	
$GROWT$	Financial performance measured as firms' growth in revenues proxied by the change in revenue from year t-1 to year t.	3	
Independent variables			
$VAIC_{i,t}$	Value Added Intellectual Capital proxied by the Pulic' model. estimated by summing the variables (HCE, SCE and CEE)	1, 2, 3	+
$HCE_{i,t}$	Human Capital Efficiency proxied by the Value Added (VA) scaled by the Employee costs.	1, 2, 3	+
$SCE_{i,t}$	Structural Capital Efficiency proxied by the difference between VA and HC scaled by the VA	1, 2, 3	+
$CEE_{i,t}$	Capital Employed Efficiency proxied by the ratio between VA and net assets of the year i	1, 2, 3	+
Control variables			
$LEV_{i,t}$	Leverage ratio proxied by financial debts scaled total assets	1, 2, 3	+/-
$SIZE_{i,t}$	Firm size proxied by the natural logarithm of total assets	1, 2, 3	+/-

C. Empirical findings

Tab. V shows the descriptive statistics of the selected variables.

TABLE V. DESCRIPTIVE ANALYSIS OF VARIABLES

	Min.	Max.	Mean	Median	Std. dev.
ROA	-178	114.6	2.4	3.9	22.4
ROE	-141.5	96.5	7.7	6.8	32.4
GROWTH	-14910	38956	597	197	3083
VAIC	-377.4	12513.7	107.7	12.1	766.3
HCE	-292.6	931	5.8	1.5	66.9
SCE	-60.6	21.1	0.3	0.4	3.4
CEE	-198.5	12510.3	97.9	8.8	742.8
LEV	-198.6	471.4	6.5	3.9	31.5
SIZE	2.1	11.5	7.6	7.6	1.5

Low standard deviation values indicate a homogeneous distribution of data, with non-high ranges of variation. The average and median values almost coincide make the average, at the base of this study, particularly significant.

As shown in Tab. V, the profitability ratios averaged 2.4% (Roa) and 7.7% (Roe) and 597 (Growth);
the components of *VAIC* were found to be 5.8 (HCE), 0.3 (SCE) and 97.9 (CEE). As it was reasonable to expect, in Italian SMEs it is more important human capital (skills, education, values, etc.) than the infrastructure in support of the same (structural capital) whose relevance is greater in large corporations.

D. Correlation analysis

Correlation analysis (Tab. VI) was performed by calculating the Pearson coefficients (below the diagonal) and the Spearman coefficients (above the diagonal) to investigate the existence of the linear relationship between economic performance and innovation.

TABLE VI. PEARSON TEST AND SPEARMAN TEST

	ROA	ROE	GROW.	VAIC	HCE	SCE	CEE	LEV	SIZE
ROA	1	0.60	0.71	-0.28	0.65	-0.02	-0.48	-0.36	0.05
ROE	0.72	1	0.78	-0.76	0.40	-0.37	-0.86	-0.11	0.71
GROW.	0.50	0.80	1	-0.40	0.51	-0.34	-0.53	-0.41	0.45
VAIC	-0.43	-0.74	-0.52	1	0.16	0.40	0.96	-0.38	-0.81
HCE	0.34	0.11	0.16	0.45	1	0.10	-0.06	-0.78	-0.73
SCE	0.18	-0.27	-0.48	0.30	0.26	1	0.31	0.31	-0.55
CEE	-0.60	-0.83	-0.60	0.96	0.21	0.22	1	-0.25	-0.73
LEV	-0.29	-0.10	-0.33	-0.42	-0.80	0.16	-0.23	1	0.31
SIZE	0.25	0.78	0.67	-0.86	-0.29	-0.47	-0.83	0.33	1

Source: author's elaborations

To partially confirm the first research hypothesis (H1) and in full adherence to the second hypothesis (H2), Tab. VI shows a positive relationship between human capital and economic performance. In particular, the relationship is positive with all the variables representing company performance: *ROA* (0.65), *ROE* (0.4) and *GROWTH* (0.51). These correlation coefficients are all lower than the value of 0.8, indicative of possible disadvantages of multicollinearity (Smriti and Das, 2018).

The results are in line with those highlighted by [44] which, by empirically verifying the link between human capital and economic growth on a microeconomic level, highlighted the importance for the Italian industry of making use of a professionally qualified workforce to favor innovative paths.

The near-zero values of SCE and negative values of CEE confirm that the greatest impact on the innovative capacity and on the economic growth potential of Italian innovative small and medium enterprises is due to human capital rather than to tangible and structural elements.

V. Conclusion

The centrality of the role of human capital, of distinctive strategic and relational skills, technical and managerial skills, in small and medium-sized Italian companies operating in innovative environments normally characterized by high added value was highlighted starting from the first phases of business operations [45, 46]. However, the link between human capital and the innovative potential of these Italian industrial realities has been analyzed, both theoretically and empirically, more at the macroeconomic level, focusing on the concept of externality, than at the enterprise level.

By recovering a microeconomic perspective, this study analyzed the relationship between innovation and economic performance of a representative sample of the population of innovative SMEs in the national territory.

As a proxy for innovation, the performance of intellectual capital was used, whose biunique relationship is acquired in the literature: innovation determines the growth of intellectual capital, thus becoming the main tool for cyclically regenerating companies' competitive assets [47].

The results of the analysis show the existence of a positive association between economic performance measured as *ROA* , *ROE* and *GROWTH* and human capital as the main innovative factor of the intellectual capital of the observed SMEs. At the same time, there is a non-decisive role of structural and physical capital, whose innovative capacities, however, tend to progressively shrink due to an intrinsic decreasing marginal productivity, unknown, instead, to human capital which is a multiplicable and self-generative resource [31] able to enhance itself with use.

The limitations of the study are those typical of a study with declared exploratory purposes. Further empirical analyzes are needed to test the theoretical insights of this research.

It is believed, however, that the positive sign of the interaction between human capital and innovation is an important fact in terms of policy: it represents an indication to invest in human capital to generate innovation. This is a particularly important indication in those countries, such as Italy, where public and private spending on research and development is always very low [48].

References

1. Consolini, M., Di Saverio, M., Loasses, C. & Richini, P. (2013). *Indicazioni per la programmazione e la realizzazione di iniziative per l'educazione all'imprenditorialità*. ISFOL. Roma.
2. Bertelé, U., & Mariotti S. (1991). *Impresa e competizione dinamica. Complessità economica, efficienza d'impresa e cambiamento industriale*. Etas. Milano.
3. Dioguardi, G. (2000). *L'impresa flessibile: una risposta alla competizione globale*, in Bertelè U., Mariotti S., Impresa e competizione dinamica. Complessità economica, efficienza d'impresa e cambiamento industriale. Etas. Milano.
4. Guoyou, Q., Saixing, Z., Chiming, T., Haitao, Y. & Hailiang, Z. (2013). Stakeholders' influences on corporate green innovation strategy: A case study of manufacturing firms in china. *Corporate Social Responsibility and Environmental Management, 20*(1), 1-14.
5. Migliaccio, G. & Pavone, P. (2019). La performance economico-finanziaria delle start-up innovative italiane: un'indagine empirica macroregionale sui bilanci con metodo Anova. *In Proceedings of XXXIV Convegno nazionale dell'Accademia Italiana di Economia Aziendale: Identità, innovazione e impatto dell'aziendalismo italiano. Dentro l'economia digitale*. Torino, 12-13 settembre 2019.
6. Acs, Z., Parsons, W. & Tracy, S. L. (2008). *High-Impact Firms: Gazelles Revisited*. U.S. Small Business Administration. Washington, D.C.
7. Nicolò, D. & Ricca, B. (2019). Under-Capitalization and Other Factors that Influence the Survival of Young Italian Companies. *International Journal of Advances in Management and Economics, 8*(2), pp. 37-51.
8. Mazzanti, M. & Zoboli, R. (2009). Embedding environmental innovation in local production systems: SME strategies, networking and industrial relations. *International Review of Applied Economy, 23*(2), pp. 169-195.
9. Kesidou, E. & Demirel, P. (2012). On the drivers of Eco-innovations: Empirical evidence from the UK. Research Policy, *41,* pp. 862-870.
10. Ciappei, C. & Poggi, A. (1997). *Apprendimento e agire strategico d'impresa. Il governo delle dinamiche conoscitive nella complessità aziendale*. Cedam, Padova.
11. Horbach, J. (2008). Determinants of environmental innovation - new evidence from German panel data sources. *Research Policy, 37*(1), pp. 163-173.

12. Pereira, A. & Vence, X. (2012). Key business factors for Eco-innovation: An overview of recent firm-level empirical studies. *Cuadernos de Gestion, 12,* pp. 73-103.
13. Marchi, L. (2019). *La creazione e la misurazione del valore. Dalla prospettiva finanziaria alla prospettiva economico-sociale*. Università degli Studi di Pisa, 19 ottobre 2019.
14. Carter, C. F. & Williams, B. R. (1957). *Industry and technical progress: factors governing the speed of application of science*. Oxford University Press. New York.
15. Rosenber, N. & Mowery, D. (1979). The influence of market demand upon innovation: a critical review of some recent empirical studies. *Research policy, 8,* pp. 102-153.
16. Schumpeter, J. (1934). *Theorie der Virtschaftlichen Entwicklung*. Berlino, Duncken & Humboldt.
17. Kirzner, I. (1973). *Competition and Entrepreneurship*. London University of Chicago Press. Chicago.
18. Birkinshaw, J. (1997). Entrepreneurship in Multinational Corporations: The Characteristics of Subsidiary Initiatives. *Strategic Management Journal*, *18.*
19. Zucchella, A. & Scabini, P. (2007). *International Entrepreneurship*. London. Palgrave.
20. Thompson, A. V. (1965). Bureaucracy and innovation. *Administrative Science Quarterly, 10*(1), pp. 1-20.
21. Schumpeter, J. (1971). Teoria dello sviluppo economico. Sansoni.
22. Freeman, C. (1982). *The Economics of Industrial Innovation*. MIT Press. Boston.
23. Porter, M. (1990). Competitive Advantage of Nations. *Harvard Business Review, 68*(2), pp. 73-93.
24. Henry, J. & Walker, D. (1991). *Managing Innovation*. Sage. London.
25. Rogers, M. (1998). *The definition and measurement of innovation*. Melbourne Institute of Applied Economics and Social Research, University of Melbourne, Melbourne Institute Working Paper.
26. Drucker, P. F. (2002). The discipline of innovation. *Harvard Business Review, 80*(8), pp. 95-103.
27. Peters, T. & Waterman, R. (1982). *In Search of Excellence*. Harper & Row. New York.
28. Simon, H. & Zatta, D. (2007). *Campioni nascosti. Come le piccole e medie imprese hanno conquistato il mondo*, Il Sole 24 Ore, Milano.
29. Preti, P. & Puricelli, M. (2007). *L'impresa forte. Un manifesto per le piccole imprese*. Egea. Milano.
30. D'Amato, V., Minelli, E. & Rebora, G. (2009). *Alla ricerca dell'unicità. Il management imprenditoriale tra strategia, organizzazione e leadership*. Franco Angeli. Milano.
31. Rullani, E. (2004). *Economia della conoscenza. Creatività e valore nel capitalismo delle reti*, Carocci.
32. Solow, R. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics, 70*, (1), pp. 65-94.
33. Denison, E. (1967). *Why Growth Rates Differ*. The Brookings Institution, Washington D.C.
34. Denison, E. (1979). *Accounting for Slower Economic Growth: The United States in the 1970s*. The Brookings Institution. Washington D.C.
35. Lucas, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics, 22*, pp. 3-42.
36. Mankiw, N. G., Romer, D. & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics, 107*(2), pp. 408-37.
37. Saunders, M., Lewis, P. & Thornhill, A. (2003). Research methods for business students, (3rd ed.). England: Pearson Education Limited.
38. Chen, M. C., Cheng, S. J. & Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital 6(2),* pp. 159-176.
39. Maditinos, D., Chatzoudes, D., Tsairidis, C. & Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital, 12*(1), pp. 132-151.
40. Smriti, N. & Das, N. (2018). The impact of intellectual capital on firm performance: a study of Indian firms listed in COSPI. *Journal of Intellectual Capital, 19*(5), pp. 935-964.
41. Public, A. (1998). Measuring the performance of intellectual potential in knowledge economy. *In Proceedings of 2nd McMaster Word Congress on Measuring and Managing Intellectual Capital by the Austrian Team for Intellectual Potential*.
42. Zéghal, D., & Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual capital, 11*(1), pp. 39-60.
43. Dženopoljac, V., Janoševic, S., & Bontis, N. (2016). Intellectual capital and financial

performance in the Serbian ICT industry. *Journal of Intellectual Capital, 17*(2), pp. 373-396.

44. D'Amore, R., Iorio, R., & Lubrano, G. (2014). *La relazione tra capitale umano, Ricerca & Sviluppo e innovazione a livello d'impresa: un'analisi su un panel di imprese italiane*, in Badia F., Cestari G. (a cura di), Il legame tra coesione territoriale, sviluppo locale e performance d'impresa. Franco Angeli. Milano.
45. Nosella, A., Petroni, G., & Verbano, C. (2006). Innovation development in biopharmaceutical start-up firms: An Italian case study. *Journal of Engineering and Technology Management*, *23*(3), pp. 202-220.
46. Peruffo, E., Franco, S., Cappa, F., & Pinelli, M. (2018). Competenze dei fondatori e performance delle start-up: un'analisi empirica. *Piccola impresa, 1,* pp. 59- 80.
47. Ronca, C. (2010). *Società della conoscenza, sviluppo locale e competitività delle imprese*. Fondazione Adriano Olivetti Collana Intangibili.
48. Bugamelli, M., Cannari, L., Lotti, F., & Magri, S. (2012). Il gap innovativo del sistema produttivo italiano: radici e possibili rimedi. *Questioni di Economia e Finanza*, *121*. Banca d'Italia. Roma.

Key Factors in Innovation Strategy Choice: The Evidence from Serbia

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Abstract—**Innovation is mainstream for survival in contemporary business environment. The main aim of innovation strategies is maximize an organization's innovation potential in a given set of circumstances. Analysis of various studies point to organization size as a key factor in innovation strategy choice in Serbia. The extensive innovation had been evidenced in manufacturing sector. Although, the research sample was representative, all enterprises came from same transition environment. Future study will include enterprises from other transition environment.**

Keywords - innovation, strategy, enterprises, Serbia

I. INTRODUCTION

There is an extensive literature on the key factors for innovation strategy choice [1, 3, 7]. Majority of studies analyze the impact of perfect and monopolistic competition, and the size of the organization.

Innovation is higher in monopolized industries than in competitive ones because the monopolist can prevent imitation and make more profit from innovation as well as finance R&D [2].

Large enterprises are more innovative than small ones because they can finance more R&D staff, can better utilize unforeseen innovations, and indivisibility in reducing innovation costs makes them profitable. Large innovative companies have a wide front of technology activities. The core technological strength is based on research and development (usually chemical and electronic products) or the design of complex manufacturing technology or complex information processing technology.

Small businesses are usually specialized in product innovation such as: tools, scientific instruments, certain chemicals, and software. Their core strength is the ability to adapt technology to the specific requirements of consumers. Strategic management requirements are to find and maintain stable product niches and benefit from the customer experience.

In addition to the size of the business, there are other factors that drive innovation. The basic factor in deciding on the choice of an innovative project is the expected investment income. Whatever strategy is accepted, this test always applies. However, it cannot be applied outside the context of the enterprise and the environment in which it exists.

II. INNOVATION STRATEGIES

The main aim of innovation strategies is maximize an organization's innovation potential in a given set of circumstances. Strategic managers should consider current and future innovation strategies if they are to remain competitive. Innovation requires a different way of organizing and thinking, and business concepts change the rules of competitive play.

The rate of a technological process is determined by the specific behavior of organizations seeking to improve or introduce new technologies. The limitations arise from the technological heterogeneity, uncertainty and rationality associated with the global optimization of principles in determining the optimal strategy. Organizations do not allocate R&D budgets and do not randomize research direction. They are guided by past experience and capabilities. The behavior of organizations is neither unique nor optimal and can be described by routines.

Organizations operate in an environment characterized by a range of market and technological opportunities. Despite the impact of technological uncertainty on the results of

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their actions, organizations have expectations. Despite the limitations, organizations are able to design different innovative strategies in which they decide how to use and leverage their technological skills and resources.

Decision-making rules are patterns of behavior that cannot be explained by optimization but may by historical conditions, experience, and evolutionary development. Organizations design and adapt their learning routines and adopt changes from the environment. From this perspective, organizations are constrained by their cognitive abilities. They do not know the full range of future chances, and therefore cannot choose the global best alternative, but are limited to local chances.

A comparative analysis of Western and Far Eastern organizations shows that innovative organizational behavior, technology strategy, and innovation are key to the success of Japanese organizations. The focus on strategic behavior of organizations points to factors that can slow or facilitate innovative activity.

Innovation strategies can be classified as follows [4]:

- Offensive,
- Defensive,
- Imitative,
- Dependent,
- Traditional and
- Opportunistic.

The choice of one of these strategies depends on the scientific and technological capabilities of the organization. If basic research is developed, an offensive strategy is most appropriate. Under the conditions of developed capabilities for experimental development, offensive, defensive strategy and design have the greatest chance of success. The scientific and technical function of manufacturing engineering in an enterprise will determine the use of an imitative, dependent, or traditional strategy. For developed technical services and patents, an offensive strategy is best, and for scientific and technical information, a defensive, imitative and opportunistic strategy is appropriate. When there is long-term forecasting and product planning in the company, an offensive and opportunistic strategy is best.

However, these strategies, while having some implications for the allocation of R&D resources, are not limited to explaining this function. They should be seen as innovative-sensitive aspects of the overall business strategy of the company.

Introducing new technologies, enhancing existing ones, learning how to adapt the behavior and imitation of successful participants are the most important components for improving an organization's technological performance and enhancing their comparative advantage. Modern organization theory points to the dilemma between exploiting existing and seeking new opportunities. Exploration involves exploration, variation, risk-taking and experimentation, while exploitation means refinement, production and efficiency. By introducing three general patterns of behavior, it can be shown that exploration and exploitation have different manifestations in different routines, and accordingly differentiate the following innovative strategies [5]:

1. Conservative,
2. Imitative and
3. Absorptive strategy.

The first strategy is the so-called conservative strategy where all innovative efforts are concentrated solely on their own research. Conservative behavior neglects the change in the nature of the modern innovation process. A conservative strategy is different from "traditional strategy" where the organization sees no reason to change products, because neither demand nor competition forces it [4]. External technological development is also negated. Innovative efforts are directed at exploiting existing technology - process improvement and exploding new technology - product innovation.

The organization uses an imitative strategy to avoid using resources for exploratory research. Reference [4] calls this strategy "defensive or dependent." With the introduction of new technology, they try to imitate only the most successful methods created by others. This strategy uses only external knowledge and capabilities. The organizations that use it are not ready to take the risk of new opportunities. They want to avoid failure and learn from the mistakes of competitors. They do not claim to be technology leaders. According to [4], an imitative strategy is a type of insurance. It enables organizations to adopt the technological change already introduced by competitors. Imitation is possible even when new

technological know-how is not appropriate for innovative organizations. However, technological knowledge is specific, formal and cumulative. In this case, technology transfer can be as expensive as independent R&D. Due to the nature of technological knowledge, imitations can be expensive. Which means that an imitative strategy also requires R&D spending and intensive research. However, in cases of limited access to technology, imitation gains will be less than the technological results of an innovative strategy.

Organizations use a so-called absorptive strategy when deciding to combine internal and external knowledge. They are undertaking research efforts to achieve two goals that exist with conservative strategies: improving production processes and introducing product innovation. External sources of knowledge are used not for the purpose of imitation but for the realization of cross-fertilization effects that enhance the possibilities. Organizations that use an absorbing strategy invest part of the R&D budget in scanning general (external) technological development. They expect synergistic benefits that will outweigh the limited technological capabilities.

Unlike imitative organizations, absorptive organizations do not copy successful technology, but seek to integrate external knowledge in order to create additional technological capabilities. Unlike conservative organizations, they do not use the entire R&D budget to improve their technology. Absorptive organizations seek a balance between the short-term benefits of using their own capabilities and the long-term use of external technological capabilities. They want to avoid the dilemma that exploiting existing knowledge reduces the ability and speed with which new alternatives can be explored.

Practically distinguishing the strategies presented is almost impossible. This is especially true for the creation of absorptive capacity, which is usually understood as a by-product of R&D activities. Conservative and imitative strategies require opportunities to understand and use knowledge in related technologies. However, absorptive abilities become less effective when complete knowledge is required. For the purpose of analysis, three strategies can be clearly distinguished.

Innovative and imitative activities are undertaken in an economic environment characterized by a degree of competitiveness. Organizations compete with price and quality that is influenced by product and / or process innovation. In general, a successful innovator will be able to divert demand from their competitors as consumers can substitute between several products. The substitution effect is driven by price and quality changes resulting from the following actions and reactions:

- Innovation allows the innovator to lower the price to increase demand.
- Non-innovator reacts by lowering their price to avoid losing market share.
- The innovated product has better quality which allows the innovator to increase the price.
- The first reaction of a non-innovator is to lower its prices.

In such an economic environment, competition between organizations is not perfect with a homogeneous output, but is oligopolistic with different production costs per unit of product and different quality of products.

Reaching a critical mass for R&D costs a lot. Large, powerful industries have competitive advantages in financing such investments, but few small innovative businesses survive. Can elephant and mouse join forces?

Large organizations in industries with high growth rates buy small competitors and their R&D and market resources, thus increasing barriers to entry. Other small competitors are focusing on niche markets, becoming specialized research or control laboratories. The success of small pioneers who become independent of major competitors at the end of the industry phase is very rare.

III. Possible Factors in Innovation Strategy Choice

Here are some of the important factors for choosing an innovation strategy:

1. Company goals: maintaining market share, increasing profits, social and environmental responsibility, increasing efficiency, diversification or concentration;
2. Organization size: large, medium, or small organization
3. Market position: expansion or decline, perceived high or low profile;

4. Type of competition within the industry: the existence of monopoly, perfect competition.
5. Lifetime of existing products: products with a long shelf life, at the end of their life, products whose life should be extended;
6. Existing and potential competition coming from: existing suppliers from the domestic market, new suppliers from abroad, new technologies that competitors have;
7. Technology design, strengths and weaknesses: extensive or limited research, high skill techniques;
8. Factory capacity or capacity: modern or old production capabilities, modern or old production lines, successful or limited production capacity;
9. Level of development: extensiveness based on enterprise size and rapidly adaptable industry, relatively small due to the nature of the industry, fierce price competition and small innovations;
10. Market forecasts that may indicate: expansion or decline of chances for existing products, chances for new products;
11. Technological predictions that can show: the pace of industry development, the pace of development of competing technologies, the pace of development of complementary technologies, gaps of technology that can be developed or used.

With this range of factors, there is no one strategy that will be the best in all conditions. All factors should be carefully considered when formulating a strategy. The alternative is that there is no strategy but a laisse-faire approach. This can sometimes succeed if there are facilitation to quickly develop new ideas into products. However, access can lead to waste of resources, missed chances due to concentration of effort in a particular direction at a critical time, so it is not recommended.

IV. METHOD

Three studies about innovation activities in Serbia during the period 2012 to 2018 have been compared [8, 9, 10]. In all studies representative sample had been used.

The sample stratified by organization size (small: from 10 to 49 employees, medium: from 50 to 249 employees and large: over 250 employees) and by activities (groups of activities according to CA 08).

Two versions of the questionnaire were offered - electronic and hard-copy – for the convenience of participants.

Four types of innovation have been examined: product, process, organizational and marketing innovation.

V. RESULTS AND DISCUSSION

The results of innovation activities in Serbian organizations regarding their size illustrates Tab. 1.

The results revealed increase of number of innovators in small and medium enterprises during the whole period. The number of large enterprises that implemented innovation have been decrease in period 2014 to 2016 compared to previous two years period.

Organization size is a key factor of innovation strategy because 70% of large enterprises were innovators, 54% of medium-sized and 30% of small enterprises.

Table 2 illustrates innovators classified into manufacturing and service sector.

TABLE I. ORGANIZATION SIZE

Size	Time period		
	2012-2014	***2014-2016***	***2016-2018***
small	5182	5417	7566
middle	1187	1228	1573
large	370	349	407

TABLE II. ORGANIZATION SECTOR

Size	Time period		
	2012-2014	***2014-2016***	***2016-2018***
manufacturing	1977	2232	2854
service	4762	4762	6692

The trend of increase of number of innovators has been evidenced in manufacturing sector. It is

interesting that same number of innovator had been in two period 2012-2014 and 2014-2016.

Next table (Tab. 3) presented innovators by section of activities, according to CA 08 classification.

TABLE III. SECTION OF ACTIVITIES

Section of activities	Time period		
	2012-2014	*2014-2016*	*2016-2018*
A – Agriculture. forestry and fishing	109	177	216
B – Mining	11	16	26
C – Manufacturing	1816	2002	2597
D – Electricity. gas and steam. air conditioning supply	42	36	16
E – Water supply. sewerage and waste management and remediation activities	104	94	141
F – Construction	359	368	499
G – Wholesale and retail trade; repair of motor vehicles and motorcycles	1281	966	1486
H – Transportation and storage	226	289	421
I – Accommodation and food service activities	175	136	264
J – Information and communications	1204	1061	1757
K – Financial and insurance activities	107	114	103
L – Real estate activities	14	5	32
M – Professional. scientific and technical activities	1128	1505	1742
N – Administrative and support activities	165	224	235
Q – Human health and social work activities	0	0	11

In vast majority of section the trend of increase of number of innovation have been evidenced. The exception is section D electricity and gas with trend of decrease number of innovation in observed period. This result is opposite to other studies that revealed that innovation is higher in monopolized industries than in competitive ones because the monopolist can prevent imitation and make more profit from innovation as well as finance R&D [2].

More intensive innovation activity was in manufacturing sector. This goes in line with other studies [6].

Another observed factor is type of innovations (see Tab. 4). Increase number of innovation had been evidenced in all types of innovation and in whole analyzed period (2012-2018). Moreover, 20 percent of observed enterprises implemented all four types of innovation.

TABLE IV. TYPE OF INNOVATION

Type	Time period		
	2012-2014	*2014-2016*	*2016-2018*
Product and process	4790	5665	7554
Organization and marketing	5486	5129	7519

VI. CONCLUSION

Majority of studies on the key factors for innovation strategy choice analyzed the impact of perfect and monopolistic competition, and the size of the organization.

Innovation requires a different way of organizing and thinking, and business concepts change the rules of competitive play. Reaching a critical mass for R&D costs a lot. Large, powerful industries have competitive advantages in financing such investments, but few small innovative businesses survive.

With this range of factors, there is no one strategy that will be the best in all conditions. All factors should be carefully considered when formulating a strategy.

The results of this study is that organization size is a key factor of innovation strategy because 70% of large enterprises were innovators, 54% of medium-sized and 30% of small enterprises.

Contrary to other study, in one monopolistic sector innovation activity has been decreased during the period 2012 to 2018.

In all three studies over 10,000 enterprises have been participate, but from same environment. Therefore, future study will expand to other transition environment.

REFERENCES

1. Aramburu, N., Saenz, J. & Rivera, O. (2006). Fostering innovation and knowledge creation: the

role of management context. *Journal of Knowledge Management*, *10* (3), pp. 157-168.

2. Castellacci, F. (2008). Innovation and the competitiveness of industries: Comparing the mainstream and the evolutionary approaches. *Technological Forecasting & Social Change*, *75*, pp. 984–1006.
3. Christensen, J. F. (2002). Corporate strategy and the management of innovation and technology. *Industrial and Corporate Change*, *11*(2), pp. 263-288.
4. Freeman, C. & Perez, C. (1994). *Structural Crises of Adjustment, Business Cycles and Investment Behaviour In Implementing New Technologies*. Blackwell, Oxford.
5. Kontić, Lj. (2008). *Innovation - challenges for future, [Inovacije - izazovi za budućnost]*. Belgrade: Zadužbina Andrejević
6. Kontić, Lj. & Jovičić, A. (2010, September). Innovation strategies in Serbian manufacturing firms–before and during crisis. In *Proceedings of the International Conference on European Entrepreneurship as an Engine for Post-Crisis Development–Challenges and Opportunities*.
7. Leiponen, A. (2005). Core Complementarities of the Corporation: Organization of an Innovating Firm. *Managerial Decision Economics*, *26*, pp. 351–365.
8. Statistical Office of Republic of Serbia (2019). Indicators of innovation activities. https://www.stat.gov.rs/en-us/publikacije/
9. Statistical Office of Republic of Serbia (2017). Indicators of innovation activities. https://www.stat.gov.rs/en-us/publikacije/
10. Statistical Office of Republic of Serbia (2015). Indicators of innovation activities. https://www.stat.gov.rs/en-us/publikacije/

Prepping for the Future: Reinvention of the Education System

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Abstract—**System of education in Serbia, as well as in many other European countries, is still based upon the more than a century old model, a product of the 2nd Industrial Revolution. Automatization of the industrial production, products standardization, mass production based on the assembly line model and diminishing need for skilled manual labor, established large demand for fork force with limited set of mediocre skills. At the turn of the 20th century, system of education also adopted mass production doctrine in order to produce such work force in needed pace and quantities. However, technological advances, primarily in ICT, computerization and advent of the Internet and network interconnection of production facilities eliminated need for unskilled work force. New technologies and development tempo set as a prerequisite continuous training and permanent education process of already highly specialized workers. In order to follow the pace dictated by emergence of new technologies, or to produce in significant quantities workforce ready to take on modern challenges, existing education system needs a general overhaul.**

Keywords - Innovation of Education System, Knowledge 4.0, Information Technology in Education; Permanent Education, Internet of Things

I. INTRODUCTION

The current model of education applied in the Republic of Serbia, and with minor variations in other countries of the former Yugoslavia as well, emerged at the turn of the 20th century as one of the milestones of the 2nd industrial revolution.

The core feature of the 2nd Industrial Revolution was mass production. The rapid industrialization of the previously predominantly agricultural society, introduction of the assembly line system into production process, standardization of products and the elimination of specialized craft production created the need for a large number of workers, trained but with a limited set of working skills. In order to meet the need for such workforce, education system also adopted the mass production doctrine through a system of elementary, secondary, vocational and tertiary schools, which produced staff of average quality and with a limited set of work skills.

Since the 1970s, the intense advancement of information and communication technologies (ICT), the overall digitalization and automation of production, the emergence of the Internet and the interconnection of production facilities have eliminated the need for a non-specialized workforce. In contrast, the pace of development of new technologies requires workers with specialized skills, but also eager to permanently improve and acquire new knowledge.

Unfortunately, despite occasional attempts of reform, the existing education system in the former Yugoslavia is not capable of keeping the pace with the emergence of new ICTs, nor to provide the industry with significant quantities of workforce that can cope with modern challenges.

II. INDUSTRIAL REVOLUTION

A. Digital revolution

In the late 1950s, the implementation ratio of digital electronics in the predominantly mechanical production began to rise, while analog electronics gradually lost its significance. In the 1960s and 1970s, television became the dominant medium for information transfer, and the concept of personal and home computers became popular. Production lines were automated by the introduction of industrial

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robots and the digitization of data. In 1991, 2G mobile phones and the Internet became available to the general public, and the world's technological storage capacity expanded exponentially from 2.6EB in 1986 to 54.5EB in 2000 and 295EB in 2007 [1, 2], which marked the beginning of information age.

The 3rd Industrial revolution, also called The digital revolution, is characterized by the beginning of the widespread use of mobile devices and the establishment of a developed communications infrastructure

B. Information revolution

The 4th Industrial Revolution brought a shift to systems built on the infrastructure of the previous, digital revolution. The Internet of Things (IoT) enables the collection and exchange of large amounts of data between different sensors, electronic devices and computer applications, with the ultimate goal of analyzing and collecting meaningful data, which in turn can furthermore help automating the process and making timely decisions [3].

The big, currently occurring technological changes, are characterized mainly by the implementation of Artificial Intelligence (AI), the emergence of autonomous vehicles and drones, aswell as 3D printing of biomaterials.

III. EDUCATION

A. Heritage

Just as products and manufacturing processes were standardized during the 2nd Industrial revolution, the education process as well was standardized in the same manner. Classrooms took their common form we recognize nowadays, literature used in education was standardized on the state level, pupils are grouped on the age basis, and the teaching process is conducted for more than 100 years in a substantially unchanged format. The lecturer presents the intended material to the pupils, who in turn have to memorize given material through a sufficient number of repetitions, and reproduce it on periodic oral and written tests. Unfortunately, the emphasis is still on the reproduction of memorized material rather than the practical understanding of the processed information.

B. Flaws in the existing education system

The positive effect of standardized, mass education is the established cause-and-effect relationship where the growth and increase in the level of education of the population leads to the opening of new, larger schools, to better training of teaching staff and a broader educational curriculum. However, after the civil war(s) and decades of industry decline on the territory of the former Yugoslavia, the existing education system rendered obsolete and unable to meet the demands of new technologies.

The quality of teaching and the educational process, the efficiency of schooling and the quality of the workforce obtained through such education, are significantly influenced by the motivation of the teachers themselves. Greater motivation leads to more effective education and vice versa, but in addition, success in the educational process requires certain predispositions and skills of teachers, adequate resources and working conditions [4].

As a measure of quality of the education system, an international program of assessment of student achievement can be used, the so-called PISA test (Program for International Student Assessment), which has been conducted annually by the OECD since 1997.

The aim of the PISA test is to assess, in the fields of mathematics, text and natural sciences, the knowledge, literacy and competence of students acquired during schooling, which are considered educational capital necessary for successful continuation of education or for a student to be successful in the workplace. The emphasis is on functional knowledge, and all tasks are related to real situations. In addition, the questions can assess students' financial literacy and their global competencies [5].

TABLE I. PISA TEST RESULTS, OECD

	2009 [6]			**2012** [7]			**2015** [8]		
	***Sc*[1]**	***Mt***	***Rd***	***Sc***	***Mt***	***Rd***	***Sc***	***Mt***	***Rd***
OECD avg.	***501***	***496***	***493***	***501***	***494***	***496***	***493***	***490***	***493***
▼ SRB	443	442	442	445	449	446	-	-	-
▼ CRO	486	460	476	491	471	485	475	464	487
▲ SLO	512	501	483	514	501	481	513	510	505
▼ FYROM	-	-	-	-	-	-	384	371	352
▼ MNE	401	403	408	410	410	422	411	418	427
▼ XKX[2]	-	-	-	-	-	-	378	362	347
B&H	-	-	-	-	-	-	-	-	-

▲ Above average; ▼ Below average
Sc-Science;Mt-Math; Rd-Reading

[1] SC - Science, Mt - Math, Rd - Reading;

[2] Kosovo, territorial part of Republic of Serbia, UN resolution 1244.

PISA tests have become an indicator for assessing the efficiency, fairness and quality of the country's education system. According to the data presented in Tab. I, the results of the PISA test in all countries on the territory of the former Yugoslavia are below average, except for Slovenia which constantly scores above average.

IV. Education System Facing the Challenges of the Information Age

In order to fully take advantage of the opportunities offered by the new technologies of the 4th Industrial revolution, we need a revolution in the education system that will not only meet the needs of the industry for the workforce, but also provide appropriate student experience, as well as effective use of teaching staff and equipment.

At the beginning of the 20th century, a paradigm was formed that science and technology must come together to modernize inefficient and cumbersome procedures of the conventional education system [9]. Nowadays, more than a century later, many countries worldwide are trying to make changes in the public education system, for economic as well as cultural reasons. Although we are no longer able to predict with great certainty future economic parameters, our children need to retain a sense of culture even though they will be part of a globalized world [10].

The learning process needs to be remodeled in such a manner that it remains useful to students. It should be accessible to as many people as possible, but yet flexible enough to accommodate the abilities and preferences of each individual person [11].

A. Universities

One of the tasks and challenges for universities is to develop students' specific digital skills, which they will then be able to apply in the workplace. However, this must not be misunderstood that all students should be trained to write computer code, because programming is just one in a series of digital skills. However, certain skills, such as development of creativity, critical thinking, communication or collaboration, cannot be automated or replaced, and thus should be placed high on the list of priorities of the education system.

Although some Universities are already gaining extensive experience in the education 4.0 in order to prepare students for the new age, the system needs to be able to meet students' expectations for the next 20 or so years.

B. Communication

The 'old school' method of interaction between the professor and the student, where the professor sends the information and the student receives and consumes that information, and after a certain period of time shows the acquired knowledge in the form of exams, needs to be radically changed.

In time when computers and IT are ubiquitous in all spheres of social activity, where the Internet and smart mobile devices are essential tools for communication, and where information flow is free, professor-student interaction should be continuous, in such a manner that the professor through the whole course continually monitor progress of his students.

C. Transformation of the education process

The educational process needs to be adjusted in accordance with the changes taking place in industry and the economy. During the process, attention should be focused on the following trends: [11]

Transformation of the educational process. What should be in the focus of the lecturer if most of the tasks in the educational process are taken up by artificial intelligence and related technologies?

Personalized adaptive learning. An individual approach that can be adapted to an individual's personal characteristics, such as talent, foreknowledge, pace of learning, behavioral model, cultural differences, or motivation.

Transformation of the grading system. Is it possible to replace the current exam form with digital experiential learning (DEL) and an incremental micro grading system? Can this task be entrusted to artificial intelligence?

Physical and digital intelligent infrastructure. By changing the approach in organizational design of university workflow, with the use of adequate digital technologies, it is possible to optimize the way students fulfill their obligations to the university.

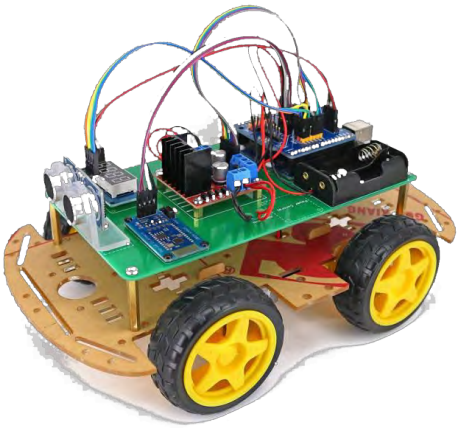

Figure 1. Partially autonomous robot vehicle based on single-board computer technology.

V. METHODOLOGY, TECHNOLOGY AND NEW TOOLS

Students should individually be provided with the opportunity to choose on how they want to learn. Although the purpose and outcome of the course are predefined by the curriculum created by the academic institution, students can independently choose the learning method and tools to reach the expected goal.

To enable students to express their creativity as much as possible, lecturers can use the following techniques:

- *Blended learning.* A combination of classic teaching material, online digital media and traditional classroom methods. It depends to a large extent on the context of application, and hence no universal approach has yet been established.
- *Flipped classroom*. Instead of the traditional approach where the lecturer presents new material to a group of students, in the concept of a flipped classroom students are introduced with the learning material before the class, while time in the classroom is used to make a more detailed approach to the topic, case analysis and to provide a deeper understanding on how to solve specific problems.
- *Bring your own device / application (BYOD/BYOA).* This approach allows students and staff to bring their own electronic devices, such as smartphones, laptops, or notebooks, and use them in the teaching process.
- *Project based learning (PBL).* An important part of the training is based on learning through project implementation. The student is expected to apply the acquired knowledge and skills during the realization of one or more projects during the semester, as a team member or independently. During work, students will hone their organizational and communication skills, which will be very important after completing their education in a work environment.
- *Student practice.* By practicing in a real-world environment, mentoring projects or managing a project team, the student will be able to become familiar with the specific tools and techniques used in the field.
- *Interpretation.* The student should be required to demonstrate the ability to understand a real phenomenon, to model it by applying the theoretical knowledge acquired, to collect data and correctly interpret and identify trends in a given set, in order to better develop the logic of understanding the world in which we live. However, the manual solving of the mathematical model, the statistical analysis or the process of forecasting the trends will be carried on computers.

Figure 2. Raspberry Pi drone.

- *Teaching props.* Good examples of use of new technologies in the educational process are card computers and microcontrollers. This primarily refers to the Raspberry Pi (Rpi) and Arduino products, which are open source and affordable, developed primarily as introductory tool in the world of programming, rapid prototyping and electromechanical engineering.

A simple autonomous robot, for example, which autonomously recognizes and bypasses obstacles using the ultrasonic sensor shown in Fig. 1, can be used as a:

- Toy, which allows children at the young age (kindergarten, preschool, elementary school) to get familiar with the concept of robots and computers, in a simple and fun manner.
- A platform capable to bring engineering students into the world of programming (C#, Python, PHP), robotics, artificial intelligence, the Internet of Things, electrical engineering and mechanical engineering. Varying the sensors provide different functionalities, and the essence of the machine changes according to whether the system is based on a microcomputer (RPi) or microcontroller (Arduino). Engaging students on such projects could help in development of analytical thinking, capability of ahead planning, also could develop and improve research skills, and most importantly, it will train students on how to analyze and solve multidisciplinary problems.

A similar drone project, based on the same technology (RPi), Fig. 2, depending on the configuration of the aircraft, will introduce the student to the domain of 3D printing, materials technology, physics, flight mechanics, network communication, GSM technologies and many other fields.

VI. Conclusion

Republic of Serbia, and the region of the former Yugoslavia as well, have always been rich in talented, adroit and clever people. However, the rapid pace of emergence of new technologies and their introduction into industrial production and everyday life requires the education sector to re-design and provide an education system capable of preparing the workforce for the technologies of the hyperconnected world in which we live.

It is necessary to modify from the ground up the way of communication between professor and student, where the professor sends information and the student receives and consumes this information, and after a certain time demonstrates the acquired knowledge in the form of exam.

Of essential importance is to intensify the training of students at the initial levels of education (primary and secondary) in the context of information technology literacy. According to UK research, more than 75% of employers notice a lack of digital skills in their employees [11].

Artificial intelligence, robotics, data science (big data) and the Internet of Things (IoT) already have a major impact on industry, economy and the structure of available jobs, in the similar way as the 2nd industrial revolution suppressed manual jobs in the late 19th century. On the other hand, creativity, communication, collaboration, critical thinking are traits that cannot be automated or replaced and the education system should be based on their development. In order to respond to this challenge as a society, it is necessary to transform education methods at all levels.

The physical presence of students will no longer be required as much as it is expected today, primarily due to tools such as virtual or augmented reality. Available technologies enable the absorption of knowledge in a modular, flexible manner, at a pace consistent with the individual's adopted lifestyle. The professor has real-time information about the pace at which the material is being adopted, and can take corrective action immediately in the event of a problem.

Students should be granted with some degree of independence in the implementation of the learning process, but this will also lead to greater responsibility when it comes to the ultimate learning outcome. On the other hand, the role of teaching staff will shift towards an individual mentoring approach. When creating a subject syllabus, it is essential that students' opinions are taken into account.

References

1. Hilbert, M. & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, *332* (6025): pp. 60–65, doi:10.1126/science.1200970. ISSN 0036-8075.
2. Gillings, M. R. et al. (2016). Information in the Biosphere: Biological and Digital Worlds. Trends in Ecology & Evolution. 31 (3): pp. 180–189. doi:10.1016/j.tree.2015.12.013.
3. Schwab, K. The Fourth Industrial Revolution. World Economic Forum, 2016, ISBN-10: 1944835016.
4. Ugrinović, D., Dobrijević, G. & Đorđević-Boljanović, J. (2015). The impact of job satisfaction on the teachers motivation in thesecondary schools in Serbia. *Socioeconomica The Scientific Journal for Theory and Practice of Socio-economic Development*, *4*(7): pp. 197-206, doi: dx.doi.org/10.12803/SJSECO.4712515.

5. PISA Srbija, "O PISA projektu", Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije. Available at: http://pisa.rs/?RS=lat, (Accessed on: 12.10.2019.)
6. OECD. "PISA 2009 Results: Executive Summary", Available at: https://www.oecd.org/pisa/46643496.pdf, (Accessed on: 22.11.2019.)
7. OECD. "PISA 2012 Results in Focus - What 15-year-olds know and what they can do with what they know", Available at: https://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf, (Accessed on: 10.10.2019.)
8. OECD. "PISA 2017 Results in Focus", Available at: https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf.
9. Petrina, S. (2004). Sidney Pressey and the Automation of Education. *Technology and Culture*, Vol. *45*(2): pp. 305-330.
10. Robinson, K. (2010). Changing education paradigms. TED conferences. Available at: https://www.ted.com/talks/ken_robinson_changing_education_paradigms. (Accessed on: 13.10.2019.)
11. Jisc. (2019). Education 4.0 - transforming the future of education (through advanced technology). Available at: https://www.youtube.com/watch?v=aVWHp8FsV1w, (Accessed on: 26.11.2019.)

Types of Innovation and Their Impact on ICT Use in Companies in the Republic of North Macedonia

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Abstract—**A few decades forwards not much has been written about innovation, but in recent years the number of innovation theories has grown, especially among those that have been published. Some theories are focused on technological development, technological research and development functions for R&D in companies, other theories are focused on individuals who create and make new products and theories related to marketing innovations. Today, innovations are a common business strategy for most businesses and various researchers and academics. ICT and innovations are of a great importance for the economic development and prosperity in the developing countries, in this case the Republic of North Macedonia. From this point, the main hypothesis of the paper is: "ICT plays an important role in promoting innovations and innovation activities". The paper highlights the part where we can see the influence of different types of innovation on ICT used in companies. The results from the empirical research implied to accepting the certain hypothesis, which lead to accepting the main hypothesis, "Activities in the companies have an impact on the ICT use in the companies in the Republic of North Macedonia".**

Keywords - ICT, innovation, types of innovation; company

I. INTRODUCTION

During the years, great effort has been made to help countries in the application of ICT in their approach to social and economic development. Infrastructure development, technological advances, and price cuts have lead to the growth of ICTs, where through its use was enabled the connection of billions of people around the world. Today, the aim of companies is not just the deployment and acquisition of technology, but the ability to use technology in an innovative way. Companies must create and commercialize a stream of new processes and products that move the edge of technology, to develop so quickly so their competitors cannot reach them.

Some of the recent changes in innovation could not have happened without ICT. The way ICT has the potential to integrate, complement and fit a wide range of knowledge and technologies from different areas into a traditional production environment, enables innovation to be the main driver for stimulation productivity in companies.

It's good to highlights the need to emphasize the approach of the innovative use of already established technology (mobile phones, television), not just to establish a new technology.

The main aim of the research is to accept and apply the benefits of different types of innovation, as well as incentives and constraints that affect this process at the firm level. There is a number of factors influencing ICT use in the company and in particular, explores the role that has the types of innovation that the company use.

The survey was conducted in order to identify the connection between ICT and innovation in the direction of strengthening innovation in the Republic of North Macedonia. This contributes to use different types of innovation in the company, and explains the need for proactive strategies, creating the necessary ambiance and connection of ICT with innovation and information society in the Republic of North Macedonia. The main hypothesis of the research is: “Activities in the

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company have an impact on the ICT use in the company".

II. TYPES OF INNOVATION

The company can make a lot of changes within its methods of operation, in order to use the factors of production and types of products that improve the company's productivity and market performance. There are several models, concepts, and types of innovation that cover a wide range of changes in the activities of companies, such as:

- Product innovation;
- Process innovation;
- Marketing-innovation;
- Organization innovation;
- Eco-innovation;
- Social Innovation;
- Sustainable innovation.

A. Product innovation

Product innovation is the introduction of new or significantly improved products or services in terms of their features or intended uses [1]. This includes significant improvements in technical specifications, components, and materials, user-friendly software, or other functional features. They may use new knowledge or technologies or maybe a combination of existing knowledge and technologies. Product innovations include the introduction of new products and services and significant improvements in the functionality or use features of existing goods and services. With the development of new products, companies gain many benefits, such as:

- Promoting and increasing competitiveness;
- Increased corporate income;
- Stimulating export activities;
- Possibility of reducing business risk.

Product and service innovations can include significant improvements in the way they are used (for example, in terms of efficiency or speed), when adding new features to existing services, or introducing completely new services. An example of significant improvement is the internet banking services, which is a result of the significantly improved speed and simplicity of using the services.

B. Process innovation

Process innovations are the implementation of a new or significantly improved production process or delivery method. This includes significant changes in techniques, equipment, and software [2]. Process innovations can be designed to reduce unit costs in production or delivery or to contribute to the production or delivery of new or significantly improved products in order to increase quality. Manufacturing methods include techniques, equipment, and software used to produce products and services. Examples of new production methods are the implementation of new automated equipment for a particular product line or the use of a computer with a product development design program. A new method of delivery is the introduction of bar codes or an active RFID (radio frequency identification) tracking system. Process innovations also include new or significantly improved techniques, equipment, and software designed for additional support activities such as procurement, accounting, computers, and maintenance. Implementation of new or significantly improved ICT is an innovation of the process although it is designed to improve the efficiency and quality of additional support activities.

C. Marketing-innovation

Marketing innovation is the introduction of significant changes in product design or packaging, the introduction of new product promotion techniques and new methods of product placement and sales channels. In addition, marketing innovations include new pricing policies for goods and services [2].

Marketing innovations are aimed at better addressing customer needs, new markets, or re-positioning a company's product in the market, with the aim of increasing company sales. A distinctive feature of marketing innovations compared to other changes to a company's marketing instruments is the implementation of a marketing method not previously used by the company. It must be part of a new marketing concept or strategy that is a departure from existing marketing methods. The new marketing method can either be developed by an innovative company or adopted by other companies or organizations. New marketing

methods can be applied to both new and existing products.

Product design change refers to changes in the form and appearance of the product that does not alter the functionality of the product or user characteristics or changes in form, appearance, packaging or taste. Marketing innovations include the introduction of new sales channels and the use of new product presentation concepts. Sales channels refer to the methods used to sell goods and services to customers and do not cover the logistics methods (transportation, storage, and handling of products) that are mainly concerned with increasing efficiency. New marketing methods to promote products include the use of new concepts to promote the firm's goods and services and the introduction of a fundamentally new brand symbol. Price innovations include the use of new pricing strategies in the market for goods or services. Seasonal, regular and other routine changes in marketing instruments are generally not marketing innovations. For such changes to be marketing innovations they must include marketing methods that were not previously used by the companies.

D. Organizational innovation

Organizational innovation refers to the implementation of a new organizational method in a company's business practice, workplace organization or external relations [2].

Organizational innovation can be designed to increase the efficiency of the company by reducing administrative or transaction costs, improving job satisfaction (and thus labor productivity), gaining access to resources that cannot be trading (such as unconfirmed knowledge) or reducing shipping costs.

Organizational innovation in business practice involves the implementation of new methods of organizing routine work and workflow procedures. These include, for example, the implementation of new practices to enhance learning and knowledge sharing within the firm. Innovations in the workplace organization involve the implementation of new methods for distributing responsibilities and decision-making among employees for the division of tasks in the firm (and organizational units), as well as new concepts for structuring activities, such as the integration of different business activities. New organizational methods implemented in a company's external relations include implementing new ways of organizing relationships with other firms or public institutions, such as establishing new ways of collaborating with research organizations or clients, new methods of integrating with suppliers, outsourcing or first-time subcontracting for business activities in production, procurement, distribution, recruitment and system services. Changes in business practice, workplace organization or external relations that are based on organizational methods already in use in the company are not organizational innovations. The formulation of managerial strategies is not an innovation in itself. Innovations occur when the strategy is implemented through the use of new software and the practice of documenting information in order to encourage knowledge sharing between different parts. Merging with other firms or acquiring other firms is not considered an innovation of the organization, even if one firm merges or acquires another firm for the first time. Mergers and acquisitions can, however, be innovations to the organization as the firm develops or adopts new organizational methods during the merger or acquisition.

E. Eco-innovation

The term eco-innovation refers to innovations that contribute to reducing the negative impact on the natural environment. Eco-innovation is the creation of new products at competitive prices, processes, systems, services and procedures designed to meet human needs and provide a better quality of life for everyone throughout the life cycle with minimal use of natural resources (materials including energy and surface) at unit output and minimal release of toxic substances [3].

Eco-innovation involves new or significantly improved solutions introduced at any stage of the product life cycle, with the aim of improving resource productivity or reducing environmental impact.

Many companies have started using eco-innovations or similar terms to contribute to sustainable development. Several governments are also promoting the concept as a way to meet sustainable development goals to protect the industry and a competitive economy.

Among the key elements in determining the success of eco-innovations is the use of a business model that emphasizes eco-innovation in the market and promotes their spread. By

replacing old business practices, innovative business models enable firms to restructure their values and create new kinds of relationships between the manufacturer and the consumer and change the consumer culture and practices of use. That's why business models are especially important for eco-innovation, to see how business models and strategies can challenge and help diffuse eco-innovation and enable systemic change and transformation [4].

In a recent study, companies were interviewed about whether they saw any difference between innovations in general and environmental innovation, and many of the companies felt that there was no difference. Most companies find out that in all their innovations they take into account all environmental measures even when environmental improvements are not the main focus of their research and innovation efforts. Indeed, many environmental innovations link them to environmental benefits and benefits to the firm or user. In this context, the motivation of an eco-innovation company is to benefit from the benefits of investing in innovative technology, thereby reducing material inputs into the production process (e.g. fixed assets, energy) [5].

F. Social innovation

Social innovation can be defined as the development and implementation of new ideas (products, services and models) to meet social needs and to create new social relationships or collaborations. They are designed to improve human well-being. Social innovations are innovations that are social both in their goals and in their own way. They are innovations that are not only good for society but also for improving the capacity of individuals to act. They rely on the inventiveness of citizens, CSOs, local communities, businesses, and public servants. They are both an opportunity for the public sector and for markets so that products and services better meet individual as well as collective aspirations [6].

Social innovation is a significant innovation in the internationally recognized Oslo Handbook, but its primary purpose is to create social change.

It is particularly important to outline ten practical steps to implement social innovation, as these steps can help regions cope with existing problems, such as how to create jobs for young people, how to integrate the migrant community in economic life, how to provide health solutions through new ICT solutions for the whole population, or how to cope with poverty (Fig. 1).

These table shows, what authorities can choose to promote social innovation. The steps are presented in order of increasing involvement in social innovation, but the order depending on the region's level of knowledge and development. Some can start with Step 3, while others might need to start from Step 1. Some might be interested in Step 9, while others might not want to implement it.

G. Sustainable innovation

Business Week and The Boston Consulting Group annually publish a list of the most innovative companies in the world, with 50 companies topping the rank of long-term sustainability. They are Microsoft, IBM, Toyota, GE, Nokia, Unilever or Tata.[1] While looking at the list of the 100 Most Sustainable Corporations in the World published by Corporate Nights and Innovest, we can see that many of the leading sustainable companies are on the top of the most innovative companies. The conclusion is that there is a link between innovation and sustainability.[2] There is no precise or defined definition of sustainable innovation, which is a result of the difficulties that arise in defining the concept of sustainability and sustainable development. Arthur Little defined "sustainable driving" innovations as "creating new market space,

Figure 1. 10 Steps to implement social innovation. Source: European Commission (2013) Guide To Social Innovation Regional and Urban Policy p.59

[1] https://www.bcgperspectives.com/content/articles/innovation_growth_most_innovative_companies_2013_lessons_from_leaders/?chapter=2 (11.02.2017)
[2]www.global100.org/global-100-index/ (11.02.2017)

products, and services or processes driven by social, environmental or sustainable outcomes". Sustainable innovation is not only about new concepts, but also about commercializing technologies, products and services, and entrepreneurship. It can also be about accepting and adopting new processes and systems on a societal level [7].

Sustainable innovation is a process where sustainability considerations (environmental, social, and financial) are integrated into the company's systems from idea generation through IR and commercialization. This is important for products, services and technologies, as well as for new business and organizational models [8].

It is important for sustainable innovation to become internationally recognized that will make a significant contribution to economic and business opportunities. Sustainable innovation is characterized by four types of strategies (Figure 2.8) that help companies move toward set goals[3]:

- Building relationships to achieve higher goals - Sustainable innovation is a challenge. In addition to personal and business interests, innovators need to share their higher goals to work together. They need to build trust that will lead to new visions based on shared values.
- Enabling a Sustainable Lifestyle - Companies that focus on meeting basic needs, rather than fulfilling desires, will ensure prosperity so people can live in a healthy environment and a healthy society.
- Stakeholder Value Creation - Sustainable innovation is not about doing it yourself, it involves working with partners in society to create value that is honestly distributed and transparent to everyone.
- Responsible use of resources - Whether natural (metal, wood, petroleum, etc.) or human (people, knowledge, technology, etc.) resources are valuable. Their responsible use means starting a level of editing and anticipating potential impacts on users, society and the environment.

The innovation drive is very important because it determines the firm's innovation. Based on this, companies using research come to the conclusion that the core unit of innovation is not a department, but a network that aims to create public and private goods. And the basic conclusion is that now companies treating sustainable innovation as a new frontier [9].

Based on the models, concepts and types of innovation presented, it can be concluded that there is a continuous need for innovations that are essential to ensure the survival of companies and their competitive power. Due to their importance, the application of different types of innovations becomes necessary for evaluating the performance of companies and for creating policies. The positive impact that different types of innovation have on the economy is widely accepted, and their economic impact is very important.

III. EMPIRICAL RESEARCH

The aim of this paper is to research the influence of different types of innovation on ICT use in companies in the Republic of North Macedonia. In Google Docs was prepared self-administered questionnaire and questions is created in closed-ended format and a 5-point Likert scale. The model of questions was based on the theory and methodology presented in the Oslo Manual. The questionnaire contained logically connected questions with introduction and five sections. Basic information for the companies is gathered in the introduction part, including a number of employees, sections, ownership and profit. The other five sections used questions for innovation activities of the company, innovation drivers and barriers, cooperation with others, measures to support innovation and ICT innovation in the company. The questionnaire was sent randomly to 400 companies in the Republic of North Macedonia, and the response was received from 103 companies. Most of the companies according to the number of employees belong to the category of micro and small enterprises, belong to the section processing and manufacturing industry and have private domestic property.

The data analysis was accomplished using SPSS v20 statistical software. Three types of analyses were primarily conducted: the first one included descriptive data analysis; the second one was Pearson Chi-Square test for independence, whilst the third one was Correlation-Pearson Correlation Coefficients. Due to the scope of the research, in this paper we will present only the first and the second

[3] https://www.yumpu.com/en/document/view/250716/5686-innovation-booklet-extern-webversie/37 (23.05.2017)

analyses, especially the part where we can see the influence of different types of innovation on ICT use in companies in the Republic of North Macedonia as a part of the individual hypothesis: Activities in the company have an impact on ICT use in the company in the Republic of North Macedonia.

In the first part is presented a descriptive data analysis especially for the question: Has your company introduced any of these four types of innovations.

This question is asked precisely to identify what kind of innovation the surveyed companies are introducing. About 25% of surveyed companies have product innovations and marketing innovations, that is, they introduce new or improved products / services with new features and functionalities and target different distribution channels, different prices, market positioning, advertising, etc. Innovation in the organization introduces 20% of surveyed companies, 16% of surveyed companies introduce process innovation and 15% responded that their company does not innovate (Tab. 1).

TABLE I. USE OF THE DIFFERENT TYPES OF INNOVATION IN COMPANIES IN THE REPUBLIC OF NORTH MACEDONIA

Types of innovation	Number of companies	Percents
product or service innovation	41	25%
process innovation	26	16%
marketing innovation	41	25%
organizational innovation	33	20%
did not innovate	25	15%
sum	166	100%

Source: author's own research

The special and individual hypotheses is tested with Pearson $\chi 2$ (Chi-Square) test for independence and given a margin of error of 5 %, i.e. $\alpha = 0,05$.

Individual hypotheses have been tested in two ways when the dependent variable is company innovation and when the dependent variable is ICT use in the company

Due to the scope of the research, in this paper, we will present only the part where the dependent variable is ICT use in the company especially the first individual hypothesis which conducts the special hypothesis "Types of innovation affect ICT use in the company".

Dependent variable: Using ICT in the company.

Independent variable (q1): Types of innovation.

H0: there is no dependency between the q1 variable and the use of ICT in the company.

H1: there is a dependency between the q1 variable and the use of ICT in the company.

TABLE II. CHI-SQUARE TEST OF THE INDEPENDENCE OF THE VARIABLES

		Using ICT in the company
Types of innovation	Chi-square	15,508
	Df	6
	Sig.	0,017

Source: author's own research

Based on the data obtained in Table 2, it can be seen that Asymp. Sig. (2-sided) or $p < 0.05$, which means that the null is rejected and the alternative hypothesis is accepted. This means that there is a statistically significant relationship between variables. That is, there is a dependency between the independent variable: types of innovation and the dependent variable: using ICT in the company (Tab. 2).

The results show that special hypothesis q1: Types of innovation affect ICT use in the company - accepted.

TABLE III. INDIVIDUALLY TESTING HYPOTHESIS

Individual hypothesis	Variables	Value	df	AsympSig. (2-sided)	Individually testing hypothesis
Q1.1	q1.1	15,508	6	0,017	is accepted
	q2.2	17,960	4	0,001	is accepted
	q3.3	15,546	6	0,016	is accepted
	q4.4	52,359	1	0,000	is accepted
	q5.5	10,780	6	0,095	is rejected
	q6.6	60,657	12	0,000	is accepted

Source: author's own research

Accepting of this special hypothesis and other special hypothesis in this section led us to accepting the individual hypothesis Q1.1: Activities in the company have an impact on ICT use in the company (Tab. 3).

From the research analysis of all individual responses and from the testing of the special hypotheses, we can see that, in general, all special hypotheses are accepted. Only q5.5 special hypothesis is rejected. Acceptance of special hypothesis lead to acceptance of individual research hypothesis Q1.1: Activities in the company have an impact on the ICT use in the company – is accepted (table 3).

IV. CONCLUSIONS

The results of this research provide the following conclusions:

- Usage of different types of innovations in company's impact of the company's innovation. Therefore, the company can make many kinds of operations changes like: introduction of new or significantly improved products or services, implementation of a new or significantly improved production process or delivery method, introduction of significant changes in the product design or packaging, implementing new techniques for products promotion, usage of new methods for product sales and sales channels, and implementation of new organizational method in the company, workplace organization or external relations.
- More and more managers are aware of the importance of innovation and they are focused on managing and use if different types of innovation in their organizations.
- Companies that use innovations are innovative organizations that improve themselves in competitiveness and improve their processes or their products and/or services.
- Companies that use different types of innovation is gaining more growth and profits from companies that don't accept and use different types of innovation. In practice, it has been shown that the production of the same standard product in the same way for decades couldn't make the same profit.
- ICT is the technological area with the highest innovation rate.
- Each company at every level should have employees who will be trained for the innovation principles, skills and tools with highly developed capabilities to apply ICT tools and to generate new business ideas. They have a major impact on the company's innovation and ICT use in companies.
- The role of ICT in advancing the innovation process is extremely detailed and complex. Companies that want to be successful must use different types of innovation that they will know and follow the company. In this way, there will be persons employed precisely for the R&D and will be coordinated in making innovative decisions. Cases of the past indicate that one of the main reasons for the failure of the development of new products is the lack of staff and a certain kind of innovation that the company can follow.

They are of great importance for the prosperity and economic development in the Republic of North Macedonia because every company uses ICT and different types of innovation. The survey was conducted in the period when the Republic of North Macedonia is supporting the innovation activity in the companies for achieving accelerated technological development, based on knowledge transfer, ICT, innovations, and R&D (research and development). Results from the empirical research implied to accepting a special hypothesis, which led to accepting the individual hypothesis that Activities in the company have an impact on ICT use in the company in the Republic of North Macedonia. The obtained results of this research can be a guide when creating an innovative strategy in the Republic of North Macedonia. Research indicates that this trend continues. Managing innovation policy is becoming increasingly complex and increasingly dependent on governments' ability to find a strategic approach to harnessing the innovation potential of their economies.

REFERENCES

1. Oslo Manual (2005). *The Measurement of Scientific and Technological Activities*. A joint publication of OECD and Eurostat, Third edition, p. 49.
2. Oslo Manual (2005). *Guidelines for Collecting and Interpreting Innovation Data*. OECD Publications, Third edition, p. 50, 51.

3. Kemp, R. & Pearson, P. (2007). *Measuring eco-innovation*. MEI project, um-merit, p.7.
4. OECD (2012). *The Future of Eco-Innovation: The Role of Business Models in Green Transformation*. Danish Business Authority, January p. 6.
5. OECD (2008). *Environmental innovation and global markets, Working Party on Global and Structural Policies*. Paris pp. 26-40.
6. European Commission (2013). Guide to Social Innovation, Regional and Urban Policy, p. 6.
7. Little, A. (2005). How Leading Companies are Using Sustainability-Driven Innovation to Win Tomorrow's Customers, p. 3.
8. Charter, M. & Clark, T. (2007). *Sustainable Innovation*, The Centre for Sustainable Design p. 9.
9. Nidemolu, R., Prahalad, C. K. & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review* pp. 57-64.

HR Management in Innovation-supportive Organizational Systems

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Abstract—**Organizational innovativeness and market success is conditioned by organizational creative capacities, which are highly dependent on innovative management practices. Innovation management practice is aimed at improving management of internally limited resources, resulting in innovative product or service portfolio, and achieving better business performances. This article focuses on the role of human resources management in innovation-supportive organizations, especially its contribution to growth, development and profitability. The purpose of the paper is to determine basic characteristics of HR management in innovation-supportive organizations, and to identify contemporary techniques for managing knowledge and employee innovation.**

Keywords – innovation, HR management, innovation indicators, knowledge management, HR techniques

I. INTRODUCTION

Organizations operating in turbulent markets, in response to market developments, are adapting to changes by investing in growth and development. However, the opportunities are not the same for all organizations and are conditioned by internal and external factors. Internally, they depend on available resources, and externally on the markets they serve, the turbulence level, and sudden unpredictable shocks. Those organizations, that are capable of adapting to contemporary changes, are transforming traditional management concepts into modern ones. They are introducing new business processes that will provide more efficient and effective business, radical or incremental changes in business output, and they possess the key factor necessary to achieve better performance and survival.

Improvement of managerial practices, ie new ways of using, allocating and managing internally limited resources, should result in product or service innovation, and achievement of better business performances. In doing so, increasing importance is attached to intangible resources, such as organizational culture, and employee know-how. The importance of scientific, innovative and creative capacity of organization for survival and business success is supported by several researchers [1, 2] Strategic management of organization's innovative capacity is achieved through the innovative human resources management (HR management), that is, the function of planning, organizing, staffing, leading and controlling, with the aim of achieving future success. It covers the selection and implementation of adequate strategic management techniques, to measure and increase the impact of innovative activities on business performances and the organizational growth [3].

Strategic management of innovation capacity is based on organizational potential that should be maximized and focused on meeting new needs, innovative changes, and achieve a long-term sustainable competitive advantage. Adequate response is possible by implementing changes in HR management practices. Setting up a flexible and complex innovation-supportive organizational system requires transformation of organizational structure and HR management functions, as well as management style. Among other things, it is necessary to establish an organizational structure characterized by a high mobility and sensitivity to the results of scientific and technological progress and organizational and technical innovations.

In order to determine the importance of HR management activities in innovation-supportive

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organizations, the basic characteristics of HR management are analyzed, and their impact on innovatively oriented activities, such as contemporary techniques for managing knowledge and employee innovation. In contemporary literature, organizational innovation is viewed as crucial and desired, since it increases the survival and continued success of organization [2, 4-6]. HR management activities, such as planning, leadership, training and empowerment of employees, are of high importance for growth, development and profitability as indicators of business success.

II. Basic Characteristics of HR Management in Innovation-Supportive Organizational Systems

HR management in innovation-supportive organizational systems should encourage and maximize the use of employees' innovative behavior. Initial HR management task is an assessment of innovative potential of organization and its employees, by defining the factors and indicators of innovative potential (Tab. 1). Quantitative measurement of innovative indicators helps to determine the degree of utilization of innovative potential, and its impact on business results.

Obtaining a realistic assessment of an organization's and employees' innovative potential requires a combination of available innovative indicators, or extending the proposed list to new ones that better define the organization's innovative potential. Outputs provide a framework for defining and assigning roles in the implementation of innovative activities. HR management may, after evaluating innovative potential, assign specific roles to employees, in order to foster innovation. The proposal for possible employee roles, according to [7], is: director or champion of innovation, as the initiators of innovation process; innovation leader, teacher, ambassador, scout and catalyst. Director of innovation should have a good knowledge of organizational business and the desired strategic direction. On those basis he/she defines an innovation strategy in accordance with the overall strategy of organization. He/she proposes innovative projects and forms an innovative portfolio based on pre-identified criteria. He/she is responsible for the implementation of innovation projects in accordance with the identified innovation strategy and for the results achieved.

TABLE I. Factors and Indicators of Innovative Potential of Organization and Employees

Factor	Indicator	Relevant references
Creativity	Percentage of leaders trained in creativity techniques, atmosphere	[8, 9]
Top management support	Amount of time managers spent with innovations compared to normal tasks	[10, 11]
Openness of company towards change and innovation	Number of external ideas/generated with customers	[12, 13]
Strategic fit of innovation	Number of newly created innovative opportunities	[14, 15]
Innovation-oriented learning	Number of managers trained in the methods and tools of innovation	[16, 17]
Internal knowledge resources, experiences and background of founder/managers	Use of internal and external knowledge and information sources	[18, 19]
Internal communication	Effective communication with management and team members	[20, 21]
Good team structure together with appropriate leadership	Accountable, dedicated, supported cross-functional teams with strong leaders	[22, 23]

Source: Author, based on [24]

Champion of innovation, or innovation manager, should identify the action plan for implementation of selected innovation project. His/her role is of advisory nature. He/she needs to be flexible, to explore innovative options, but without making decisions. Innovation leader is a project leader who monitors the implementation of projects with a high degree of innovation, from conceptualization to implementation. He/she is responsible for selecting and directing the members of project team, and should possess negotiating skills and carry out continuous communication. Innovation teacher defines a learning agenda to overcome current gaps related to the behavior of team members, and gaps within innovation processes. Works with innovation team, trains them in the application of innovative

instruments and processes. Together with innovation teacher, innovation ambassador supports the team members in implementing ideas and concepts in terms of expertise and best practice. Internal scout or innovation scout should have good internal connections and know who is doing what in organization, as he/she is tasked with identifying innovation opportunities that are consistent with internal situation. This role is most commonly found within multidivisional organizations, where linking unrelated divisions, or merging different product lines, should be done in order to open a new market. In addition to innovation scout, there is a scout of future opportunities whose task is providing a link between future developments and the internal situation in organization. Innovation catalyst should create an innovation culture within organization so that employees become familiar with the importance of innovation, leading to easier acceptance of innovation and new practices within organization. HR management in innovation-supportive organizational systems, which has realistically evaluated the innovative capacity of employees and assigned roles to them, is more likely to succeed.

III. KNOWLEDGE MANAGEMENT THROUGH EMPLOYEE TRAINING AND DEVELOPMENT

Knowledge-based economy have emerged as a result of increasing impact of knowledge and technology on economic growth and development [25]. Knowledge management is gaining importance in the contemporary business environment as it directly changes business patterns as well as economic theory.

A fundamental component of a knowledge-based economy is a greater reliance on intellectual capacity than on physical inputs and natural resources [26]. This requires continuous training and development of employees, i.e. the implementation of the concept of continuous training and education by HR management. The result of continuous training and education is new knowledge, aimed at technological change, positive impact on productivity, and better results in production and all other business performances.

Knowledge management concept is about knowledge and know-how as an essential organizational asset, which must be preserved and utilized in the right way, by continuous organizational learning that will foster innovation and increase the efficiency of business process. As a driving force of the modern economy, it becomes an indispensable way of doing business in a dynamic business environment, and one of the conditions for achieving long-term competitive advantage. It aims at transforming external knowledge internally and incorporating new knowledge into existing business frameworks.

Forming a new knowledge base requires flexible workflow, information processing, business procedures, decision-making process and employee motivation [27]. Flexible workflow is the ability to modify established business practices, influenced by sudden situations occurring inside or outside the organization. The quality of knowledge base depends on information processing, while the commercialization of knowledge depends on business procedures and decision-making processes that guide the implementation of knowledge through employee motivation. The goal of modern organization is not only the formation of knowledge base, but its constant evolution, influenced by new trends. A continuous process of innovation can be implemented if organization: operates on the principle of creative chaos that emerges as motivator for change; possesses a wealth of information that enables finding new promising solutions to defined problem; has developed internal rivalries among teams, which offer different solutions to a defined problem with the choice of the best possible solution; conducts strategic employee rotation leading to a dynamic movement of new knowledge within the organization [28].

Human resources management directs knowledge through an optimal combination of employees, different personalities, resulting in greater learning capacity and innovation. The balance of introverted and extroverted personalities in employee structure is needed to ensure a constant flow of ideas by introverted personalities, and analysis of their external feasibility by extroverted personalities [29]. The unbalanced structure of the mentioned personalities can lead to negative effects, by investing in research and development of all potential ideas, without considering the alignment with external trends. It is necessary to involve employees who, on the basis of their intuition and imagination, present ideas that have great creative and innovative potential, as well as employees who carry out the analysis of presented ideas, possibilities for

commercialization and mass application. Employees who make decisions based on incomplete data are an indispensable category in innovation team, as they are prepared to take on a high degree of uncertainty and risk, which is tied to any innovation. This combination of personalities should enable the organization to achieve highly innovative business results over a long period of time [29].

Depending on the scientific potential of employees and the possibility of their improvement, HR management defines training and development programs, in order to improve the competences of all employees and to create the basis for organizational innovative capital. Several training models could be distinguished: training based on the use of equipment, on process performance and through job rotation [29]. Equipment-based training enables the proper use of newly implemented technology, faster adoption of new modes, increased productivity, and quality of work and efficiency of work. Process-based training broadens the number of processes that employee can perform, influences the development of communication and coordination skills, as well as teamwork. Training through job rotation increases the degree of diversity of organizational knowledge, which allows employee to adapt more easily to redesigned or expanded job [30].

New knowledge that has been successfully implemented into organizational frameworks, by applying an adequate training model, has the effect of perfecting business processes and achieving greater performance. Effective knowledge management has the following positive results: improving the decision-making process, faster problem solving while minimizing possible mistakes, reducing development time, increasing innovation, improving business performances, and increasing external customer satisfaction [28].

IV. HR Management Techniques for Improvement of Employee Inovation

High degree of organizational creativity is achieved through the application of HR management techniques improvement of employee innovation. This involves incorporating a creative business concept, with the aim of forming a creative employee structure and maximizing their potential. Organizations are confronted with many of these HR techniques: brainstorming, brain-writing, creative associations, incubation, TRIZ, etc. The application of some of the techniques, or a combination of these, aims to convert the internally available innovative potential of employees into profitable output.

Brainstorming technique is so-called idea invasion technique, where the emphasis is on pursuing normative creativity, finding a creative solution to a problem by creatively exploring the development of new products and services [31]. It is based on planning the future, and identifying possible directions for development, in order to achieve long-term sustainability. It enables the synergetic effect through the generation of ideas by a multidisciplinary group of individuals, from within or outside the organization, rather than identifying potential ideas by one individual. The use of summarized knowledge stimulates more ideas. Technology-intensive and innovation-oriented organizations apply brainstorming for both quantitative and qualitative reasons, that is, to get as many potential ideas as possible, while getting new highly creative ideas.

Electronic brainstorming enables the exchange of ideas without a formal meeting, via e-mail or fax, and using the Internet as an additional source of inspiration [32]. When conducting this brainstorming, it is necessary to identify the time limit for which the employees should respond to the problem by supplementing new ideas, i.e. by putting together a chain of ideas.

Brain-writing technique involves identifying alternative ideas from the left and right hemispheres, to provide a combination of left hemisphere functions related to speech, writing, computing, logic, or a rational-analytical approach to problem solving, and the right hemisphere in charge of intuition, perception, and visualization, that is, an emotional approach to solving a problem [33]. Creative solutions aimed at development of innovations, and their practical application, are the result of balanced use of the left and right hemispheres of the brain.

Creative association and analogy method drives the team trapped in traditional way of thinking by lowering unrelated words and inspirations, which associate on a given topic, and stimulate the definition of new perspectives and solutions [28]. There are two types of associative and analogical thinking, one of

which is descriptive in terms of explaining a given topic, and the other is exploratory one that should result in the identification of a new solution. This method is a source of creative thinking and problem solving, whereby existing knowledge in one area, or other similar fields, can be used. The wider the range of different inspirations to a given problem, the greater the range of brand-new solutions to identified problem. This method is used by HR management in organizations that are technologically and innovatively intensive, with extensive experience and knowledge, and whose new combinations lead to true product, service or process innovation.

Incubation technique involves intensive reflection on a given problem, through several longer sessions that results in incubation of ideas for possible solutions [34]. Sessions that involve intense focus on a given problem are followed by non-thinking about the problem, in order to establish maximum concentration that will lead to incubation of a large number of solutions. The basic characteristic of obtained ideas and solutions is a high degree of novelty, which enables the development of new products and services, the implementation of a new business process, or the innovation of management [34].

Mapping is a graphic representation of detailed breakdown of a problem into keywords, ideas, images and numbers, which make up a logical sequence [28]. The center of graphical representation defines the problem, which further branches out to as many new but similar ideas for its solution, until the possible ideas, keywords, phrases and facts related to the given problem are exhausted [28]. In this way, different combinations of possible solutions are identified, which are subject to further analysis regarding their efficiency, effectiveness and innovation. This method can be used to visualize problems, generate ideas, and make decisions [35]. It presents a large amount of data, provides an answer to the question, where have we been and where we want to go, i.e. series of new trajectories that were not previously apparent. The benefits of its application are in broader observation of the problem, in identifying possible directions, and in defining a new conceptual framework that will reorganize earlier ideas with creative thinking [35].

The goal of TRIZ inventive problem solving method is to avoid the psychological inertia of team members, which leads to common or existing solutions to the problem, and finds a new, specific solution using some of the principles in other fields [36]. The application of TRIZ method is possible because problems, solutions and technical evolution are repeated across different fields, with some degrees of modification. Choosing a complementary solution requires a detailed comparison of identified business problem with general problem, in order to make a realistic decision on optimal solution.

V. Working Flexibility Concept in HR Management

The implementation of working flexibility concept within HR management directly influences the growth of organizational performances from the perspective of innovation, encouraging employees to maximize the use of accumulated and latent knowledge. This mindset fosters the organizational proactiveness and agility, responding quickly to sudden changes and challenges from the environment by introducing something new or adapting the old. The concept basis is a knowledge-based economy and a flexible knowledge management process, hiring multi-disciplinary employees that can perform various jobs and operations, and their constant training and development. Workers performing two operations are thought to be 20% more flexible, those performing three operations 50%, those performing four to five operations 80% more flexible [37]. Such employee structure encourages the implementation of flexible HR management, and overcoming problems of lack or overload of individual employees, which prevents delays in business process.

Encouragement of the working flexibility concept should be supported within HR management, through an employee compensation system. The compensation system should be based on the number of work operations that employees can perform, or on the skill-based-pay SBP [38]. In this way, the compensation system is shifted form focus at work into a new one with focus at employees [39, 40], at their expertise and skills. Compensations encourage individual learning, and directly affect a higher organizational knowledge. By applying such a compensation

strategy, the desired qualification structure of employees is profiled, and their work behavior is directed towards new trends and maximum utilization of new opportunities.

In addition to positive effects offered by the working flexibility concept, there are disadvantages such as decrease in the efficiency of employees, moving from one job to another, motivation, fairness in relation to other employees, as well as difficult interaction with other employees. Reduced efficiency is due to the frequent rotation of employees to new jobs, insufficient experience and routine in performing them. In order to minimize the decrease in efficiency, it is necessary to draw up a rotation plan, taking into account the required time for adjusting to the new tasks and the optimum time of realization. Grouping to distinguish between employees who are flexible and non-working can directly demoralize and demotivate workers with less skills and qualifications. Competition, intolerance, poor interpersonal relationships and communication are also possible, leading to an unhealthy work environment that disrupts desired business performances.

VI. Conclusion

Innovative HR functions form a new management framework, which sets the HR management model to retain and increase business performances. Innovativeness in organizational systems is a dynamic category, influenced by intense changes from internal and external environment. Organizations operating in an intensive, both internal and external environment, are applying new HR management approaches in order to reorient further business direction and achieve better business results.

Organizations characterized by unstable internal environment can improve their performances by implementing the following HR management activities: assessment of innovative potential of organization and its employees by defining the factors and indicators of innovative potential, continuous training and development of employees, HR techniques for converting the internal innovative potential of employees into profitable output, working flexibility concept, and compensation system with focus at employees, at their expertise and skills.

Organizational systems that continuously engage new qualification structures have employees who are more flexible and resilient at accepting and implementing innovations. This conclusion points to employees as influencers, when implementing the innovation process, while the organizational culture, that encourages fundamental change and new technological principles, also influences a high innovation. High innovation in organization depends on employees as agents of change that drive innovation, that is, their attitude toward innovation, their motivation, qualification, creativity, productivity and efficiency.

When creating creative and innovative human resources, HR managers face the challenge of balancing their existing knowledge, creativity, attitude and subjective behavioral norms with their desire for more innovative business behavior. In doing so, they should focus on direct link between the implementation of compensation, training and development strategies, the working flexibility concept, and business performances. Organizations that understand the linkage and cause-and-effect relationship between the aforementioned categories can, despite higher employee allocations, achieve lower overall labor costs through labor rotation, performing different work tasks by one employee, and unnecessary additional involvement of external experts. Efforts of HR managers should be aimed at forming employees as proactive individuals who are not satisfied with their existing business, but actively participate in finding and implementing new products, services or processes.

References

1. Wolfe, R. (1994). Organizational Innovation: Review, Critique and Suggested Research Directions. *Journal of Management Studies*, 31(3), pp. 405-431.
2. Damanpour, F. (1996). Organizational complexity and innovation: developing and testing multiple contingency models. *Management Science*, 42(5), pp. 693–716.
3. Keupp, M. M., Palmié, M. & Gassmann, O. (2012). The Strategic Management of Innovation: A Systematic Review and Paths for Future Research. *International Journal of Management Reviews*, 14(4), pp. 367–390.
4. Gopalakrishnan, S. & Damanpour, F. (1997). Are view of innovation research in economics, sociology and technology management. Omega,

International Journal of Management Science, 25(1): pp. 15–29.

5. Hurley, R. F., Hult, T. M. & Knight, G. A. (2005). Innovativeness and capacity to innovate in a complexity of firm-level relationships: A response to Woodside 2004. *Industrial Marketing Management*, 34(3), pp. 281–283.
6. Siguaw, J. A., Simpson, P. M. & Enz, C. A. (2006). Conceptualizing innovation orientation: A framework for study and integration of innovation research. *Journal of Product Innovation Management*, 23(6), pp. 556–574.
7. Von Stamm, B. (2008). *Imaging Innovation, Design and Creativity*. Chichester: John Villas & Sons.
8. Chiesa, V., Coughlan, P. & Voss, A. (1996). Development of a technical innovation audit. *Journal of Product Innovation Management*, 13(2), pp. 105–136.
9. Ayob, A., Hussain, A., Mustaffa, M. & Majidc, R. (2012). Assessment of creativity in electrical engineering. *Procedia – Social and Behavioral Sciences*, 60(2012), pp. 463–467.
10. March-Chordà, I., Gunasekaran, A. & Lloria-Aramburo, B. (2002). Product development process in Spanish SMEs: an empirical research. *Technovation,* 22(2002), pp. 301–312.
11. Graner, M. & Mißler-Behr, M. (2013). The use of methods in new product development – A review of empirical literature. *International Journal of Product Development*, 16(2), pp. 158–184.
12. Enkel, E., Perez-Freije, J. & Gassmann, O. (2005). Minimizing market risks through customer integration in new product development: learning from bad practice, *Creativity and Innovation Management*, 14(4), pp. 425–437.
13. Ogawa, S. & Piller, F. (2006). Reducing the risks of new product development. *MIT Sloan Management*, 47(2): pp. 65–71.
14. Griffin, A. & Page, A. L. (1993). An interim report on measuring product development success and failure. *Journal of Product Innovation Management*, 10(4), pp. 291–308.
15. Hittmar, S., Varmusa, M. & Lendela, V. (2015). Proposal of evaluation system for successful application of innovation strategy through a set of indicators. *Procedia Economics and Finance*, 26(2015), pp. 17–22.
16. Kerssens-van Drongelen, I. C. & Cooke, A. (1997). Design principles for the development of measurement systems for research and development processes. *R&D Management*, 27(4), pp. 345–357.
17. Banerjee, R. (1998). Indicators of innovation as a process. *Scientometrics*, 43(3): pp. 331 –357.
18. Caloghirou, Y., Kastelli, I. & Tsakanikas, A. (2004). Internal capabilities and external knowledge sources: complements or substitutes for innovative performance? *Technovation*, 24(2004), pp. 29–39.
19. Sawang, S. (2011). Key performance indicators for innovation implementation: perception vs. actual usage. *Asia Pacific Management Review*, 16(1), pp. 23–29.
20. Lester, D. H. (1998). Critical success factors for new product development. *Research-Technology Management*, 41(1), pp. 36–43.
21. Suwannaporn, P. & Speece, M. W. (2010). Assessing new product development success factors in the Thai food industry. *British Food Journal*, 112(4), pp. 364–386.
22. Cooper, R. G. & Kleinschmidt, E. J. (1993). New-product success in the chemical industry. *lndustrial Marketing Management*, 22(2), pp. 85–99.
23. Weiss, M., Hoegl, M. & Gibbert, M. (2011). Making virtue of necessity: the role of team climate for innovation in resource-constrained innovation projects. *Journal of Product Innovation Management*, 28(S1), pp. 196–207.
24. Dziallas, M. & Blind, K. (2019). Innovation indicators throughout the innovation process: An extensive literature analysis. *Technovation*, 80-81(2019), pp. 3-29.
25. OECD, (1996). *The Knowledge-based economy*. Paris: Organization for economic cooperation and development.
26. Powell, W. W. & Snellman, K. (2004). The Knowledge Economy. *Annual Review of Sociology*, 30(2004), pp. 199–220.
27. Slavicek, V. (2011). Enhancing Business Process Management with Knowledge. *E+M Ekonomie a Management*, 14(1), pp. 123-134.
28. Pervaiz, K. A. & Charles, D. S. (2010). *Innovation Management: Context, Strategies, Systems and Processes*. England: Pearson Education Limited.
29. Shearmur, R. (2015). Far from the Madding Crowd: Slow Innovators, Information Value and the Geography of Innovation. *Growth & Change*, 46(2), pp. 424-442.
30. Martinovic, M. & Tanaskovic, Z. (2014). *Menadžment ljudskih resursa*, Visoka poslovno - tehnička škola strukovnih studija, Užice.

31. Radic, A. (2018). Brainstorming kao jedna od tehnika odlučivanja. *Engineering management*, 4(2), pp. 134-142.

32. Pinsonneault, A., Barki, H. & Gallupe, R. B., Hoppen, N. (1999). Electronic Brainstorming: The Illusion of Productivity, *Information Systems Research*, 10(2), pp. 110-133.

33. Goffin, K. & Mithcell, R. (2012). *Innovation Management*. NY: Palgrave Macmillan.

34. Vukmirovic, N. (2005). Inovacije i preduzetnički intelidžens u funkciji razvoja korporativnog preduzetništva. *Industrija*, 2(3), pp. 27-45.

35. Velliaris, D. (2009). *Learning Guide: Mind Mapping*, Australia: University of Adelaide.

36. Rajic, D., Zakula, B. & Jovanovic, V. (2006). *Uvod u triz*, Beograd: Srpska inventivna grupa-SIG.

37. Sawhney, R. (2013). Implementing Labor Flexibility: A Missing Link Between Acquired Labor Flexibility and Plant Performance. *Journal of Operations Management*, 31(1-2), pp. 98-108.

38. Shaw, J.D., Gupta, N., Mitra, A. & Ledford, G.E. (2005). Success and Survival of Skill-Based Pay Plans. *Journal of Management,* 31(1), pp. 28-49.

39. Mahoney, T.A. (1989). *Employment Compensation Planning and Strategy*. Washington, DC: BNA Books. Dierdorff, E.C.,

40. Surface, E.A. (2008). If you pay for skills, will they learn? Skill change and maintenance under a skill-based pay system. *Journal of Management*, 34(4), pp. 721-743.

Challenges of Development of Innovative Sector of Republic of Serbia

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Abstract—**This paper presents challenges of development of innovation sector of Republic Serbia. Through the cooperation of research institutions and universities in Serbia and their organizational integration, productive results can be achieved in accordance with the Europe 2020 Strategy. In the paper are given statistical data that show the development of innovation, investment in research and development, the application of innovation in companies, the percentage of financial support to innovators through various funds, as directions for the further development of innovation.**

Keywords - Global Competitiveness Index (GCI), Innovation, innovation sector, R&D

I. INTRODUCTION

The role of policy makers in the field of innovation is very delicate. The state of Serbia has achieved its success in the innovation sector thanks to a successful innovation policy since the adoption of the Law on Innovation and the establishment of the Register of Innovation Entities and the Innovation Fund. Such active innovation policy has maintained continuity in the development of innovation potential of the Republic of Serbia.

Through the cooperation of research institutions and universities in Serbia and their organizational integration, productive results can be achieved in accordance with the Europe 2020 Strategy and its guidelines. In that sense, Serbia's innovation system and its results should be more carefully evaluated. It is also necessary to define concrete actions for the key initiative "Measuring Progress", so that the performance indicators of the innovation system in Serbia are not only indicatively defined but also measurable and comparing over a long period of 25 indicators for the Scoreboard methodology.

Further emphasis must be put on maintaining human resources in this sector. This means that in the field of innovation policy, particular attention should be paid in the future to development policies that foster innovation with scientific advancement and policies of openness and attracting highly qualified personnel while preventing their outflow, as well as training researchers for the purposes of national research objectives while providing attractive employment conditions in public research institutions.

This, above all, implies that budget investment of about 0.37% (18.7 billion RSD for R&D in 2018) should be urgently increased to a minimum of 1%, as well as an increase in the share of researchers in the total number of employees from the current 0.5% to the target 1.5%.

According to the latest survey of the Republic of Serbia from 2011, the average age of our citizens who moved abroad from 2002 to 2011 is 28.7 years. One in five is a college or college graduate. According to a survey conducted by the Cabinet of Ministers in charge of demography and population policy, three quarters of them do not plan to return to Serbia. Serbia is a country that leaves 4,250 people a month, or about 51,000 people annually, according to the European Statistical Office. During the same period, 228,000 young people emigrated from the Western Balkans, a figure that should alarm policymakers in the region, and especially in Serbia. The outflow of the workforce is only worse in the region in Croatia.

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It is believed that the data collected during the next census in Serbia will show a worse picture than this one. And when there are no young people, as the most innovative part of the radon active population, then there is no innovation. That is why Serbia in this year's assessment of the World Economic Forum in 2019 occupied 72 positions in relation to 141 ranked countries, while maintaining the same ratio of 60.9 and slipping by 7 positions compared to last year, from 65th place [1].

This is a piece of information that should also alert those responsible for urgently changing the current science and innovation strategy and adopting a more modern, tailored demographic, extremely fluid environment in the most educated part of the Serbian workforce.

Can this trend be mitigated by innovative legal solutions, changing strategy in the fields of education, science, innovation, and even business conditions and their incentive in Serbia? In search of this answer, it is necessary to analyze the impact of public policies in Serbia on the development of the research and innovation sector so far.

II. Analysis of the Development of the Innovation Sector in the Period 1990 to 2018.

After escaping the difficult period of 1990s, the budgetary allocations for science in Serbia increased significantly in gross amount, from a modest € 27 million in 2001 to € 100 million in 2008 [2].

Until 2000, and little had been done in this area in terms of legislation and in any other related activities as well, it was an uneasy task to make up more than a decade of what was missed. Along with initiating the procedures for creating a legal framework, the significant actions have been started to promote and emphasize the importance of this activity for the growth and development of the economy and thus the general society of Serbia [3]. After 2000 and until the Law on Innovation Projects [4] was passed, were related to the development of innovation, and for their most part referred to the development of an adequate legal framework that would regulate this matter in accordance with international standards and practices.

According to the Statistical Office of the Republic of Serbia (2002 - 2004) [5], the manufacturing sector was the most innovative (Fig. 1), as were the small and medium-sized enterprises (Fig. 2).

In the period from 2006 to 2008, investment in science, and therefore in innovation, has increased significantly, according to the available data from the Archives of the Ministry of Education, Science and Technological Development, as given in Fig. 3.

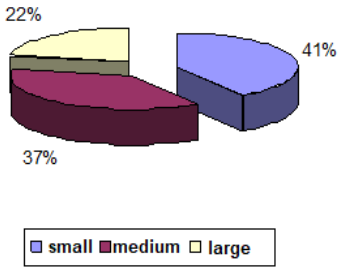

Figure 1. Company representation by size [5].

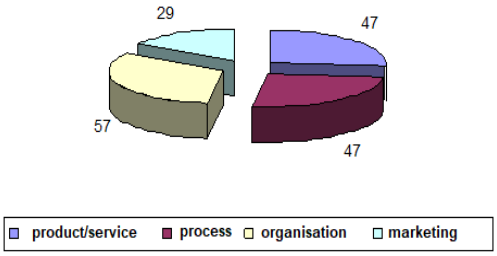

Figure 2. Innovation activities by fields of activity, size of enterprise and type of innovation, [5].

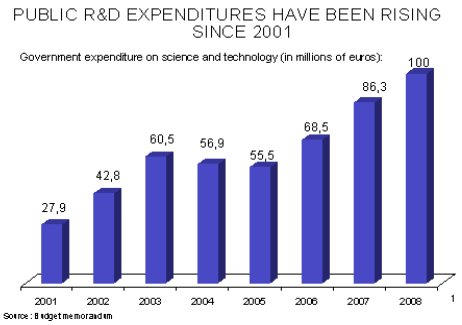

Figure 3. Investments in R&D from 2001 to 2008, [4].

Innovative activity has been achieved and enhanced. The above data represent a new, better direction in the movement of innovation activities compared to the previously analyzed period from 2000 to 2004 (Fig. 4).

What marked this period was the passage of the Law on Innovation Activity together with the supplementary rules and regulations that finally brought the long-awaited legal regulation in this area. This Law is a crucial starting point for any further action. In accordance with Article 11 of the Law on Innovation Activity, the Ministry of Science and Technology Development established the Register of Innovation Organizations and the Register of Private Entities Innovators, as well as procedures required for the entry of interested organizations and private entities in the Register [6].

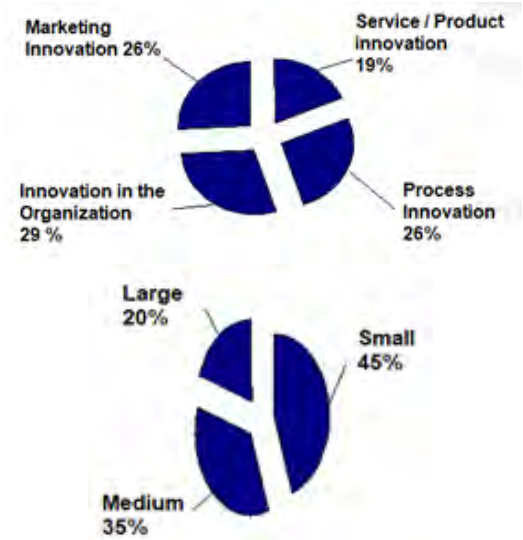

Figure 4. Innovator companies by size and innovation, [5]

What marked this period was the passage of the Law on Innovation Activity together with the supplementary rules and regulations that finally brought the long-awaited legal regulation in this area. This Law is a crucial starting point for any further action. In accordance with Article 11 of the Law on Innovation Activity, the Ministry of Science and Technology Development established the Register of Innovation Organizations and the Register of Private Entities Innovators, as well as procedures required for the entry of interested organizations and private entities in the Register[6].

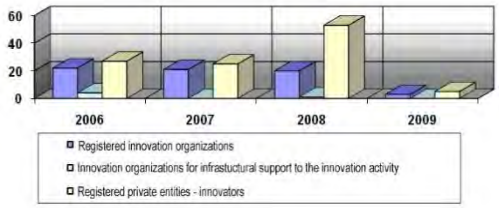

Figure 5. Overview of the dynamics of innovation organizations and private entities innovators registration by years, [4].

The dynamics of the registration of innovation organizations and private entities innovators by years is given in Fig. 5.

The analysis of indicators of innovative activities in the Republic of Serbia from 2008 to 2010 showed almost 70% of large businesses are innovative, just over half of medium-sized businesses and more than a third of small businesses. Innovative activities are more prevalent in manufacturing businesses, where more than half of innovations were introduced, while in service businesses, innovations were introduced by more than 40%. Tab. 1.

The largest number of innovators received financial assistance from state instances and the least from EU funds (Fig. 6).

TABLE I. BUSINESSES BY INNOVATION, ACTIVITY AND SIZE, 2008-2010, [5].

	Total	Innovators	Businesses that did not innovate	Innovator participation, %
In total	12141	5812	6329	47.9
Small business entities	9347	4143	5204	44.3
Medium Businesses	2237	1280	957	57.2
Big business entities	557	389	167	69.8
Manufacturing business entities	4141	2314	1827	55.9
Service Business Entities	8000	3498	4502	43.7

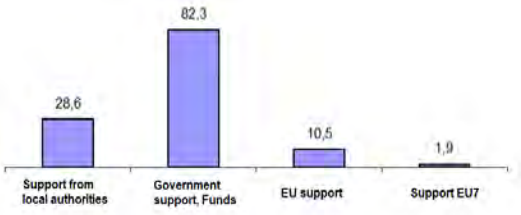

Figure 6. Financial support structure for innovators (%), [5].

The survey of indicators of innovative activities in the Republic of Serbia from 2012 to 2014 showed 63.2 % of innovators received financial assistance from state instances (Fig. 7), which indicates that the Republic of Serbia was able to improve the innovative environment in the observed period compared to previous years.

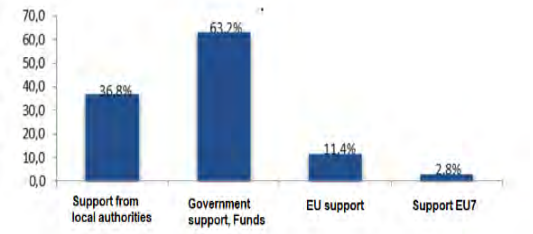

Figure 7. Financial Aid Structure for Technology Innovators 2012-2014 [5].

Unlike the previous period in the 2014-2017 period, the partial share of funding for innovators changed by significantly increasing EU7 support from 2.8 to 6.6%, and reduced government support from 63.2 % to 56.3% and local governments from 36.7 to 23.9% (Fig. 8).

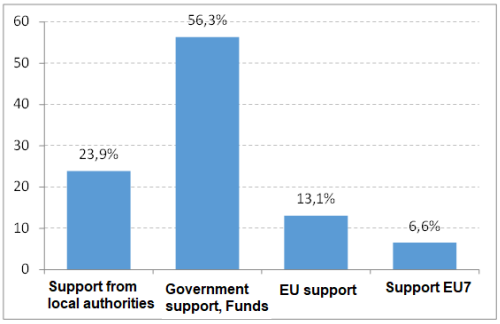

Figure 8. Financial aid structure for technology innovators 2014-2017 [5].

III. CONCLUSION

In addition to analyzing the available indicators to measure progress in the innovation sector, it is also very important to analyze Serbia's innovative human capacity in relation to countries in the EU environment and average. The participation of researchers in Serbia in the total number of employees is about 0.5%, while in the EU it is 1.5%, in some Member States it is approximately much higher: Iceland (3.58%), Finland (3, 22%), Sweden (2.71%). Financing for research, development and innovation in Serbia is carried out within the government budget and amounts to about 0.38% of GDP, which is a very low investment compared to the EU. And compared to smaller EU member states, these investments in Serbia are noticeably smaller: Bulgaria - 0.53%; Greece - 0.58%; Croatia - 0.84%; Hungary - 1.15%; Portugal - 1.66%; Slovenia - 1.86%; Austria - 2.75%; Denmark - 3.02%; Finland - 3.96%. For these reasons, it is necessary to increase both the number of researchers and the budget investment in science as soon as possible [7].

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REFERENCES

1. The Global Competitiveness Report. (2019). World Economy Forum (WEF).
2. Đurović-Petrović, M. (2011). Public Management Influence on the State of Innovation Sector in Serbia and South East Europe. In *Proceedings of the International Scientific Conference-Management Development in Central and South-East Europe: Special Issue - Selected Papers*, pp. 293-313. European Academy of Science - Vienna, ISBN-978-3-9503225-0-7.
3. Đurović-Petrović, M. (2012). *Development of Engineering Management and the Role of Engineering Managers in the Republic of Serbia*, *Management Development in Central and South-East Europe, Belgrade.* European Academy of Science - Vienna, ISBN 978-3-9503225-0-8, pp. 291-310.
4. Ministry of Science and Technology Development. "Law on Innovation Projects".
5. Statistical Office of the Republic of Serbia, Indicators of innovative activities. www.rzs.rs.
6. Đurović-Petrović, M., & Lozanović–Šajić, J. (2018). Innovation as the pillar of the global competitiveness index of the economy of Serbia, In *MEF 2018,* pp. 308-330, Belgrade.
7. Đurović–Petrović M., & Lozanović–Šajić, J. (2019). The development of the innovation sector in Serbia. In *MEF 2019*, Belgrade, accepted, in print.

Circular Entrepreneurship – Towards Responsible Enterprise

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Abstract—**In order to have a sustainable future the humankind must consider that the nature is at risk. Generally, nature is characterized by circular phenomenon with interconnected ecological relationships in a viable environment. We must learn again to live in tune with nature and with one another. As circular entrepreneur promotes change and exploits opportunities to do business in accordance with the principles of circular economy, that ensures the use of resources repeatedly, thus preventing large amounts of resources from drifting and becoming waste. The present paper aimed at developing a better understanding the efforts, options and actions of circular entrepreneurs and assessment of present literature regarding the definitions, necessities and implications of circular economy. As, at the moment, a theory specifically centred on circular entrepreneurship is deficient, the method used was the literature research and determining some main lines defining the specifications that characterize the circular entrepreneurship. In the results the authors acknowledged among the characteristics that the circular entrepreneurs must master creativity, revival for use, service orientation, etc.**

Keywords - circular economy, circular entrepreneurship, JEL: L26

I. INTRODUCTION

Growth off the global economy is based on increase use and demands of resource fossil fuels, metals, minerals, biomass, forestry, fishery, etc. But the resources are diminishing in the same time with the human cities are growing, the resource exploitation boosts, and the waste quantities are growing. Also, the climate change adds a new threat to human life by making the weather more unpredictable and more intense phenomenon, as a result of business development based on consumption without considering the long-term effects on the environment.

The trends are evident. We have moved to an economy of disposability where the invaluable resources we extract are going to waste and triggering destruction to humans and earth. The destructive effect determined by single-use plastics are now well known, with an estimated truckload being dumped into the ocean every minute; about 25% of food made for human consumption is, also, dumped to waste; and, clothing production has doubled, yet consumers wear their clothes for half as long, to present just some examples [1].

The extraction and processing of the natural resources that stream faster through our economies enhances to half of earth's greenhouse gas emissions. Simultaneously, the financial value of these resources is immense. An annually estimated value of $62.5 billion is discarded in e-waste (Fig. 1). That is three times more than the annual output of the world's silver mines and more than the GDP of the majority countries.

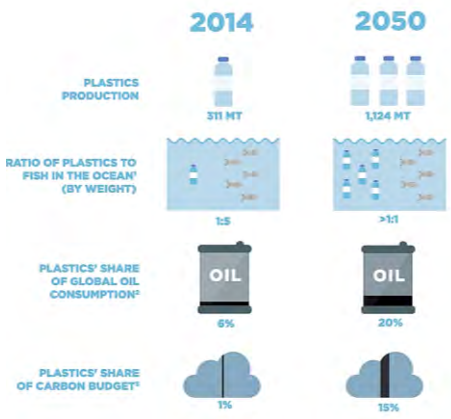

Figure 1. The projected increase in plastics production. Source: [1]

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Figure 2. Circular Economy. Source: [2]

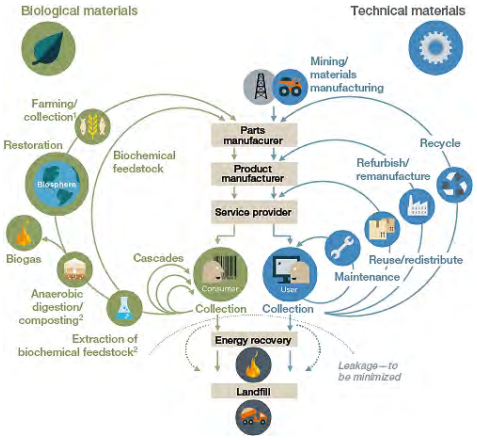

Figure 3. The circular economy—an industrial system that is restorative by design. The butterfly model. Source: [11]

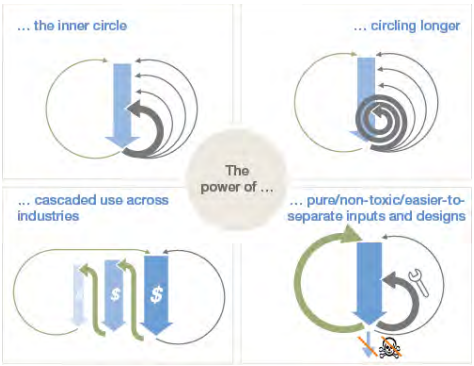

Figure 4. Sources of value creation for the circular economy. Source: [11]

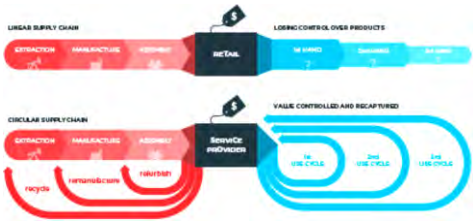

Figure 5. Controlling & recapturing value in multiple use cycles vs losing control over products. Source: [9].

These are a few of the facts that determine to change the way human are thinking, not only in the matter off how to use resources, but also how to make the life cycle of a product more sustainable to the point that the technology should not produce any waste, but involve product in everyday life by recycling it continuously.

This is the shift from the linear model of "take-make-dispose" to the circular model of recycling, re-use, and designing for recyclability. (Fig. 2).

II. Literature Review and Definitions

"The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended" [2].

Considering the above definition, the circular economy intents to keep in using the products and material values as long as possible. The major change is that at the end of the product life it is used again in order to create further value. So, the use of resources and the waste are reduced (Fig. 3).

Or, maybe, a more comprehensive definition/ presentation is Presented by World Economic Forum and it sounds like this: „ A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models„ (Fig 4) [3].

After the description and characterisation of circular economy it was necessary to add a definition to those who apply the principles and strategies of circular economy: the circular

entrepreneurs. The definitions of those are still in the thinking and research stage. Some of them are presented below.

According to Daalderop a Circular Entrepreneur is "... an agent who promotes change and exploits opportunities for the purpose of doing business in accordance with the principles of the Circular Economy "[4].

Garcia adds more characteristics and explain Circular Entrepreneur as "an agent that fosters the creation of a circular economy through innovative products, services and/or business models, who take risks and take advantage of new opportunities to create positive changes. A circular entrepreneur is a pioneer and inspires other entrepreneurs, organizations and even governments to make the transition to a circular economy, showing that the circular economy is possible. The solutions created by the circular entrepreneur are intentionally regenerative and impact positively the planet and humanity" [5].

Zucchella [6] consider both the circular economy and the circular entrepreneurs as a part of an process: "Process of formation and exploitation of opportunities using both commercial and ecological logic to address environmental challenges with the aim of closing, slowing and narrowing the loop of resources and regenerating/ reconstituting natural capital. It considers the role of individuals and the role of the organisations they set up o transforms. Finally, it encompasses the different entrepreneurial processes, from exploration to exploitation of opportunities in the circular economy domain".

III. Strategies and Opportunities for Circular Entrepreneurs

In the current situation when we are heading towards the comprehensive adoption of the circular economy, entrepreneurs can access new opportunities, some unexpected ones, which increase the value of the business due to the involvement of the component that comes in support of nature and, therefore, the social result. But in order to embraces the possibilities offered by the circular business must be aware of the sustainability challenges that can inspire us to act. Some example of circular solutions and opportunities for circular entrepreneurs:

- Circular fashion (e.g. ECOALF, Spain) [7] – opportunities for circular entrepreneurs: the development and/or use of biodegradable materials and harmless chemicals, the design of garments so that biological materials are easily separated from technical materials to facilitate its recovery at the end of use, the design of garments with a focus on durability and the implementation of leasing schemes;
- Enzymatic recycling creates new virgin PET plastics directly from plastic waste [8], (e.g. Ecoplast, Austria) – opportunities for circular entrepreneurs: reuse of plastic materials with no loss in value or quality;
- Convert the Agro industry by-products into bio-based molecules for food, feed, cosmetic applications, as a substitution to oil based ones [8] – opportunities for circular entrepreneurs: produce bio-based fertilisers and/or flavours and fragrances, food conservators, antibiotic substitution in the feed industry, bio-based solvents, and bio-plastics;
- Rental system for everyday objects [8] - opportunities for circular entrepreneurs: rent based on a monthly or prepaid fee, objects like sport equipment, cooking, gardening, partying sets, DIY tools, car equipment and leisure equipment.

One of the Circular Entrepreneurs (henceforth CE) major opportunity are circular product-services (or product-as-a-service, henceforth CPS). The CPS are products in the form of services while retaining ownership instead of transferring ownership to users. When designing a CPS, entrepreneurs must consider [9] (Fig. 5):

- A logical starting point for circular business is changing the very base of the business core activities;
- The profit will be gained through multiple use cycles. Also, the profits can increase significantly when circular activities enable a second and third product use phase (Fig. 5);
- The supply chain should be stimulated along its entire length. Collaborate with businesses from downstream and upstream and find ways to share risks and returns;
- Educate your customer: specify the difference and motivation for your proposal to a traditional one. The insecurity of benefits will make people reluctant to change. E.g. for technical products, the circular economy largely replaces the concept of a consumer

with that of a user. This calls for a new contract between businesses and their customers based on product performance;

- Redefine the role of retail. CPS reduce the need for retail because of new ways to reach to the user (e.g. digital platforms) and change the responsibilities of manufacturers, service providers and users;
- Gradually transition to a CPS. Cross-fund CPS models with regular sales and buyback structures until it is totally "self-sustaining";
- Enhance the importance of environmental activities impact on financial performance. Measuring and reporting the environmental impact of circular activities determine not only the financial institutions to make decisions based on other values in addition to their financial goals.

In 2017 Kirchherr et al. adapted a 9R framework that defined 10 strategies that drive the crossing from the linear economy through increasing circularity to the circular economy (Fig. 6).

The entrepreneurs should rethink the Value Hill. In linear economy after the use of the product (post-use, Fig. 6) the product loses entirely its value. Business models are generally sales oriented and therefore revenues come mainly from selling as many products as possible. This creates an incentive for producers to design products that have a relatively short lifespan in order to continuously sell new products. The old products end up in landfills or are incinerated, quickly destroying the value that was created in the manufacturing process.

In circular economy the products should be kept for as long as possible at their highest value (post-use, Fig. 7).

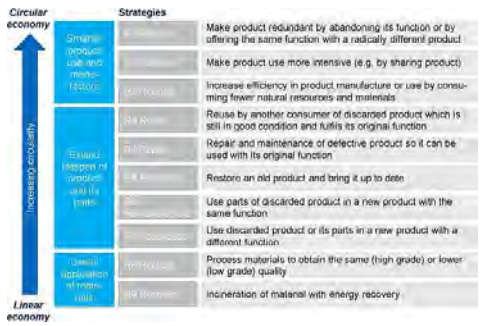

Figure 6. The 9R Framework. Source: [13].

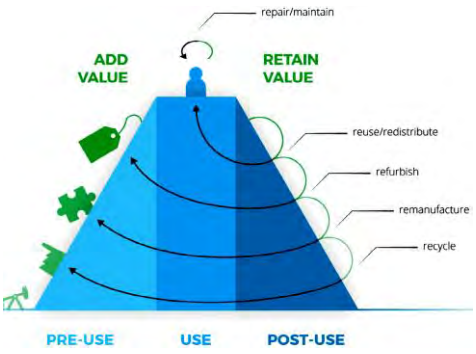

Figure 7. Value hill in circular economy. Source: [12].

On Value Hill the product route covers three phases. In the pre-use phase (mining, manufacturing, sale, distribution) value is added in every step and the product moves uphill. In-use phase, the second phase, involve the usage of the customer and is shown at the top of the hill. Here the value of a product is at its highest. The third phase is the post-use phase, where the product loses value. But, by inserting the complete product or its components back into a previous phase (e.g. by providing second-hand products they flow directly back into the use phase), value is retained. In every level different business activity occur.

A research group from Delft University of Technology (Netherlands), consider that a design for a circular economy narrows, slows, closes and regenerates material resource and energy loops. These strategies are complementary and require life cycle based, systemic and multi-actor approaches [10].

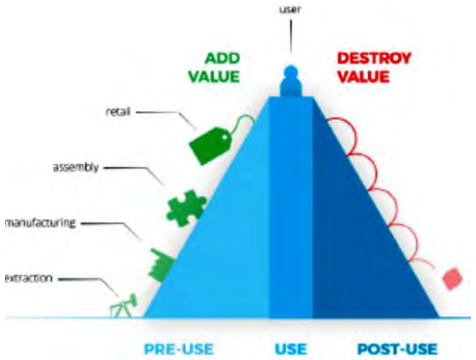

Figure 8. Value hill in linear economy. Source:[12].

A. Narrow loops (use less)

Narrowing loops means of using fewer parts and products, and a smaller amount of material and energy during the manufacture and distribution of physical products, components and materials;

B. Slow loops (use longer)

Slowing loops refers to utilizing products, parts and materials longer over time. Loops can be slowed by selling long-life and high quality products (mostly in the premium segment), and offering intermediate service (such as maintenance, repair, or spare parts availability) or advanced service (provide an outcome, a result or a function), also often referred to as product-service systems);

C. Close loops (use again)

Closing loops refers to the recycling and reusing of wasted products, parts and material and/or the use of biodegradable materials (and their safe disposal into the natural environment);

D. Regenerate loops (renew)

Regenerating refers to a reduced use of hazardous substances, the enhanced use of renewable energy during value creation, delivery and use, as well as the regeneration of natural ecosystems to create and provide critical ecosystem services for human thriving.

E. Identifying and engaging crucial partners.

It is necessary to identify the relevant and critical partners for developing a circular oriented business. So, a quick assessment of whether the idea contain enough value to lead to joint partners is essential. Make a tangible plan for whom to contact and why.

F. An implementation plan.

The plan should consider specific actions that can be applied right away with the available knowledge, resources and human capital. The idea should be implemented as soon as possible.

IV. CONCLUSION

In a resource-limited world, future have no place for waste. Becoming creative with how we acquire, utilize and dispose of materials is essential for a successful and sustainable global economy. Business and sustainability professionals from around the world are making a move to transform the business by implementing better processes for sustainable inputs, improving product design and closing material loops. This is the foundation of the circular economy.

A circular economy provides to businesses the means to a new type of growth and opportunities to solve some of the biggest challenges of our time. Even that some companies successfully apply the circle economy standards, the shift has just begun. It is one of the greatest business opportunities of our generation.

The business must shift from linear to circular to regenerative business models. The tendency, determined by the climatic changes and the decrease towards the lack of resources, is to initiate in business models activities that will reintroduce resources in the cycle of the nature, which will lead to its regeneration. Thus, the entrepreneurship is important to drive forward this change, considering that governments will only take action just if people demands.

The circular entrepreneurs are not definitely understood and defined as a new specific entrepreneur. Considering the above definitions and explanations we can conclude that the circular entrepreneurs is an agent who promotes in accordance with circular economy, showing that the circular economy is possible. The solutions created by the circular entrepreneur are intentionally regenerative and impact positively the planet and humanity.

He should closes, slows and narrows the loop of resources and he encompasses the different entrepreneurial processes, from exploration to exploitation of opportunities in the circular economy domain

REFERENCES

1. Gawel, A. (2019). Innovation and entrepreneurship can cut waste and deliver the circular economy, Available at: https://www.weforum.org/agenda/2019/10/innovation-entrepreneurship-waste-circular-economy/
2. Circular economy: definition, importance and benefits. News. European Parliament. Available at:https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits
3. From linear to circular - Accelerating a proven concept. Towards the circular economy: Accelerating the scale-up across global supply chains. Available at: http://reports.weforum.org/toward-the-circular-economy-accelerating-the-scale-up-across-global-

supply-chains/from-linear-to-circular-acceleratin g-a-proven concept/?doing_wp_cron=157470935 2.0650949478149414062500

4. Daalderop, T. Circular Entrepreneurship, The case of Urban Agriculture in the Circular Economy. Available at: https://edepot.wur.nl/ 385546
5. Garcia, C. L. (2019). Circular Entrepreneurship: Opportunities for young entrepreneurs of the Americas. Availble at: https://www.cep-americas.com/single-post/2019/06/20/Circular-E ntrepreneurship-Opportunities-for-young-entrepr eneurs-of-the-Americas.
6. Zucchella, A., Urban, S. (2019). *Circular Entrepreneurship: Creating Responsible Enterprise*. Palgrave Macmillan Pub., Cham, Switzerland, p. 195.
7. https://ecoalf.com/es/p/ana-gimeno-49
8. https://solarimpulse.com/
9. Fischer, A. & Achterberg, E. (2016). Create a Financeable Circular Business in 10 Steps. Available at: https://www.circle-economy.com/ wpcontent/uploads/2016/12/finance-white-paper-20161207-EN.pdf
10. Brown, P., Baldassarre, B. & Konietzko (2019). Design for Circular Economy research group, Delft University of Technology, The Netherlands. Available at: https://www.circularstrategies.org/
11. https://www.ellenmacarthurfoundation.org/our-story/the-team/team
12. Achterberg, E., Hinfelaar, J. & Bocken, N. (2016). Master circular business with the value hill. Available at: https://www.circle-economy.com/ wpcontent/uploads/2016/09/finance-white-paper-20160923.pdf
13. Kirchherr, J., Reike, D. & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. In *Resources, Conservation and Recycling*, vol. 127, pp. 221-232.

Application of Different Methods for Distance Estimation

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Abstract—**The great importance for correct operating of many systems is having as much information as possible from surroundings. One of them is the exact or approximate distance from system to the different objects. That enables system to successfully perform many tasks. This paper presents application of sensor-based and vision-based methods for measurement and estimation of distance for different purposes, with special emphasis on stereo-vision methods.**

Keywords – estimation, distance, sensor-based, vision-based

I. INTRODUCTION

Measuring and estimation of distance have very important role in determination of object's orientation and position in different application, especially in robot vision, automotive and Intelligent Transportation Systems (ITS). Recognizing surroundings accurately and quickly is one of the most essential and challenging tasks for many systems. Knowing the exact or approximate distance enables system to perform different tasks that can be connected with human, such as informing and warning, as well as to be semi- or fully-autonomous through use of determined distance to, for example control, start, stop moving, etc.

However, there are two types of methods for measuring and estimation of the distance between two objects – active and passive. In this paper, application of sensor-based and vision-based systems for distance measurement and estimation for different purposes, is presented. The special emphasis is given on stereo-vision methods.

II. SENSOR-BASED METHODS

The active methods are based on sensors (ultrasonic, radar, laser beam, etc.) and send different types of signal to the object in order to measure distance [1]. Systems based on these types of sensors use different work methods for measurement of distance.

Radar is based on emitting of high-frequency electromagnetic waves to measure the distance and relative speed of target objects. There are two main radar technologies used in ITS: impulse and Frequency-Modulated Continuous Wave (FMCW) radar. Impulse radar is based on measuring of time needed for a short pulse to travel from the radar sensor to the object, reflect and travel back to the sensor. FMCW radar transmits a frequency-modulated signal and uses direct proportionality of frequency difference between the outgoing and incoming waves, and relative distance to the target object. This system is in today's vehicles as part of forward collision warning applications, lane change assistance, side warning assistance and automatic cruise control (ACC) [2, 3]. There are three types of radar: short-range, with measurement range up to 20 or 30m, medium-range radar-up to 100m and long-range sensors-up to 250m. Current available accuracy of radar is 10 cm up to 1-5%, while the speed accuracies are around 0.2 m/s. They are very robust and not so sensitive on bad environmental conditions, but not usable for long distances [3].

LIDAR (Light Detection and Ranging) is laser-based system and works in near infrared region of the electromagnetic spectrum at 905 nm. Measuring of distance is based on time-of-flight of reflected light pulses. There is possibility to use rotating device and few laser lights sources to scan points in space. These systems are called laser scanners and can measure points in one plane - 2D laser scanner, and 3D laser scanner – can also vary the elevation

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angle. Their maximum perception range is between 80 m and 200m, because of limitation of transmit power due to complying with eye-safety regulations. Accuracy of laser scanners is between 0.02m and 0.5m, while lateral accuracy is limited by their angular resolution of around 0.1°, and speed accuracy is 0.5m/s. Laser scanners are sensitive on environmental conditions, and water, dirt, dust, fog, etc. can significantly affect on sensor performance [3].

Time-Of-Flight (TOF) or 3D camera captures the entire scene with one single light pulse. Getting distance information is based on that each camera pixel measures the time delay of modulated infrared light by comparing the phase of the outgoing and the incoming signal. Operating range for TOF is 10m, in some cases 20m, and accuracy is 1cm. These devices are used in industrial automation and robotics, automotive applications in driver assistance and safety applications (pedestrian recognition, parking assistant and pre-crash detection) [3].

III. VISION-BASED METHODS

Passive methods receive information about object's position from environment using of camera for passive measurement of scene [1]. Vision-based systems use passive methods to provide highly valuable information about the environment. These systems usually use different techniques for processing of the images from camera in order to detect object and estimate the distance between two objects. There are cases where sensor-based systems do not usable, for example for parking assistance. Unlike sensors such as ultrasonic where "blind spots" can have a large impact on the robustness and reliability of automated parking function, surround view cameras can generate an accurate ground topology around the vehicle to provide information about location of kerbs, parking blocks and parking locks as well as surface changes for understanding of free space (Fig.1) [4]. Cameras work usually at frame rates between 15 fps and 25 fps and, thus, have measuring rates comparable to radar sensors and laser scanners. However, relative velocity cannot be directly measured, but has to be differenced from successive images. Camera sensors are, like human visual perception, sensitive to adverse lighting conditions, such as fog and rain or low sun and can be blinded by the light directed to the camera.

Vision-based systems are usually grouped into two classes: monocular and stereo-vision systems.

Figure 1. Images from the surround view camera network [4].

Monocular vision-based system uses single camera for capturing of images and exploit the geometry of the scene for distance estimation. These systems are used in different application, such as automotive, robot vision, human, railway, etc. There are many methods which based on different relationships between object and distance, such as relationship between the resolution of an object of interest and the distance from the camera [5], as well as other methods, Bayesian filters [6], homograph-based [7], artificial intelligence tools [8], etc.

On the other hand, stereo vision-based system uses two cameras to obtain 3D coordinates of an object and thus to estimate the distance [3]. Application of stereo vision principle was used in [9] for estimation of distances to the objects placed at distances 10m, 20m, 30m, 40m, 50m and 60m. The objects were placed in the nature and then photographed by two cameras. The user should select the object on left camera and the algorithm finds similar object on the right camera. From displacement of the same object on both pictures, the distance to the object can be calculated. Although the method is based on relatively simple algorithm, the calculated distance is still quite accurate, but better results are obtained with wider base. However, two webcams as sensing elements

were used in [10] in order to estimate distance of an object, according to the principles of stereo vision, as well as digital laser range finder for comparation. Four experiments were done, at distances 19, 46, 66, 103 cm – measured with laser range finder with resolution ± 0.5, and results showed good agreement between them with percentage error ranged from 1.13% to -2.05%, with notice that the error increases slightly as distance increases. Stereo camera can be used in different applications, such as automatic fruit harvesting system [11], for estimation of the size, distance and position of the fruits whereas the robotic arm is used to mechanically pick up the fruits (Fig. 2). This system was tested in laboratory conditions with a reference small object, an apple and a pear at 10 different intermediate distances from the camera (205 – 2050 mm), and the average distance error was from 2% to 6%.

Figure 2. Picking up of fruit by robotic arm [11].

Also, use of stereo matching and mosaicking for the calculation of distances from the powerline to the underlying surface, after the full 3D surface between two power poles has been generated, is presented in [12]. However, use of stereo camera is also present in automotive application. In [1], distance between car and baseball was estimated using of stereo vision. Through seven experiments, results showed that this method provided a good accuracy up to 160 m, with maximum error of 6.25%. On the other side, authors in [13] used stereo camera for obtaining distance from vehicle to the speed hump and bump, with an accuracy of ±20cm in range of 2-10m (Fig. 3).

Figure 3. One of the detected Hump at distance of 5.056m [13].

Another method is based on stereovision principle with use of only one camera on mobile phone [14], that was manually displaced in order to record images from different lines of sight. Since the displacement between the two images is not known in advance, it was measured using the phone's inertial sensors. Evaluation of the accuracy was done by performing distance calculations to everyday objects in different indoor and outdoor scenarios, and with different distances and baselines. Results were compared with that of a stereo camera phone and showed that an increasing baseline leads to a higher distance accuracy in most cases, but also was observed that lighting conditions and unintentional device rotations influenced the results. Similar, in [15], authors used mono camera and inertial sensor for capturing of two images and setting the baseline, for distance estimation. Through experiments, the accuracy of the proposed method was evaluated, where the distance error is 3.9% on average in a few meter ranges. There are hybrid methods for distance estimation, which include stereo camera, as one presented in [16], with application for indoor mobile robot platform. For calculation of the distances between the robot and object, triangulation method was used first, but this technique was insufficient for objects located on the left or right side of the robot or in the case of the stereo camera pair fixed to the robot with an angle down to the floor. Therefore, a new approach was proposed by adding a look-up table and curve-fitting methods to the triangulation technique, with the stereo camera pair located on the robot with an angle down to the floor. In the experimental studies, an average accuracy rate of 97.69% was obtained.

IV. CONCLUSION

Estimation of distance from certain system to the object can be challenging, because of the different environment and weather conditions. Also, precision of estimated distance can have the great impact on behavior of the system, considering that distance may be used for performing of many tasks, such as informing, controlling, etc.

In this paper, application of different methods for estimation of distance in many purposes, is presented. Methods are divided into two groups: Sensor-based, as active, and vision-based, as passive methods. In framework of sensor-based systems, Radar is used in automotive applications because of its robustness and insensitivity on bad environmental conditions, but it is not usable for long distances. On the other hand, LIDAR is sensitive on environmental conditions. and have better accuracy than Radar. Time-Of-Flight (TOF) camera is used in industrial automation and robotics, as well as automotive applications as a part of driver assistance system, because of its good ratio of range and accuracy. On the other hand, vision-based methods have wide applications, as monocular and stereo-vision systems, and they are sensitive on weather and environment conditions, but have great accuracy on long distances. Monocular systems use one camera, while stereo-vision systems basically use two cameras for distance estimation. While these methods have advantages and disadvantages, there are hybrid methods that use a combination of multiple sensors or sensors and artificial intelligence tools in order to compensate the disadvantages of these methods.

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REFERENCES

1. Salman, Y. D., Ku-Mahamud, K. R. & E. Kamioka. (2017). Distance measurement for self-driving cars using stereo camera. *6th Int. Conf. on Computing and Informatics*, Kuala Lumpur, Malaysia, pp. 235-242.
2. Sivaraman, S. & Trivedi, M. M. (2013). Looking at vehicles on the road: a survey of vision-based vehicle detection, tracking, and behavior analysis. *IEEE Transactions on Intelligent Transportation Systems*, Vol. *14*, No. *4*, pp. 1773-1795.
3. de Ponte Müller, F. (2017). Survey on ranging sensors and cooperative techniques for relative positioning of Vvehicles. *Sensors*, Vol. 17, No. 271, pp. 1-27.
4. Heimberger, M., Horgan, J., Hughes, C., McDonald, J. & Yogamani, S. (2017). Computer vision in automated parking systems: design, implementation and challenges. *Image and Vision Computing*, vol. 68, pp. 88–101.
5. Deepu, R., Murali, S., & Raju, V. (2013). A mathematical model for the determination of distance of an object in a 2D image", International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV), p. 1, The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).
6. Diaz-Cabrera, M., Cerri, P. & Medici, P. (2015). Robust real-time traffic light detection and distance estimation using a single camera. *Expert Systems with Applications*, Vol. 42, pp. 3911-3923.
7. Pavlović, M. G. et al. (2018). Advanced thermal camera based system for object detection on rail tracks. *THERMAL SCIENCE*, Vol. 22, Suppl. 5, pp. S1-S11.
8. Gökçe, F., Üçoluk, G., Şahin, E. & Kalkan, S. (2015). Vision-based detection and distance estimation of micro unmanned aerial vehicles. *Sensors*, Vol. 15, pp. 23805-23846.
9. Mrovlje, J. & Vrančić, D. (2008). Distance measuring based on stereoscopic pictures. *9th International PhD Workshop on Systems and Control: Young Generation Viewpoint*, Izola, Slovenia, 1-3. October 2008.
10. Mahammed. M., Melhum, A. I. & Kochery, F. A. (2013). Object distance measurement by stereo vision. *International Journal of Science and Applied Information Technology* (IJSAIT), Vol. 2, No. 2, pp. 05-08.
11. Font, D., et al. (2014). A proposal for automatic fruit harvesting by combining a low cost stereovision camera and a robotic arm. *Sensors*, Vol. 14, pp. 11557-11579.
12. Sun, C., et. al. (2006). Measuring the distance of vegetation from powerlines using stereo vision. *ISPRS Journal of Photogrammetry & Remote Sensing*, Vol. 60, pp. 269–283.
13. Varma, V. S. K. P., Adarsh, S., Ramachandran, K. I. & Nair, B. B. (2018). Real Time Detection of Speed Hump/Bump and Distance Estimation with

Deep Learning using GPU and ZED Stereo Camera. *Procedia Computer Science*, Vol. 143, pp. 988-997.

14. Holzmann, C. & Hochgatterer, M. (2012). Measuring distance with mobile phones using singlecamera stereo vision. *32nd International Conference on Distributed Computing Systems Workshops*, pp. 88-93.
15. Suh, Y. S., Phuong, N. H. Q. & Kang, H. J. (2013). Distance Estimation Using Inertial Sensor and Vision. *International Journal of Control, Automation, and Systems*, Vol. 11, No. 1, pp. 211-215.
16. Solak, S., & Bolat, E. D. (2018). A new hybrid stereovision-based distance-estimation approach for mobile robot platforms. *Computers and Electrical Engineering*, Vol. 67, pp. 672–689.

Using the Weighted Sum Preferred Levels of Performances in House Selection

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Abstract—**The selection of a house for purchasing represents a very important decision that influences the quality of the future life of a customer. Various dimensions expressed through different criteria impact the final choice of the house. The Multiple-Criteria Decision-Making (MCDM) methods provide a possibility of involving of all criteria influencing the particular decision. The main intention of this paper is to propose the Weighted Sum Preferred Levels of Performances (WS PLP method) as a useful tool that will contribute to increasing the reliability of the performed selection. The applicability of the proposed methodology is demonstrated through the real case study that involves 5 houses in 5 different parts of the city of Zaječar that are evaluated against 9 criteria. The obtained results confirmed that the given method increases the reliability and enables the making of appropriate decisions.**

Keywords – MCDM, WS PLP method, Entropy method, house selection, Zaječar

I. INTRODUCTION

The selection of a house for living represents a very important decision for a customer. The particular house should comply with the different requirements of the future owner. These requirements sometimes could be conflict because satisfying one of them goes at the expense of others. The MCDM methods could contribute to successfully overcoming this problem.

In recent years, the MCDM methods have become very popular for the facilitation of the decision-making process and their popularity still growths. Until now, many different MCDM methods are proposed. The comprehensive overview of developed MCDM methods could be found in the papers of many eminent authors [1-3]. Also, these methods are used for resolving different real-world problems [4-6].

In this case, we propose the application of the WS PLP method [7] for the selection of house for purchasing. The case of the application of the MCDM methods in house selection was, also, observed by the authors [8-11]. We assessed 5 houses in Zaječar against the 9 evaluation criteria. With the main aim of presenting the applicability of the given method, the rest of the paper is organized as follows: in section II the methodology is explained; section III contains the numerical example; that is followed by the conclusion.

II. METHODOLOGY

The selection of the optimal house is performed by applying the Entropy method [12] for determining the criteria significance and the WS PLP method for ranking of alternatives and final selection [7]. The WS PLP method is based on the earlier developed Simple Additive Weight (SAW) or Weighted Sum (WS) methods [13-14]. The WS PLP method makes a distinction between the best alternative and that one which has the best matching with the decision-maker's (hereinafter marked as DM) preferred performance ratings (*ppr* values). In that way, the DM knows what alternative is the best from all and which is in accordance with expressed requirements. In some cases, one alternative has a good ranking position because some criteria have extremely good performances while others could be quietly unsatisfying. The WS PLP method that clearly indicates and this is its main advantage relative to the other MCDM methods.

The calculation procedure used in this paper can precisely be presented through the following steps:

Step 1. Select the set of the representative criteria and form decision matrix X as follows:

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$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{12} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}, \quad (1)$$

where x_{ij} represents the performance rating of the alternative i with respect to the criterion j, m denotes the number of the alternatives and n the number of the criteria.

Step 2. Determine the criteria weights. In the present case, we use the Entropy method [12]. The main reason for this relies in the fact that the Entropy method could be considered as very objective. Determining of the criteria weights is performed by using the following equation:

$$w_j = \frac{1 - e_j}{\sum_{j=1}^{n} \left(1 - e_j\right)}, \quad (2)$$

where $j = 1,..n.$

The output entropy e_j of the j_{th} factor is calculated as:

$$e_j = -\frac{1}{\ln(m)} \sum_{j=1}^{n} r_{ij} \ln\left(r_{ij}\right), \quad (3)$$

where $j = 1,\ldots,n.$

The term: $\sum_{j=1}^{n} w_j = 1$, should be fulfilled.

Step 3. Define the *ppr* values for all criteria. The *ppr* values are determined according to the DM's preferences, which represent the elements of the virtual alternative $A_0 = \{x_{01}, x_{02},\ldots,x_{0n}\}$. If the *ppr* value of any criterion is not determined by the DM, then it is determined as follows:

$$x_{0j} = \begin{cases} \max\limits_{i} x_{ij} \,|\, j \in \Omega_{\max} \\ \min\limits_{i} x_{ij} \,|\, j \in \Omega_{\min} \end{cases}, \quad (4)$$

where x_{0j} represents the optimal *ppr* of the criterion j; $\Omega_{\max}$ is set of benefit and $\Omega_{\min}$ is set of cost criteria.

Step 4. Form the normalized decision matrix. Stanujkic et al. [15] proposed the normalization procedure that enables DMs to express their preferences for the *ppr* more effectively. That is done by using the following (5) and (8):

$$r_{ij} = \frac{x_{ij} - x_j^*}{x_j^+ - x_j^-}; j \in \Omega_{\max}, \text{ and} \quad (5)$$

$$r_{ij} = \frac{x_j^* - x_{ij}}{x_j^+ - x_j^-}; j \in \Omega_{\min}, \quad (6)$$

where r_{ij} denotes the normalized performance rating of the alternative i with respect to the criterion j, x_j^* is the *ppr* value of the criterion j, and x_j^+ and x_j^- are the largest and the smallest performance ratings of the criterion j, respectively.

Step 5. Calculate the overall performance ratings for all alternatives in the following way:

$$S_i = \sum_{j=1}^{n} w_j \cdot r_{ij}, \quad (7)$$

where S_i denotes the overall performance rating of the alternative i, and $S_i \in [0,1]$.

The calculations should be continued thorough the following steps in the case when the overall performance ratings for two or more alternatives satisfying the condition: $S_i > 0$. Otherwise, the alternative with the largest S_i is optimal, and the ranking is performed in ascending order.

Step 6. Calculate the compensation coefficient for all alternatives that fulfill the term: $S_i > 0$, as follows:

$$c_i = \lambda d_i^{\max} + (1 - \lambda)\, \overline{S}_i^+, \quad (8)$$

where:

$$d_i^{\max} = \max_i d_i = \max_i r_{ij} w_j, \quad (9)$$

$$\bar{S}_i^+ = \frac{S_i^+}{n_i^+}, \quad (10)$$

where $d_i^{\max}$ is the maximum weighted normalized distance of the alternative i relative to the *ppr* values of all the criteria so that $r_{ij} > 0$, $\bar{S}_i^+$ denotes the average performance ratings obtained on the basis of the criteria so that $r_{ij} > 0$, n_i^+ is the number of the criteria of the alternative i so that $r_{ij} > 0$, λ is the coefficient ($\lambda = [0,1]$) and is usually set at 0.5.

Step 7. Compute the adjusted performance rating for all the alternatives in which $S_i > 0$ in the following way:

$$S_i' = \sum_{j=1}^{n} w_j r_{ij} - \gamma c_i, \quad (11)$$

where S_i' denotes the adjusted overall performance rating of the alternative i, c_i represents the compensation coefficient ($c_i > 0$), and γ is the coefficient ($\gamma = [0,1]$).

Step 8. Rank the considered alternatives and select the most appropriate one. The alternative with the highest S_i' value is the most appropriate and the ranking is performed in ascending order.

III. CASE STUDY

In this section, the application of the proposed methodology pointed to the selection of the optimal house for purchase in Zaječar is presented. The alternative houses are located in different parts of Zaječar which are presented in Tab. 1.

TABLE I. THE LOCATION OF THE CONSIDERED HOUSES

Alternative	**Part of the city**
A_1	Podliv
A_2	City center
A_3	Ključ
A_4	Šljivarski put
A_5	Beli breg

The set of the evaluation criteria relies on that one presented in the paper of Li [16]. For the needs of this paper, the given set is slightly modified and adjusted for the application in this particular case. The main dimensions and evaluation criteria are presented in Tab. 2.

TABLE II. EVALUATION CRITERIA [16]

Dimensions	**Criteria**		**Measure**
Transportation network	C_1	Transportation connection	Grade from 1 to 5
	C_2	Proximity to work	Grade from 1 to 5
Neighborhood infrastructure	C_3	Landscape	Grade from 1 to 5
	C_4	Education and healthcare facilities	Grade from 1 to 5
Community environment	C_5	Security	Grade from 1 to 5
	C_6	Population density	Grade from 1 to 5
House attributes	C_7	Size	m^2
	C_8	Age	year
	C_9	Value	€

As can be seen from Tab. 2, we take into account 9 evaluation criteria that cover 4 dimensions important for a house customer. The estimation of the houses against the first 6 criteria will be expressed over grades from 1 to 5 (1 as the worst grade and 5 as the best). Besides, this list of criteria is not the ultimate; depending on the needs, a greater number of criteria could be included.

The demonstration of the proposed methodology is based on the data regarding the houses in Zaječar taken from the website of a real-estate agency (http://nekretnine-zajecar.co.rs/). It is presumed that one customer (in further text marked as DM) is interested in the purchase of the house in Zaječar. There are 5 houses in 5 different parts of the city that satisfies his requirements. First, by using (2) and (3), the weights of criteria are determined. Besides the defined criteria weights and all input data, Tab. 3 contains the *ppr* values that show the desired values of the considered criteria according to the DM (customer in this particular case).

Table 4 represents the normalized performance ratings, obtained by using (5) and (6). By applying the normalization procedure, the various measures are reduced to a single measure.

TABLE III. THE INITIAL DECISION MATRIX

Criteria Alternatives	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
optimization	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*min*	*min*
w_j	0.1338	0.1345	0.1994	0.1338	0.0281	0.0698	0.0661	0.1994	0.0351
ppr	***3***	***2***	***3***	***4***	***4***	***2***	***160***	***35***	***55000***
A_1	3	2	3	3	4	3	150	30	46000
A_2	5	5	3	5	4	5	189	45	61000
A_3	4	3	4	4	4	4	150	15	52000
A_4	3	2	3	2	3	3	260	20	59000
A_5	2	2	4	2	3	3	180	30	40000

TABLE IV. THE NORMALIZED PERFORMANCE RATINGS

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
A_1	0.0000	0.0000	0.0000	-0.3333	0.0000	0.5000	-0.0909	0.1667	0.4286
A_2	0.6667	0.0000	0.0000	0.3333	0.0000	1.5000	0.2636	-0.3333	-0.2857
A_3	0.3333	-0.6667	1.0000	0.0000	0.0000	1.0000	-0.0909	0.6667	0.1429
A_4	0.0000	-0.6667	0.0000	-0.6667	-1.0000	0.5000	0.9091	0.5000	-0.1905
A_5	-0.3333	-0.6667	1.0000	-0.6667	-1.0000	0.5000	0.1818	0.1667	0.7143

TABLE V. THE RANKING RESULTS OBTAINED ON THE BASIS OF S_i

Alternatives	S_i	**Rank**
A_1	0.0325	**4**
A_2	0.1795	**2**
A_3	0.3560	**1**
A_4	-0.0191	**5**
A_5	0.0529	**3**

The ranking results obtained on the basis of S_i, which are calculated by using (7), are given in Tab. 5.

In this step, we decide whether to continue with the evaluation or to stop here. In the case when $S_i > 0$ it is acceptable to continue with the procedure. Because the overall performance rating for alternative A_4 – *Šljivarski put* – is lower than 0, it will be excluded from the further assessment. The other alternatives will be submitted to further evaluation procedure because they fulfilled the desired conditions.

Table 6 demonstrates the ranking results based on the S_i' value, obtained by using (8)-(11), respectively, for $\gamma = 1$ and $\lambda = 0.5$.

TABLE VI. THE RANKING RESULTS BASED ON THE S_i' VALUE

	$d_i^{\max}$	S_i^+	n_i^+	$\bar{S}_i^+$	c_i	S_i	S_i'	**Rank**
A_1	0.0349	0.0832	3	0.0108	0.0229	0.0325	0.0097	**3**
A_2	0.1047	0.2560	4	0.0449	0.0748	0.1795	0.1047	**2**
A_3	0.1994	0.4517	5	0.0712	0.1353	0.3560	0.2207	**1**
A_5	0.1994	0.3046	5	0.0106	0.1050	0.0529	-0.0521	**4**

According to the obtained results presented in Tab. 6, the most suitable house for purchasing is the alternative A_3 – *Ključ*. This alternative fulfills all of the requirements expressed through the *ppr* values and some of them even exceed. In this case γ =1, which means that the priority is given to the alternative that has the best matching with *ppr* values while the last ranked is the alternative A_5 – *Beli breg*.

The influence of the compensation coefficient γ on the final ranking order is shown in Tab. 7.

TABLE VII. THE RANKING RESULTS OBTAINED ON THE BASIS OF DIFFERENT VALUES OF γ

	$y = 0$		$y = 0.5$			$y = 1$		
	S_i'	**Rank**	c_i	S_i'	**Rank**	c_i	S_i'	**Rank**
A_1	0.0325	**4**	0.0114	0.0211	**3**	0.0229	0.0097	**3**
A_2	0.1795	**2**	0.0374	0.1421	**2**	0.0748	0.1047	**2**
A_3	0.3560	**1**	0.0676	0.2883	**1**	0.1353	0.2207	**1**
A_5	0.0529	**3**	0.0525	0.0004	**4**	0.1050	-0.0521	**4**

Varying of the γ brings some changes in the ranking order of the alternatives. While the alternative A_1 remained in the first position, the fourth position changed in the case when γ =0. Namely, in that case, the alternative A_1 - *Podliv* is the last ranked because it has the worst overall performance ratings.

The given example exactly shows that the WS PLP method gives the DM the possibility to choose among the alternative that has the good matching with set requirements and that which has the best performances of all considered alternatives. Additionally, DM is aware of that which alternative does not satisfy the requirements and could exclude it from further evaluation in the early stage.

IV. CONCLUSION

The main aim of this paper is to emphasize the applicability of the WS PLP method in the case of a house selection. The decision process is based on the 9 criteria that belong to the 4 main dimensions important for house selection that are: transportation network, neighborhood infrastructure, community environment, and house attributes. The 5 potential houses in the Zaječar are submitted to the evaluation procedure. The significance of the criteria is determined by using the Entropy method. The main reason for using the mentioned method for obtaining the criteria weights is reducing subjectivity to the minimum possible level.

The obtained results proved that the proposed WS PLP method is useful and contributes to the facilitation of the decision

process. We consider that this technique could be helpful to the real estate agents because they could determine in an easy way which real estate should have the priority for offering to the particular client.

The proposed methodology is based on the use of crisp numbers and this represents the main constraint of the paper. Because the uncertainty and vagueness are immanent to real-world problems, it is very hard to express them by using only crisp numbers. Incorporation of the fuzzy, intuitionistic or neutrosophic numbers into proposed methodology would increase its convenience for application in the unpredictive and changeable business environment.

REFERENCES

1. Kornyshova, E. & Salinesi, C. (2007). MCDM techniques selection approaches: state of the art. In *2007 IEEE Symposium on Computational Intelligence in Multi-Criteria Decision-Making*, pp. 22-29. IEEE.
2. Zavadskas, E. K., Turskis, Z. & Kildienė, S. (2014). State of art surveys of overviews on MCDM/MADM methods. *Technological and Economic Development of Economy*, *20*(1), pp. 165-179.
3. Gavade, R. K. (2014). Multi-Criteria Decision Making: An overview of different selection problems and methods. *International Journal of Computer Science and Information Technologies*, *5*(4), pp. 5643-5646.
4. Zavadskas, E. K. & Turskis, Z. (2011). Multiple criteria decision making (MCDM) methods in economics: an overview. *Technological and Economic Development of Economy*, *17*(2), pp. 397-427.
5. Mardani, A., Jusoh, A., Zavadskas, E. K., Cavallaro, F. & Khalifah, Z. (2015). Sustainable and renewable energy: An overview of the application of multiple criteria decision making techniques and approaches. *Sustainability*, *7*(10), pp. 13947-13984.
6. Chai, J., Liu, J. N. & Ngai, E. W. (2013). Application of decision-making techniques in supplier selection: A systematic review of literature. *Expert Systems with Applications*, *40*(10), pp. 3872-3885.
7. Stanujkic, D. & Zavadskas, E. K. (2015). A modified weighted sum method based on the decision-maker's preferred levels of performances, *Studies in Informatics and Control 24*(4), pp. 461-470.
8. Srinivasan, V. C. (1994). Using the analytic hierarchy process in house selection. *The Journal of Real Estate Finance and Economics*, *9*(1), pp. 69-85.
9. Schniederjans, M. J., Hoffman, J. J. & Sirmans, G. S. (1995). Using goal programming and the analytic hierarchy process in house selection. *The Journal of Real Estate Finance and Economics*, *11*(2), pp. 167-176.
10. Mulliner, E., Smallbone, K. & Maliene, V. (2013). An assessment of sustainable housing affordability using a multiple criteria decision making method. *Omega*, *41*(2), pp. 270-279.
11. Becker, A. & Becker, J. (2017). A selection of offers on the Szczecin residential market with the AHP method. *Folia Oeconomica Stetinensia*, *17*(1), pp. 68-79.
12. Shannon, C.E. (1948). A Mathematical Theory of Communication. *Bell System Technical Journal*, *27*(3), pp. 379–423.
13. Churchman, C. W., & Ackoff, R. L. (1954). An approximate measure of value, *Journal of the Operations Research Society of America*, *2*(2), pp. 172-187.
14. Fishburn, P. C. (1967). Additive utilities with incomplete product set: applications to priorities and assignments, *Operations Research*, *15*(3), pp. 537-542.
15. Stanujkic, D., Magdalinovic, N., & Jovanovic, R. (2013). A multi-attribute decision making model based on distance from decision maker's preferences, *Informatica*, *24*(1), pp. 103-118.
16. Li, L. (2011). Housing choice in an affluent Shanghai – decision process of middle class Shanghai residents. *Modern Economy*, *2*, pp. 9-17.

Higher Education for Sustainable Development Goals

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Abstract—**The urgent need has been faced at the global level regarding the environment and societal changes by the thought of sustainable development. As there has been a need of more sustainable world and the same was commonly agreed by United Nations member in September 2015 as there has been 17 Sustainable Development Goals and all are of equal importance to be dealt with. But we are concerned with 4th SDG which deals with higher education as it is a need of an hour to look into the higher education scheme related to National and International needs. The 2030 Agenda is a universal agenda, which is not only for poor countries or for the underdeveloped countries but also focus on Millennium Development Goals of 2000.**

Keywords - MDG- Millennium Development Goals, SDG- Sustainable Development Goals, SEAMEO-Southeast Asian Ministers of Education Organization

I. Introduction

At the global level the arguments and debates have been made to tackle the problems related to environmental and societal changes. There are 17 Sustainable Development Goals, the SDGs, have been promoted by the United Nations in 2015 aiming at responding to those global challenges by 2030. We all are called to transform our world toward a sustainable future, combating most of the inequalities and reducing the environmental impact of our societies. No one has to be left behind in this race; hence we need innovative solutions to address most of the SDGs on time and achieve these ambitious targets.

It is clear that Higher Education plays an important and vital role in this challenge and has a big responsibility in driving the change. Educating future society leaders to sustainability is a must and has to permeate all aspects of your future career and personal life. We want our students to be ambassadors for a sustainable development.

II. Concept of Sustainable Development

The sustainable development has been considered to be a milestone of our planet. A global commitment was made in September, 2015 which was given a formal consent within a United Nations framework, launch the path once again towards a new development program for the planet which is to be implemented by 2030. The 17 development goals have been linked to it, which provide motivated and suggestive references to it. This is a global concern so everyone is involved in it.

III. Society and Economy

There has been so many reasons that why the sustainable development is main challenge for society and the economy, definitely a that type of challenge that will have a real impact or influence on our lives tomorrow and it all depends on our present decisions. The question again and again which arouse is that why sustainable development is of so much importance to us and all people and business on earth. It can be answered by introducing the core concept of sustainable development. In simple terms the sustainable development means that we can be sustainable only if we pay attention or address the important issues relating to economic, social field and of course the third is environment. In order to understand each element, we have to go through the definition of Brundtland Commission which says “the development that meet the needs of present without compromising the ability of

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future generations to meet their own needs". So as per the definition we must think about future impacts too when we or making decisions about the present.

IV. Sustainable development is Economic Development

The development related to economic is one of the relevant concerns because most of the people they deviate on political beliefs, which means that if anything not economically sound will definitely have an effect on business and by the expansion, jobs and employability too. As the economic development is about providing incentive for business and the further organizations so that they can adhere to the guidelines of sustainable development, beyond normal legislative requirements.

V. On International Level the Role of Higher Education

When we are talking to achieve the goals at international level it would not be possible until and unless a strategy is planned for the same. In this we have to work together not taking this thing into the preview that one is a developed country and has no need to coordinate with the others but one has to take it as a global issue in which both the developed and the under developed has to help each other. In other words, it is a global concern in which we have to hold the hands together and wherever one is good the other must help.

VI. On National Level Role of Higher Education

When we have to adapt the goals of sustainable development in national context it will involve a number of processes in which for initial recommendations there will be a need to address the gaps and then one has to work in - depth to analyses the system and then has to create policy reason, identifying the combination of different groups and changing transitional target into national frameworks, which will be than including the recognition of interconnectedness of all national , transnational , regional and global policy frameworks with each other.

In today's era, world is seeking role of education, specially the higher education, in the nation's development and educational progress. The role of higher education in country's development is unavoidable, and universities are one of the most highly recognized and significant resources in human societies. So, both the developed and developing countries have to resolve issues and look at macro strategies at national level. In those countries, where higher education is taught by using different and new methods, progress and development will be swifter.

VII. Interdisciplinary Education in Sustainable Development

It is very clear that SDGs cannot be developed in isolation as it is an interdisciplinary course in which touches several disciplines like education, law, agriculture, engineering, geography, architecture, sociology, psychology, citizenship, history, economics and business. It has become very important to study the concept of sustainable development interdisciplinary. Scientist from many areas are working together from local to global scales with this thought to help the society in bringing a change from sustainable development. This is the concept to change the things not at local level but globally with the purpose of society transformation. This perspective has been increasingly focused on environmental education, promoting knowledge and also including the concept of higher education in it.

VIII. How Sustainable Future Demands Can Be Met Through Higher Education

There are few questions arises that how does the new development agenda which has been put forth suits to higher education? Is it possible for more people to go on and to receive the higher training? Or the other concept is does higher education have a wider part to play. The sustainable development works as a regular because it recognizes that multifarious, normal and the communal systems are linked with each other. If one system will be changed than it may influence the others. As it is a strong belief that the higher education system will help in achieving the other and above all will be helpful in building a peaceful society. The task of privileged education goes ahead of the increasing enrolments and it has to be understood. So, this means, to get a success, it

is important that the universities must focus on the three educational missions–research, teaching-learning and community-based service. It cannot be achieved alone by the universities. If it is in preview that higher education is to be a broad medium of pioneering society, it has to toil with governments and the other matured agencies to tackle the main challenges. The three actors which has been discussed earlier can work together is firstly by investing the community money in study and expansion of research and by making the new partners who will coordinate with them.

IX. Investment in Awareness-based Knowledge and Accountable Research

As the changes are being done at a very fast rate so it is clear that low investment in government funded university scientific research cripples and takes lot of years to come for any new social and economic development. So, it is primacies to understand that we can grow only if we concentrate on the research-based development in the latest technology, as well as in their broadcasting. All the agencies whether it is public or private these days rely on latest technologies to solve all the problems of the world which are very pressing. So sustainable development in new scenario means investment in elevated excellence study-based research programs and with this the other continuing systematic investigation or research to be backed by public funding. The problem can be tackled in three ways –by targeting the global problems, increasing funds of research and above all constructing up skilled research aptitude. In present scenario a large number of the countries do not have the methodical competence to meet the international load which are required for latest technologies. The main focus of the government is the green change that is related to environment which is of global concern to every nation and country. So, government of every country is now planning for emphasizing on the global needs because it is not a problem of a single country but has to be dealt globally.

It is not a question of debate that the poor country cannot invest in research but it is a time when the countries have to work together by helping the poor countries also by collaboration in research or in the fields which are required so that the common problems can be solved out and we all be successful in achieving the SDGs.

X. The Cooperation Mechanisms and Building New Partnerships

As the cooperation mechanism has somehow absent earlier, as the multilateral development bodies and university invested their hard work in constructing or building the strong upper learning system , other than being treated as split and not coordinated due to which the higher education leadership remains missing from the significant development policies and also due to which global education policy didn't came into effect. These are somehow the missed opportunities were there, not only related to the growth advanced education segment, but also for rest of education segment to benefit from higher education sector based on the knowledge and skills. So, for the implementation of agenda 2030 it is important that all the stake holders must become members of advisory board in the same.

Another planning to build privileged education sector is by the regional cooperation. The national improvement in several of the areas is likely to benefit from regional partnership and collaboration as still the agenda of 2030 is global .As the role of regional organizations will be critical because regional network help the governments to understand the situation that the other countries would have solved the problem in a similar situation and how would they have been responded and guided in the next steps. The few countries have made a strong peer learning system as it is in European Higher education area and the Association of Southeast Asian Nations.

As the members of ASEAN call together a yearly harmonization meeting with Southeast Asian Ministers of Education Organization (SEAMEO) to carry on the shared regional goals and priorities related to education. So, these are the few initiatives with which, ASEAN and SEAMEO are taking steps to harmonize the regional higher education systems with an aim to facilitate the mobility of students, faculty and researchers for better regional economic integration. The other

regions of Arab States, Latin America and sub –Saharan Africa would all benefit from trying their hand at a similar strategy

CONCLUSION

The goal 4 of sustainable development goals i.e. higher education has an important role to play in development challenges. In higher education system it is holding the potential to educate excellent teacher, the unrevealed research and above all connect the service to the communities. This is not all regarding offering advanced training and skills. This is not adequate to plainly be scheduled in international targets. The only things that really form an element of sustainable development agenda, government, multilateral agencies and universities must work together by targeting publicly funded research and building partnerships across different segments.

It is a well-known factor that for the achievement of Goal 4 we have to walk together whether it is at regional, national or international level because the problem is a global one. We have to see that more and more MOU's be signed with the other national and international universities so that the students should go for exchange program, for research and also for the exchange of ideas.

REFERENCES

1. Bassett, R. M. & Maldonado, A. (Eds.). (2009). *International organizations and higher education policy: Thinking globally, acting locally?* New York: Routledge.
2. Barlett, P. & Chase, G. (2004). Sustainability on campus: Stories and strategies for change. Cambridge, MA: MIT Press.
3. Cloete, N., Bailey, T., Pillay, P., Bunting, I. & Maassen, P. (2011). Universities and economic development in Africa: Pact, academic core and coordination. Wynberg, South Africa: Centre for Higher Education Transformation (CHET).
4. Clugston, R. M. & Calder, W. (1999). Critical dimensions of sustainability in higher education. In W. L. Filho (Ed.), Sustainability and university life, pp. 31–46, Frankfurt, Germany: Peter Lang.
5. Bloom, D. E., Canning, D., Chan, K. J. & Luca, D. L. (2014). Higher education and economic growth in Africa. *International Journal of African Higher Education*, *1*, pp. 22 –57.
6. Collins, C. S. (2013). An overview of African higher education and development. In A. W. Wiseman & C. C. Wolhuter (Eds.), The development of higher education in Africa: Prospects and challenges, pp. 21–65, Bingley, UK: Emerald Group Publishing Limited.
7. Cortese, A. (2003). The critical role of higher education in creating a sustainable future. *Planning for Higher Education, 31*, pp. 15–22.
8. Education Commission. (2017). About the Education Commission, Commission leadership, research agenda and partners. Brussels: Author. Available at: http://educationcommission.org/about/
9. GUNI. (2017). Higher education in the World 6. Towards a socially responsible university: Balancing the global with the local. Girona, Spain: Author.
10. Hauschildt, K., Gwosć, C., Netz, N. & Mishra, S. (2015). Social and economic conditions of student life in Europe. Synopsis of indicators: Eurostudent V 2012–2015. W. Bertelsmann Verlag.
11. Kinser, K., Levy, D. C., Casillas, J. C. S., Bernasconi, A., Slantcheva-Durst, S., Otieno, W. & LaSota, R. (2010). The global growth of private higher education. ASHE higher education report, *36*, Hoboken, NJ: Wiley.
12. McCowan, T. (2016). Universities and the post-2015 development agenda: An analytical framework. *Higher Education, 72*, pp. 505–523.
13. Niedermeier, F. & Pohlenz, P. (2016). State of play and development needs: Higher education quality assurance in the ASEAN Region. Jakarta, Indonesia: German Academic Exchange Service (DAAD).
14. Oketch, M. (2016). Financing higher education in sub-Saharan Africa: Some reflections and implications for sustainable development. *Higher Education*, *72*, pp. 525–539.
15. Schendel, R. & McCowan, T. (2015). *Higher education and development: Critical issues and debates*. In T. McCowan & E. Unterhalter (Eds.), Education and development: An introduction, pp. 275–293. London: Bloomsbury.
16. Shahjahan, R. A. (2012). *The roles of international organizations (IOs) in globalizing higher education policy*. In J. C. Smart & M. B. Paulsen (Eds.), Higher education: Handbook of theory and research, *27*, pp. 369–407. Dordrecht: Springer.

An Overview of Sustainable Competitiveness Composite Indices

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Abstract—**In measuring the performance of companies, regions and countries, today's scientists no longer rely on simple methods such as comparisons by GDP per capita. In research circles, it has become clear that the level of competitiveness depends on many interrelated indicators. What is also significant is that more and more models contain indicators of sustainable development given its growing importance. Providing a solution for basic human needs, sustainable development is summarizing achieving equality, social self-determination and cultural diversity, environmental development and protection, as well as maintaining ecological integrity. The aim of the paper is to present the importance of measuring sustainable competitiveness, as well as to present some of the most important models for measuring it. Using the models presented, it is possible to obtain realistic information on the level of sustainable competitiveness in companies, cities and countries.**

Keywords - competitiveness, competitiveness indices, sustainable development, 2030 Agenda

I. INTRODUCTION

In 2015, the United Nations set targets for its member states to reach by 2030. This set of 17 goals aimed at achieving sustainable development has been named the 2030 Agenda [1]. The European Union strongly supports the above-mentioned strategy and its goals, as it believes that sustainable development is crucial for increasing the competitiveness of all countries in the world. For this reason, the EU has set itself highly ambitious standards in the areas of circular economy, energy efficiency, the use of renewable energy, etc., and thus has become a leading global force in the fight against climate change. Also, the European Union's 10-year strategic plan, entitled "Europe 2020", a strategy that integrates smart, sustainable and inclusive growth, is coming to end soon.

In order for the EU to remain highly competitive, it is necessary to redefine the targets for the coming multi-year period and to determine the relevant indicators by which they can be monitored. For this reason, measuring the level of sustainable competitiveness achieved has become crucial both for company managers and local, regional and national management bodies. The paper presents several models for measuring sustainable competitiveness at the micro, meso and macro level.

II. SUSTAINABLE DEVELOPMENT

Development and sustainability are two fundamental elements that created sustainable development concept itself. Some authors find the meaning of development as economic development and the term “underdeveloped areas” (also called “Third World Countries”), putting emphasize on areas with the significantly lower standard of living than developed areas [2].

There are many definitions of a sustainable level, but the main concept is generally similar. There are 3 pillars which represent the core of sustainable development – the society, the economy and the environment. Also, the basic idea is always the same – people, habitats and economic systems are inter-related.

The World Bank, set a definition of sustainable development as “a process of managing a portfolio of assets to preserve and enhance the opportunities people face” [3]. As a

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conceptual framework sustainable development is a „process of changing the world's predominant view to one that is more holistic and balanced" [4]. Sustainable development is also a process that is applying the integration principles, as well as it is an end goal that is identifying and fixing the specific problems of resource wasting health care, poverty, social exclusion unemployment, etc.

United Nations General Assembly signed in 2015 the 2030 Agenda for Sustainable Development [1]. The 2030 Agenda for Sustainable Development presents one of the most comprehensive, far reaching and demanding international agreements formed till now. The agenda promotes the sustainable development goals as a unique set of goals, targets and guidelines, for its member states, for the next 15 years. The Agenda focus is on the taking hunger away as well as poverty and inequality reduction in all their forms. It consists of 17 goals, 169 targets as well as 230 indicators [1]. The list of *Sustainable Development Goals* is given below [1]:

1) *No poverty*
2) *Zero hunger*
3) *Good health and well-being*
4) *Quality education*
5) *Gender equality*
6) *Clean water and sanitation*
7) *Affordable and clean energy*
8) *Decent work and economic growth*
9) *Industry, innovation and infrastructure*
10) *Reduced inequalities*
11) *Sustainable cities and communities*
12) *Responsible consumption and production*
13) *Climate action*
14) *Life below water*
15) *Life on land*
16) *Peace, justice and strong institutions*
17) *Partnerships for the goals*

The Agenda is represented through the goals and targets which explain what has to be implemented together, taking full account of all potential synergy effects as well as interlinkages. One of most important facts, essential program's success of reaching the goals is its perceived importance. In each world's country one ministry or department is needed to be formed in order to coordinate and take the certain actions, in the mission of reaching 2030 goals. Some of good examples are Austria, Norway and France. Agenda is connected to a financing framework of The Addis Ababa Action Agenda which recognizes not only the need for innovation and business development but social protection as well. What it also supports is the Paris Agreement on Climate Change, as it promotes and facilities energy efficiency as well as clean energy [5].

The concept of sustainable development changes from its beginning, but its fundamental principles and goals remains the same. Although many countries are far away from sustainable development, as well as the gap between countries (undeveloped and developed) countries is huge, there is a great opportunity for developed one to give know how and know what which will provide better future for all the nature and living beings.

III. MEASURING COMPETITIVENESS

In the past, gross domestic product (GDP) per capita in one region or country was considered a major benchmark, similar to the level of productivity in a company. However, it has become clear that competitiveness cannot be measured on the basis of a single indicator, and the success of companies, regions and countries depends on multiple relationships from a number of factors. According to the definition of the European Commission, "an economy is competitive if its population can enjoy a high and rising standard of living, as well as a high-level sustainable employment" [6]. On the company level competitiveness can be defined as „the firm's ability to sustainably fulfills its dual role: fulfilling customer requirements and earning profits" [7].

Measuring competitiveness has become a very popular topic today among researchers in all fields. In the last decade of the last century, there has been a rapid popularization of the use and construction of competitiveness measurement models, year by year they have become more specialized and contain an increasing number of indicators [8].

IV. SUSTAINABLE COMPETITIVENESS COMPOSITE INDICES

As a consequence of the trends brought with them by the third and fourth industrial revolutions, the environment in which people live and work has become uncertain and complex, leading to a lack of available resources and shaky ecosystems [9]. Such changes have driven the development of the need to define and monitor new indicators that show progress towards a green economy based on sustainable development. The World Economic Forum defines sustainable competitiveness as "the set of institutions, policies, and factors that make a nation productive over the longer term while ensuring social and environmental sustainability" [10].

These facts led researchers such as [11, 12] to develop a standardized a set of indicators relating to the achievement of sustainable development by companies, cites and countries. In addition, the sustainable development sub indicators are integrated into many models that measure general competitiveness. We can see these examples from studies such as the Global Competitiveness Index, Europe 2020 Strategy Competitiveness Index, Global Innovation Index...etc. Also, in recent years there has been a rapid increase in specialized models for competitiveness measurement at all levels, aimed at determining sustainable competitiveness. Indices of this type include factors such as energy consumption in households and industry, CO2 emissions, the use of renewable energy sources for recycling waste and many others [9]. Below, the paper will review selected composite indices of sustainable competitiveness.

A. The Global Sustainable Competitiveness Index

The Global Sustainable Competitiveness Index is a model that seeks to integrate different fields of sustainable development. The model consists of 5 dimensions, with the same effect on the final result [13]. These include:

- •Natural capital - existing natural environment and availability of resources;
- •Social Capital - freedom, health, life satisfaction;
- •Resource Management - the efficiency and effectiveness of using available resources;
- •Intellectual Capital - the ability to generate capital and create jobs through innovation in the global market;
- •Governance Efficiency - the effectiveness of key and government investments, such as infrastructure, job creation, etc. [13].

The Global Sustainable Competitiveness Index uses predominantly quantitative indicators for its measurements because its authors consider that qualitative indicators are susceptible to manipulation by the evaluator. The model uses 111 data mainly obtained from the World Bank statistical database [13]. Tab. I shows the results of the 2017 measurements, which indicates that countries in northern Europe, such as Sweden, Norway, Iceland and Finland, have the highest positions.

TABLE I. THE GLOBAL SUSTAINABLE COMPETITIVENESS INDEX (GSCI) [13]

Rank	GSCI	
	Country	***Score***
1	Sweden	60.5
2	Norway	58.2
3	Iceland	57.6
4	Finland	57.4
5	Denmark	57.2
6	Ireland	55.4
7	Switzerland	55.3
8	Austria	54.8
9	Latvia	54.2
10	Estonia	53.7

B. The Global Destination Sustainability Index

The Global Destination Sustainability Index is a model for measuring the sustainable competitiveness of destinations worldwide. The index is based on indicators that determine the viability of destinations, the performance of tourism events, conferences and other business events. The goal of constructing this model is to contribute to greater sustainability in business tourism [14]. Its results are significant for city tourism organizations, destination managers and event managers because they provide guidance for future planning, organization, management and control for MICE (meetings, incentives, conferences and exhibitions) tourism [14]. In addition, the results of this index provide insight into best practices and learn from their examples.

Tab. II shows the results of The Global Destination Sustainability Index for 2019 according to which we can see that the city Gothenburg, located in Sweden, is the first to stand out. This city stands out, multiple times, at the top of the ranking list, according to the aforementioned index, and its main advantages are the effective solution of climate change problems, investing in renewable energy sources, as well as the replacement of vehicles using fossil fuels. Also, Gothenburg is known for respecting cultural diversity, tolerance, social sustainability and high inclusion of all vulnerable groups [14].

TABLE II. THE GLOBAL DESTINATION SUSTAINABILITY INDEX (GDSI) [14]

Rank	GDSI		
	Country	***City***	***Score***
1	Sweden	Gothenburg	90%
2	Denmark	Copenhagen	88%
3	Switzerland	Zurich	85%
4	Scotland	Glasgow	78%
5	Denmark	Aalborg	76%
6	Sweden	Malmo	76%
7	Iceland	Reykjavik	76%
8	Australia	Sydney	75%
9	Australia	Melbourne	74%
10	Sweden	Uppsala	74%

C. *The Sustainable Cities Index*

The Sustainable Cities Index was constructed with the aim of assessing citizens' opinions on the sustainability of the urban environment in which they live [15]. This index also gives an insight into the various opportunities which cities offer to their residents. The model consists of three sub-indices that in different ways reflect sustainable development in urban areas and are thus closely linked to the UN Sustainable Development Goals. These include: People (social dimension), Planet (environmental dimension) and Profit (economic dimension) [15].

According to the 2018 Sustainable Cities Index, London ranks first in the rankings as the city with the highest level of sustainability out of a total of 100 cities analyzed worldwide (Tab. III). It stands out especially for the People and Profit sub-indices, while the Planet sub-index shows slightly weaker results [15].

TABLE III. THE SUSTAINABLE CITIES INDEX (SCI) [15]

Rank	SCI		
	Country	***City***	***Score***
1	United Kingdom	London	88
2	Sweden	Stockholm	86
3	United Kingdom	Edinburgh	85
4	Singapore	Singapore	84
5	Austria	Vienna	82
6	Switzerland	Zurich	81
7	Germany	Munich	80
8	Norway	Oslo	80
9	Hong Kong	Hong Kong	80
10	Germany	Frankfurt	80

D. *The Global Green Economy Index*

The Global Green Economy Index aims to measure the sustainable competitiveness of countries by using different performance data of the green economy [16]. This model uses a combination of qualitative and quantitative indicators, which are divided into four dimensions. These include: Environment, Climate Change and Management, Efficiency and Market and Investment [16].

The index ranks 130 countries worldwide, and according to 2018 measurements, Sweden, Switzerland and Iceland are at the top of the list (Tab. IV). The results generated by this model can be a useful tool for environmental, sustainable development and green economy strategists.

TABLE IV. THE GLOBAL GREEN ECONOMY INDEX (GGEI) [16]

Rank	GGEI	
	Country	***Score***
1	Sweden	0.7608
2	Switzerland	0.7594
3	Iceland	0.7129
4	Norway	0.7031
5	Finland	0.6997
6	Germany	0.6890
7	Denmark	0.6800
8	Taiwan	0.6669
9	Austria	0.6479
10	France	0.6405

E. *Global 100*

The index, under the name, *Global 100* ranks companies around the world, according to green

economy indicators, which revenues exceed US $ 1B according to data from the last fiscal year [17]. Measurements are made according to 21 different indicators that are specially adjusted depending on the sector in which the company is located [17]. These indicators refer to the domains of human resources management, procurement, sales and management [17]. Depending on the importance of individual indicators, they are assigned different weight values that are also adjusted depending on the industry sector to which the organization belongs.

The results of top 100 companies are separately analyzed and published. In 2019, the first place went to the Danish company *Chr. Hansen*, which operates in the food and chemical sectors of the industry. This company has a tradition of 140 years in business, with a mission to produce natural solutions for its customers [17]. They produce various probiotics, enzymes, natural colors, etc.

TABLE V. THE GLOBAL 100 [17]

Rank	Global 100			
	Company	***Country***	***Industry***	***Score***
1	Chr. Hansen Holding A/S	Denmark	Food or other Chemical Agents	82.99%
2	Kering SA	France	Apparel and Accessories	81.55%
3	Neste Corporation	Finland	Petroleum Refineries	80.92%
4	Ørsted	Denmark	Wholesale Power	80.13%
5	GlaxoSmithKline plc	United Kingdom	Biopharmaceuticals	79.41%
6	Prologis, Inc.	United States	Real Estate Investment Trusts	79.12%
7	Umicore	Belgium	Primary Metals Products	79.05%
8	Banco do Brasil S.A.	Brazil	Banks	78.15%
9	Shinhan Financial Group Co.	South Korea	Banks	77.75%
10	Taiwan Semiconductor	Taiwan	Semiconductor Equipment	77.71%

V. DISCUSSION AND CONCLUSION

Competitiveness models, at all levels, have become a very popular tool for getting fast and aggregated results that are used in many professions today. Given that, there has been an increase in the number of authors dealing with this topic, their specialization has soon been resorted to, so sustainable competitiveness is now recognized as a special way of maintaining competitiveness. In recent years, the importance of sustainable development has been increasing, so measuring the attained level of the set goals in this domain is very important. Particular emphasis is placed on the importance of monitoring the *Sustainable Development Goals* set by the UN under the *2030 Agenda*.

The paper gives an overview of 5 different models that deal with determining the degree of sustainable competitiveness of companies, cities and countries. By analyzing the composite indices shown, we can conclude that the Scandinavian and northern European countries are at the top of the list, which is to be expected given their investment in environmental protection, the solutions of problems caused by carbon dioxide emissions, and the general achievement of citizens' satisfaction through sustainable development.

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REFERENCES

1. Timmermans, F. & Katainen, J. (2019). *Reflection Paper Towards a Sustainable Europe by 2030*. European Commission.
2. Tomislav, K. (2018). The Concept of Sustainable Development: From its Beginning to the Contemporary Issues. Zagreb *International Review of Economics & Business*, *21*(*1*), pp. 67-94.
3. Soubbotina, T. P. (2004). *Beyond economic growth: An introduction to sustainable development*. The World Bank.
4. Tracey, S. & Anne, B. (2008). *OECD insights sustainable development linking economy, society, environment: Linking economy, society, environment*. OECD Publishing.
5. Hambrey, J. (2017). The 2030 Agenda and the Sustainable Development Goals: The challenge for aquaculture development and management. FAO Fisheries and Aquaculture Circular, (C1141).
6. European Commission. Enterprise DG. (2000). *European Competitiveness, Report 2000: Working Document of the Services of the European Commission*. Luxembourg: Office for Official Publications of the European Communities.
7. Chikan, A. (2008). National and Firm Competitiveness: A General Research Model. *Competitiveness Review: An International Business Journal*, *18*(*1/2*), pp. 20-28.
8. Katić, A., Ćosić, I., Anđelić, G. & Raletić, S. (2012). Review of Competitiveness Indices That Use Knowledge as a Criterion. *Acta Polytechnica Hungarica*, *9*(*5*), pp. 25-45.
9. Okanović, A., Jokanović. B. & Kisin, J. (2018). Sustainable Business for Companies in a Global Environment. *Ecologica*. *25*(*91*), pp. 489-494.
10. WEF (2014). *The Global Competitiveness Report 2014–2015*. Geneva: World Economic Forum
11. Singh, R. K., Murty, H. R., Gupta, S. K. & Dikshit, A. K. (2009). An overview of sustainability assessment methodologies. *Ecological indicators*, *9*(*2*), pp. 189-212.
12. Krajnc, D. & Glavič, P. (2005). A model for integrated assessment of sustainable development. *Resources, Conservation and Recycling*, *43*(*2*), pp. 189-208.
13. SolAbility. *The Sustainable Competitiveness Report*. SolAbility. 2017
14. Global Destination Sustainability Index. Available at: https://www.gds-index.com/ (Accessed: November 2019.)
15. Batten J. (2018). *Sustainable Cities Index*. Arcadis.
16. The Global Green Economy Index. (2018). Dual Citizen LLC. Available at: https://dualcitizeninc.com/global-green-economy-index/ (Accessed: November 2019.)
17. Global 100. (2019). Corporate Knights magazine. Available at: https://www.corporateknights.com/reports/2019-global-100/2019-global-100-results-15481153/ (Accessed: November 2019.

New Approach To Innovation Policy

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Abstract - **The objective of this paper is to elaborate the latest trends in the innovation management. First, we explain why current measurements of the employee productivity based on the "pay me for what I can affect" principle are mostly wrong and argue that such inappropriate measurements tend to inhibit the motivation for the innovation creation. Second, we try to give a new insight on the employee motivation in the context of differences between the employee motivations in rich-developed vs. poor-undeveloped countries. While higher standard of living enables the employees in rich countries to choose the job/position based on multiple criteria, the employees in poor countries rarely have the option to choose, i.e. the key motivator for them is monthly net salary. One must understand this crucial difference in order to create appropriate environment for the innovation creation. Third, we elaborate on the organizational attention and point out the fact that managers usually do not get the relevant information from the employees due to the asymmetry between employees and management. Finally, we explain why and how incomplete contracts negatively affect the innovation creation and propose the measures to fix this issue.**

Keywords – innovation policy, employee performance, motivation.

I. INTRODUCTION

Latest trends in the innovation management and improvements of the innovation policy tend to emphasize the behavioral approach to economics. This paper will elaborate on four innovation related hot topics: (1) measurement of individual employee contribution i.e. productivity, (2) better understanding of the employee motivation, (3) attention and foresight in organizations, and (4) the implications of the incomplete contracts to the creation of innovations within a modern company.

II. MEASUREMENT OF EMPLOYEE PRODUCTIVITY

A. Inappropriate Indicatos for the employee performance measurement

Defficiency of the existing system for the measurement of the productivity is in the fact that it is focused on the quantity and ignores the quality in terms of the problem complexity and the quality of the produced solutions.

Let us illustrate the issue using the example of the IT company where customer support department deals with customer complains on the existing functionalities. Support staf deals with issue solving, i.e. bug fixing, while managers tend to count the number of solved issues i.e. bug fixes. The problem with this approach is that manger is more focused on the number of issues – where hard and easy issues are mixed together. Consequently, employee productivity is measured by the number of issues, mostly ignoring the issue complexity.

Another example would be the new functionality development, where business analysts create documents such as functional specifications and test plans and managers count the number of created documents. The problem is the same as above, i.e. long and complex documents are mixed with short and easy to meke documents.

The cause of the problem is the fact that managers do not have a reliable basis for the measurement of the employee productivity. Managers tend to measure the items that are available. From the employee perspective, the number (of solved issues, created documents) used by mangers to measure the employee productivity is a wrong/ insufficient because it adds apples to oranges. From one side, managers do understand that not all tasks have

same level of complexity. From the other side, practice has shown that, in the absence of additional more reliable items, managers do use the number that is known to be deficient and inapropriate. The key benefit is that this usage of inapropriate indicators enables managers to promptly measure the employee productivity and the key issue is that the result is wrong.

B. Consequences of employee performance measurement based on wrong indicators

Measurement based on inapropirate indicators has two key cosequences.

First negative consequence is that curent practice of employee productivity measurement brings benefits to employees that work on relatively easy tasks, because more easy fixes means higher performance and higher salary – comapre dot counterparties that work on more complex tasks, with less fixes for complex issues, leading to lower performance and lower salary.

Second negative consequence of current practice provide an incentive to employees to lower the quality of their work aiming to increase the salary. Let us use the example of IT development i.e. software/application development. From one sice, if a developer recives more details task (functional specification) from his coleague (business analyst) he will be in the position to work (create a new code) faster i.e. more productive. From the other side, business analyst knows that his performance is measured by the number i.e. not by the quality of functional specifications he creates, thus he will have an incentive to create (write) short documents with less details. Unforutunate developers do not have the position to affect the process, i.e. they will receive less detailed tasks (functional specificatons) and spend much more time looking for the additional explanations on what the requirements are – due to tasks not beeing well documented with sufficient details and examples. The performance measurement system wrongly motivates the business anslysts to create inappropriate (short) specifications. Wrong motivation has dangerous negative consequences and it is better to avoid such motivation.

C. Implications of employee performance measurement based on wrong indicators

Measurement based on inapropirate indicators has negative implications on the innovation creation . From one side, the basis for the inovation is fair system of compensation where employees trust that their efort in the form of innovation will be rewarded by the company management. The higher that trust is, the more they are motivated to create inovations. From the other side, if current system of employee productivity is corrupted, even if this is not a delibarate management action, but simply the consequence of available indicators, the employees will not have appropriate motivation and this will definitely have the negative impact on the innovation creation.

Bengt Holmstrom (Nobel prize in economics 2016) has analyzed incentive payments, i.e. money rewards (bonuses) paid by the company to employees based on employee performance (incentive pay). Holstorm has identified two key obstacels, one being the imperfect measurements. "If a performance measurement is noisy, it is worthless", i.e. no measurement is better than wrong measurement [2]. This finding backs up the idea that employee performance measurement based on wrong indicator may bring more problems than benefits. Solution proposed by Holmstrom [2] is to use alternative indicators "someting that employee is not able to affect, rather than something that he is able to affect". The key contribution of this theory is following finding – even if task is perfectly measurable, and even if we can crate perfect incentives (corelate performances and salaries), the best solution in some situations may be to avodi the incentives i.e. bonuses. The breakthrough novelty [2] is that "system of pay me for what I can affect – may be very dangerous and harmful due to the fact that – it is esy to produce results, but those are the wrong results!"

In the context of our example, business analyst may affect the way i.e. quality of specifications he creates, making it harmful to measure his perfromance based on the number of created specifications, because he has a motivation to increase his performance by lowering the quality, i.e, he is motivated to create less detailed documents – he can easily increase his performance, but this is the wrong method to measure pefromance.

III. UNDERSTANDING THE EMPLOYEE MOTIVATON

A. High income vs. low income countries

When it comes to employee motivation, most of HR theories are created in the developed countries and reflect the current situation in those areas. From the other side, employees in todays globalized wordl, mostly work in the multinational companies, where very different employees are mixed, i.e. work together. The motivation of an average employee in the West Europe or North America is very much different compared to the motivation of employees working in much less developed countries, with much less salaries, both in nominal and in relative terms.

Let us look at the average emplyee working in the developed country for an montly net salary of 4,500 EUR. One third of his salary (1,500) will cover the rent/mortgate, other third (1,500) the expenses for food and transport, while last third (1,500) will be avaialble for savings or consumption. Such an employee has higher earning compared to costs and some space for savings. This situation creates his motivation. Such an employee may choose – to work on a less desired company/position for higher salary or in an more desired company/position for a lower salary. Key prerequisite is that his monthly income covers expenses, thus he has an option to have a preference. The difference between less stresful job and more stresful job would be 500 EUR, so he could give up 500 EUR out of 1,500 EUR, lading to his savings decrase from 1,500 EUR to 1,000 EUR on montly basis.

From the other side, an average employee in the undeveloped i.e. poor country would tipically work for 1,000 EUR while his costs are 1,200 EUR, meaning that his monthly income hardly covers monthly expenses. In such position, an average employee does not have any savings and is highly sensitive to small increases of his income. Such an employee is not in the position to chose between less and more stresfull job. Once he is given a chance to earn 500 EUR more per month, he will immediately jump to that position, regardless of the level of stress on this position. 500 EUR in a poor country makes a huge difference, while in a developed country this amount is not so importans as it is in the poor country.

Consequently, the employee motivation is very much different among the employees within a multinaitonal company. Unfortunatelly, the human resouces theory does not recognize this fact properly. In fact, it tends to have same criteria for the motivation for all employees regardless of the obvious fact that those employees belong to two very distinctive categories. Solution to this issue is that multinational companies need to accept the facts that not all countriea are the same, and not all people are driven by same motivation factors.

Most of employees working in low income countries have only one motivator, and that is monthly net salary. Kanye West [4], one of the 100 most influential people in the world, argues that "*Whether you broke or rich you gotta get this, Havin' money's not everything, not havin' it is*".

Further, Kiyosaki [5] stipulates "The more you have, the more you spend – so money does not make you happy – the assets make you happy". Finally, Kronenberger [3] argues that "if you have money, you cannot honestly say that money is not everything".

B. The health insurance example

Let us look at the example from the undeveloped country that illustrates the above thesis. At this moment, most of IT companies located in Serbia try to attract employees (developers). This competition among companies has led to the fact that most IT companies offer a compensation package, where almost all elements are identical, except the monthly net income. The observed fact that compensation packages tend to be almost identical may be explained with the reference to similar two examples, one related to trade management and other related to health insurance management.

The example of trade management looks at food suppliers, i.e. super markets. From one side, each single super market chain in Serbia (Tempo, Roda, DIS) has its own individual pricing policy and promotion policy – some products are relatively more expensive while some other are relatively less expensive. From the other side, food supply chains have almost identical average prices, i.e. price differences tend to be relatively small. Similarly, all elements of the compensation package (health insurance) on the IT market tend to be identical.

The example of health insurance shows the consequences of price wars of health insurance providers (insurance companies) on the Serbian market. From one side, insurance companies offer different insurance packages for the employees working in the Serbian IT sector. From the other side, each insurance company need to modify the premium (price) of its services for the following year, based on results in the current year. Having in mind that all health insurance providers use the same pricing model, (with same input parameters, such as costs per employee in the previous year), on the long run, IT company will not make any difference between various providers of the health insurance. Similarly to mobile telephony providers, the difference tends to be minimal, and relatively insignificant.

The conclusion of the analysis of compensation packages for IT employees in Serbia is that companies offer different packages of benefits, where total value of benefits tend to be almost identical for almost all companies, due to the fact that IT companies mirror its competitors, leading to price modifications, leading to price equality. Standard economic theory suggests that, given that all other factors are equal, two alternatives should be compared based on differential costs/expenses. In the context of our example, this means that one need to exclude all equal expenses (same in both alternatives), and compare only differential expenses. Having in mind that additional benefits that IT companies offer to employees tend to be equal, the only differential expense is that employees should compare IT companies should be salary, i.e. salary per working hours.

IV. Attention and Foresight in Organizations

A. Attention Research

From one side, the attention researches deal with issues that draw ones attention, i.e. what people notice vs. what they filter out in terms of noticing i.e. seeing and hearing. Which section of the page we notice first – top right corner or some other section. From the other side, understanding of attention may help management to improve its company's innovative capacity.

Further, the organizational attention deals with the flows of information within the company. The focus is on one key question – do managers get the relevant information. The most common answer to this question is no, and key reason for this appears to be the asymmetry in expectations. The perspectives are strongly biased meaning that huge discrepancy exists between the managerial expectations on what they want to hear as a feedback from the employees vs. what employees want to share with the management.

Finally, managers need to address the issue of the organizational attention in terms of choosing one of two alternatives – focus on the present vs focus on the future. The focus on the future would assume significant costs of estimating the future in terms of the trends analysis. The focus on the present would assume that company observes what happens on the market and simply reacts on the identified market trends.

B. Implications of the Organizational Attention

The emerging concepts of the organizational attention and managerial attention have not been comprehensively defined. Schoemaker [6] elaborates on key implications of the organizational attention and stipulates several key segments of interest: "methods and techniques to assess organizational attention, the use of knowledge management system in order to focus/deepen the organizational attention, the relationship between attention and learning, scenario planning combined with scanning dashboards, and leaders awareness of biases and random noise in decision making".

- First, sophisticated IT enables the non-intrusive analysis to measure effects of managerial decision in a form of email message or web announcement. The software may combine the artificial intelligence with the text analytic approaches to analyze employee emails in order to search for and understand the employee's reaction to top management actions. The issue of privacy is nicely managed by masking the email authors i.e. names of employees, similar to masking the company names in customer databases. The analysis does not need to have details on individual level which effective enables the legal backdoor for the company to practically spy on employees. This trend is immanent and this claim is based on the fact that similar approaches are already used to assess

consumer preferences and experiences in the travel industry.

- Second, each company – similar to an individual, builds up its knowledge on the top of the existing knowledge. Consequently, in order to modify existing company knowledge one needs to grab and redirect the company attention. Existing knowledge is managed by Knowledge Management Systems (KMS). Knowledge Management Information System facilitates the creation of new knowledge and appropriate integration of new knowledge into the business process [1]. Key issue is that company knowledge is diffused to various entities within the large company. In addition, the poor communication puts a complexity on the task of focusing and directing that knowledge. Key management task in this respect is to focus the employees attention to most important tasks such as quality and customers.
- Third, managers should control the relationship between attention and learning. The standard SWOT analysis should be used to assess past misses and successes in order to improve the organizations future attention. According to Schoemaker: "Although past weaknesses are imperfect predictors of future problems, if the underlying causes are systemic, there will be a positive correlation"[6]. In order to avoid so called blind spots, top management should initiate incentives for employees to engage in areas that are not in the focus of the present concerns.
- Fourth, managers should make sure that signals from the external environment are identified and properly differentiated from the so called noise. In order to properly understand the week signals i.e. to put them into the appropriate context. Appropriate management techniques include development of possible scenarios and expected outcomes and the analysis of those scenarios
- Fifth, managers should have an objective to create more space for the kind of tasks that humans do better than machines, such as pattern recognition and understanding deep human emotions

V. INCOMPLETE CONTRACTS THEORY AND THE INNOVATIONS

A. Issues caused by incomplete contracts

The Hart & Moore (1998) argue that innovation is related to intellectual property rights and the agreement on intellectual property is basically a legal agreement between the innovator and the financier. The key problem in the agreement is that conditions tend to change over a time, which will by definition lead to one side not being satisfied. In order to prevent the breach of cooperation and foster the innovation creation, state must create innovation friendly environment where contracts are negotiated on regular basis, to compensate for the constant changes in other factors that dynamically change in modern world.

The key issue with current labor contracts is that all benefits from innovation are owned by company, leaving employees with little if any motivation to create innovations.

B. Solutions to identified issues

The solution would be a change in the legal treatment of the innovation, aiming to distribute benefits form the innovation to innovators, i.e. not only to companies. In order to practically achieve this new distribution, one must keep negotiating and renegotiating the terms of cooperation.

VI. CONCLUSION

We have elaborated on the new approach to innovation policy and that new approach consists of four interrelated topics. Each of elaborated topics represents a policy on its own and affects modern companies, and the potential for the innovation creation.

First policy is related to measurements of the employee productivity. The key problem with the measurement of employee performance is the fact that it is based on the inappropriate "pay me for what I can affect" principle which may lead to imperfect distribution and decrease the motivation for the innovation creation.

Second, we have explained how employee motivation depends on the country where employee works and pointed out fundamental differences between the employee motivations in rich-developed vs. poor-undeveloped

countries. The consequence of this approach is the finding that most of employees in poor countries recognize a salary as primary motivator. The employers must understand this motivation in they want to create appropriate environment for the innovation creation.

Third, we have explained the notion of organizational attention and noted the key problem – that managers do not always get the relevant information from the employees. Identified issue is caused by the asymmetry of interests between employees and management.

Finally, we have explained the notion of incomplete contracts and the reasons why employers need to modify current labor contracts in order to increase the motivation of employees to create innovations.

REFERENCES

1. Jovičić, A., Đokić, A. & Stanić, T. (2018). Information technology and efficiency of company management. *Ekonomski signali*, *13*(2), pp. 75-87. UDK: 005.74:[007:004, http://www.ekonomskisignali.edu.rs/baze/arhiva.php?vid=13&bid=2&sta=7
2. Holmström, B. (2016). *Pay for Performance and Beyond*.
3. Kronenberger, L. (1964). *The Cart and the Horse: American Life Today - Its Urban Culture, Its Social Attitudes, Its Manners and Ambitions.*
4. Kanye West. (2007). Good life.
5. Kiyosaki, R., & Lechter, S. (1997). *Rich Dad Poor Dad.*
6. Schoemaker, P. J. H. (2019). Attention and foresight in organizations. *Futures Foresight Sci.* 1:e5. https://doi.org/10.1002/ffo2.5

Entrepreneurship and Economic Performance: Evidences from Selected OIC Countries

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Abstract—**The OIC countries encountered problems concerning reduction of poverty, filling gaps between income inequalities and achieving economic development. Thus, the main question to ask was: "What can be the solution?" Furthermore, entrepreneurship and economic growth had an increasing pattern. Hence, many scholars have highlighted the importance of economies' entrepreneurial activities and the impact of entrepreneurship and economic growth on poverty, income inequality and economic development. Meanwhile, studies that are quantitatively analyzing the interrelationship between entrepreneurship and their impact on economic performance are very limited. Therefore, the aim of this study is to fill the gap in entrepreneurship literature and to study the causal relationships between the entrepreneurship, income inequality, poverty, employment and economic growth in the panel of 22 OIC countries during 2012-2017. The results suggested that entrepreneurship plays a vital role on poverty, income inequality, employment and economic growth in the OIC countries.**

Keywords - economic growth, entrepreneurial behavior, poverty, income inequality, employment

I. INTRODUCTION

Over the past three decades, the role of entrepreneurship in economic growth has been one of the major research topics [1-3]. In an effort to adapt to the importance of entrepreneurship, governments around the world have adopted various policies to enhance competitiveness, focusing on factors such as appropriate tax regimes, subsidies, growth and investment, innovation, or simple business rules. Small and medium businesses [4].

Entrepreneurship is believed to be an important mechanism of economic growth and development [5]. Their role is to promote prosperity by creating new jobs [6], reducing unemployment [7], and increase economic development and growth of a region [8]. They also increase productivity by bringing innovation and speed up structural changes by forcing existing business to reform and increasing competition. However, even the previous literature examining the relation between income distribution and innovation has neglected economic agents who implement innovation: entrepreneurs. It is puzzling that existing studies have not provided much room for entrepreneurs who can mediate between income inequality and economic growth. To the best of our knowledge, only a few studies have examined the relationship between income distribution and economic growth by considering the role of entrepreneurship [9, 10].

In the existing literature on entrepreneurship, much research has not been done the direct relationship between entrepreneurship and economic performance. Thus, the main purpose of this paper is to examine the relationship between entrepreneurship and economic growth. Contrary to previous studies, with a comprehensive insight into examining all aspects of economic performance using available data for the 22 OIC countries, the potential impacts of the entrepreneurship on the economic growth, poverty, income inequality and employment of selected OIC member countries are examined. Regarding the main purpose of the research, as well as the importance of government policies in developing entrepreneurial activities and creating an appropriate business environment, the main question to be taken into consideration is as follows:

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1. How does the entrepreneurship affect the promotion of economic performances?
2. What is the contribution of entrepreneurship to the economic development through employment generation, GDP growth, poverty alleviation and income inequality?

The results of this study can be helpful in policymaking governments to stimulate entrepreneurial activities and economic performances. Moreover, entrepreneurs can be more effective in choosing their business and developing it, knowing the competitive advantages of countries.

The structure of the present paper organized as follows: In the second part, the theoretical foundations of the research presented in which the concept of the competitiveness of countries and the impact of the components of competitiveness on entrepreneurial activity explained; in the third section, the methodology of research and data is presented. Section three, provides a detailed explanation of the method and data collection. In the fourth section, empirical analysis is performed and in Section 5 the conclusions of the research are stated.

II. Literature and Research Hypotheses

The literatures about impact of entrepreneurship on poverty and income inequality are small. In ref. [11] it is mentioned that the conventional wisdom has been to associate entrepreneurship with higher inequality because of the risk embodied in it. By using the inequality decomposition techniques, he has given the conclusion of his study about entrepreneurship and income inequality in Southern Ethiopia that a uniform increase in entrepreneurial income reduces per capita household income inequality but increasing the number of entrepreneurs does not affect income inequality. Moreover, using supporting policy to encourage entrepreneurship, to reducing inequality could be success in the society that low income, low wealth and relatively uneducated [11]. This is supported by [12-14] that entrepreneurship leads to wealth concentration due to the higher saving rate of entrepreneurs [12].

On the other hand, [15] and [16] argued that inequality could encourage entrepreneurship in developing countries. However, the direction of relationship between inequality and entrepreneurship is depending on moderating factors [13]. In line with the study [17] that the financial constraint plays a key to determine the business start-up and the richer household are easier to start a business. Ref. [18] emphasize the increasing number of entrepreneurship among the poor by the explanation of characters of the poor with have few skills and little capital which is difficult for the poor to find a job as an employee but easier to be an entrepreneur. This is supported by the work of [19], that a country's higher development level can encourage and strengthen entrepreneurial activity. In the work of [20] by using the Kuznets curve to evaluate the impact of various income sources on inequality which is found that one of the factor that effect to declining section of the Kuznets curve is related to the declining share of entrepreneurial income.

Consequently, we can formulate the following hypothesis:

Hypothesis 1: the higher the level of entrepreneurial behavior in a country, the higher the level of economic development

Hypothesis 2: the higher level of the entrepreneurial behavior in a country, the lower the size of income inequality

Hypothesis 3: the higher level of the entrepreneurial behavior in a country, the lower the size of poverty

Hypothesis 4: the higher the level of the entrepreneurial behavior, the larger the size of the employed population.

III. Methodology

List of selected OIC countries are shown in Tab. 1.

TABLE I. List of selected OIC countries

Bangladesh	Pakistan	Jordan
Benin	Senegal	Morocco
Cameroon	Sierra Leone	Tunisia
Chad	Uganda	Bahrain
Gambia	Albania	Qatar
Mali	Egypt	United Arab
Mauritania	Indonesia	Emirates
Mozambique	Iran	

To evaluate the relationship of entrepreneurship on Economic growth, the researchers regressed the following equation:

$$GDP_{i,t} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} . \quad (1)$$

$GDP_{i,t}$: Gross Dpmestic Product per capita

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

To evaluate the relationship of entrepreneurship on employment, the researchers regressed the following equation:

$$LF_{it} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} . \quad (2)$$

LF_{it} : Total labor force

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

To evaluate the relationship of entrepreneurship on poverty, the researchers regressed the following equation:

$$HCR_{it} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} . \quad (3)$$

HCR_{it} : Headcount Ratio

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

To evaluate the relationship of entrepreneurship on income inequality, the researchers regressed the following equation:

$$GIN_{i,t} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} . \quad (4)$$

$GIN_{i,t}$: Gini Coefficient Ratio

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

IV. RESULTS

Tab. 2 displays the results of the test of hypotheses 1, 2, 3, 4, that is, the independent effect of entrepreneurship on overall economic performance, that is, the effect of entrepreneurial activity on economic performances of GDP growth, Employment, poverty and incom inequality.

The regression results showed that the entrepreneurship was a significant determinant of the poverty at 1% level of significance.

TABLE II. ESTIMATION RESULTS FOR OIC COUNTRIES

Variables	Coef.	Z
Regression 1		
Intercept	0.3013	2.47
GDP growth (annual %)	0.4067	3.23
R^2	86%	
Regression 2		
Intercept	0.02576	3.22
Employers, total (% of total employment)	0.1145	4.47
R^2	83%	
Regression 3		
Intercept	0.11364	2.87
Poverty (headcount ratio)	0.21328	5.45
R^2	78%	
Regression 4		
Intercept	0.0024	3.26
Income inequality (Gini coefficient)	0.0276	4.35
R^2	85%	

The value for R-squared was 0.78, which meant that 78% of the changes in the headcount ratio could be explained by the changes in the entrepreneurial activities. This was a clear indication that the TEA was a significant determinant of poverty. It also showed that the said variable was negatively related to poverty.

In addition, The regression results showed that entrepreneurship was a significant determinant of the income inequality at 1% level of significance. The value for R-squared was 0.85, which meant that 85% of the changes in the gini coefficient could be explained by the changes in the entrepreneurial activites in OIC countries. This was a clear indication that the TEA was a significant determinant of income inequality. It also showed that the said variable was negatively related to income inequality.

Furthermore, The regression results showed that the Micro, Small and Medium Enterprises was significant determinant of the economic growth at 1% level of significance. The value for R-squared was 0.86, which meant that 86% of the changes in the economic growth could be explained by the changes in the Micro, Small and Medium Enterprises. This was a clear indication that the Micro, Small and Medium Enterprises were significant determinants of the economic growth. The results from the regression analysis showed that there was a negative relationships between entrepreneurship, and poverty and income inequality. It entailed that a percent (1%) increase of TEA accounted to poverty could lead to a decrease of 0.21328 and a decrease of 0.0276 to income inequality. Whereas, the analysis revealed that there was a positive relationship between the entrepreneurship and the economic growth and employment. It meant that a percent (1%) increase of TEA accounted to economic growth could lead to an increase of 0.4067. Moreover, there was a positive relationship between the entrepreneurship and create employemt. Hence, a percent (1%) increase of TEA accounted to the increase in employment of 0.1145. The researchers take these results as evidence that entrepreneurship plays a vital role on poverty, income inequality, economic growth and emloyment in OIC countries.

V. CONCLUSION

Limited research studies the impact of entrepreneurial activities on economic performance. This study responds to this issue by examining how entrepreneurship affects economic performance. In this regard, the relationship between entrepreneurial activities and economic performances such as poverty reduction, income inequality, employment and economic growth for 22 selected OIC countries from 2012 to 2017. As an empirical matter, the significant support was found for the notion that the firm establishment causes poverty and income inequality decrease, but economic growth and employment increase.

REFERENCES

1. King, R. G. & Levine, R. (1993). Finance and growth: Schumpeter might be right. *The quarterly journal of economics*, 108(3), pp. 717-737.
2. Wennekers, S. & R. Thurik. (1999). Linking entrepreneurship and economic growth. *Small business economics*, 13(1), pp. 27-56.
3. Acs, Z. & Szerb, L. (2007). Entrepreneurship, Economic Growth and Public Policy. *Small Business Economics*, *28*(2), pp. 109-122.
4. Acs, Z. J. & Stough, R. R. (Eds.). (2008). *Public policy in an entrepreneurial economy: creating the conditions for business growth*, *17*, Springer Science & Business Media.
5. Schumpeter, J.A. (1934). *The Theory of Economic Development.* Harvard University Press, Cambridge MA.
6. Van Stel, A. & Storey, D. (2004). "The link between firm births and job creation: Is there a Upas tree effect?" *Regional Studies*, 38(8), pp. 893-909.
7. Evans, D. & Leighton, L. S. (1989). Some empirical aspects of entrepreneurship. *American Economic Review*, 79, pp. 519-535.
8. Acs, Z. J., Desai, S. & Hessels J. (2008). Entrepreneurship economic development and institutions. *Small Business Economics*, 31(3), pp. 219-234.
9. Gutiérrez-Romero, R. & Méndez-Errico, L. M. (2015). *The long-term impact of inequality on entrepreneurship and job creation*.
10. Tselios, V. (2011). Is inequality good for innovation? *International Regional Science Review*, *34*, pp. 75-101.

11. Kimhi A. (2010). Entrepreneurship and income inequality in southern Ethiopia. *Small Business Economics*, Springer, 34(1), pp. 81-91.
12. Quadrini, V. (2000). Entrepreneurship, Saving and Social Mobility. *Review of Economic Dynamics, Elsevier for the Society for Economic Dynamics,* 3(1), pp. 1-40.
13. Meh, C. (2005). Entrepreneurship, Wealth Inequality, and Taxation. *Review of Economic Dynamics, Elsevier for the Society for Economic Dynamics*, 8(3), pp. 688-719.
14. Cagetti & Nardi, D. (2006). Entrepreneurship, Frictions, and Wealth. *Journal of Political Economy, University of Chicago Press*, 114(5), pp. 835-870.
15. Hillel, R. (2002). Migration, "Credit Constraints and Self-Employment: A Simple Model of Occupational Choice, Inequality and Growth," *Economics Bulletin*, 15, pp. 1-5.
16. Wim, N. (2008). Entrepreneurship in Economic Development, Working Papers RP2008/20, World Institute for Development Economic Research (UNU-WIDER).
17. Anna, P. L. & Townsend R. M. (2004), Entrepreneurship and Financial Constraints in Thailand. *J. Corporate Finance,* 10, pp. 229–62.
18. Abhijit, B. & Duflo, E. (2007). The Economic Lives of the Poor. *Journal of Economic Perspectives*, 21(1), pp. 141-167.
19. Zoltan, A. J. & Armington, C. (2005). Using Census BITS to Explore Entrepreneurship, Geography, and Economic Growth, Small Business Research Summary No. 248, U.S. Small Business Administration's Office of Advocacy.
20. Deutsch, J. & Silber J. (2004). Measuring the Impact of Various Income Sources on the Link between Inequality and Development: Implications for the Kuznets Curve. *Review of Development Economics*, 8(1), pp. 110-127.

Gamification as an Innovative Approach in Security Systems

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Abstract—**Problems of motivation and training of its members is increasingly hard logistical and economic task for armed forces and security services in general, so in the last two decades solving of problems of selection of innovative but cheap training of soldiers became crucial. Strategists of defense and security systems are creating efficient methods for motivation, attraction, selection and training of the personnel. One of the most innovative HR techniques is gamification. Officers are becoming managers who are using experiences and procedures of the gaming industry to transform the mass of their recruits into a military or security collective that can answer to difficult challenges posed by imaginary or real opponent. By using gamification, mechanisms of games are used for representative presentation of a projected goal as attractive and easy-to-win rewards that will motivate a person to act as it is expected. Games and its narratives are one of the most efficient methods of teaching and it can be applied regardless of age or goal of the teaching. Gamification is also an efficient tool for overcoming psychological and mental barriers that occur in stressful training of soldiers and security agents.**

Keywords - gamification, game, military, security systems

I. INTRODUCTION

En générale, gamification is application of game principles in various aspects of life which, *en générale,* are not related to game, nor to its being in phenomenon or noumenon sense. Basic characteristic of applied gamification of anything is its effort to implement attributes of ontological being of game in situations and at times when such application even seems nonsensical. It is increasingly present in fields such as economics, marketing, arts, sports, politics, but also in some traditionally closed systems such as army. Gamification can be also defined as use of gaming techniques in non-gaming environments. The basic goal is to stimulate persons to participate in the desired activity and to reach achievement the creators of gamification in each case envisioned. In the beginning it was used in relatively less significant aspects, such as realization of prize contests, surveys, event organization, charities, product testing, educational work with children, attracting voters to participate in elections and various other needs, but later the application of gamification spread to services crucial for functioning of the state and the society.

In this paper we will point to another aspect of gamification, and it is a kind of misuse of games, particularly video games in non-gaming purposes, which are sometimes useful, but often are destructive. This paper will focus on gamification as production and use of games and video games for non-gaming purposes and that are, *by default*, opposed to the being of game. We remind that game, and video game, does not have another purpose or goal other than game itself, meaning that game should not serve anyone or anything[1]. Game shall not be expected to provide any other goal other than mere playing[2]. Nonetheless, as we will stress in this paper, gamification as usage of video games and

[1] Igra nema nikakvu „svrhu“, ona ne služi ničemu. Ona je beskorisna i ne koristi ničemu — ona se ne odnosi unapred na konačni cilj, na bilo koji konačni cilj ljudskog života koji se traži ili u koga se veruje. Pravi igrač se igra samo da bi se igrao. Igra stoji za sebe i u sebi, ona je „izuzetak“ više nego u jednom smislu“. Fink, Eugen, *Osnovni fenomeni ljudskog postojanja,* Nolit, Beograd, 1984, strana, 295

[2] Filipović, A. (2016) *Paradigma kulturološkog pozicioniranja video igre,* doctoral dissertation, Fakultet dramskih umetnosti, Univerzitet umetnosti u Beogradu

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its principles is getting traction[3]. Everything can become a game and a game can be created for anything. Hundreds of video games are already created and used for easier approach to problem solving in the most difficult aspects of human activity and organization, like army, police and secret security services.

In order to be applied successfully, gamification has to meet certain preconditions. First of all, clear rules have to be defined, which allows the game to be just, interesting and transparent. It is also important to adapt the attributes of the game to the goal for which it was created, as well as to specific attributes of the participants. Then the competitive spirit has to be stimulated, even if it is the game where a person competes with himself. All participants must have clear benefits from playing and a system of promotion or levelling has to be created. Challenges, rewards and promotions are basic elements of attractiveness of the game. It is of particular importance that players can exchange achieved in-game rewards for real rewards in reality[4].

The term gamification was first used by Nick Pelling[5] in 2002. In his software tools he used gaming scripts and achieved the effect of computer games in fields far away from the game[6]. Nonetheless, until recently gamification was almost never used professionally. Many companies used gaming mechanisms for solving business problems, but without understaning of the volume and importance of that idea.

For this paper we choosed three aspects of gamification usage and video games development by armies and security services of many countries, mostly developed Western countries. These are:

- Use of video games and its principles in recruitment of new soldiers and officers,
- Use of video games in practical training of soldiers and security agency officers,
- Use of video games in psychological preparation for expected stress and densensitization of soldiers and security officers for stressful situations such as killing of enemy combatant

II. GAMIFICATION AS A RECRUITMENT TECHNIQUE FOR ARMY SERVICE

After great shuffling[7] of global relations, in early 1990s the United States of America remained world's only superpower. The level of economy, education and quality of life of people reached its peak. The US Army remained unchallenged in its supremacy. Nonetheless, the processes generated in the American society led to unrecorded levels of general alienation, particularly among young people in large urban areas, and that brought problems to the most important institution of the American society – the armed forces. Increase of welfare, freedom and individual happiness only touched the US Army. Problems occurred in perception and image of that profession. After poor experiences of the Vietnam War and much better offers outside the armed forces caused the best recruits to stop being interested for military service. In addition to all other problems, the recruit pool for the world's strongest army was shrunk to less desirable candidates for recruitment, in sense of education and capabilities. These were all good and loyal citizens of the USA, but the level of their general knowledge and usefullness for military service did not allow them to be trained for usage of modern weapons, technology and vehicles. In an effort to create a new image, the US Army began a campaing in late 1990s called „Be All You Can Be". As a part of the campaign an interesting program video game was launched, and it was one of the first efforts to use video game technology as a gamification process for recruitment. Several years later, the US Army released the video game „America's Army[8] ", which the potential recruits could download and test their skills and capabilities in

[3] Gartner Group (https://www.gartner.com/en) predicts that by 2015 it will be used by 70% of the world's largest companies, providing with its help 50% of innovation. Moreover, M2 Research (http://www.m2research.com) expects that by the end of the decade, US companies alone will spend about three billion dollars a year on gamification technologies and services.

[4] Radovanović, T. (2019) *Sve može postati igra, Studentski dnevni list, https://www.studnel.com/it/item/1948-sve-moze-postati-igra,* retrieved 10.11.2019

[5] Nick Pelling (*Nicholas John Pelling)* is a British-born computer programmer and investigative writer best known as the creator of the 1984 game *Frak!*

[6] Беловсяк Н. (2015) *Геймификация: как повысить успешность серьёзного бизнеса при помощи игры*, Электронные данные, http://internetno.net/category/analitika/gamification_about/ retrieved 19.11.2019

[7] Nestanak SSSR, ujedinjenje Nemačke, raspad Varšavskog vojnog saveza….

[8] *America's Army* is a series of first-person shooter video games developed and published by the U.S. Army, intended to inform, educate, and recruit prospective soldiers. Launched in 2002, the game was branded as a strategic communication device designed to allow Americans to virtually explore the Army at their own pace and allowed them to determine if becoming a soldier fits

multiplayer environment. All the participants completed a survey and by doing that became a part of a community called „Online Army". The best players received „badges of honor" and were stimulated to join the army.

Retired colonel Casey Vardinsky, former chief economist of the US Army and professor at United States Military Academy at West Point, who was instrumental in creation of *America's Army* lated explained why the gamification method was selected and why the video game was created: „The army is such an institution that it has to use the best available techniques, methods and technologies in order to achieve its goals. We were visionary in recognizing capabilities of video games and began to use video game technologies in order to provide virtual soldier experience to potential candidates that would help the potential soldier to have fun, become informed and in the end become engaged. Nobody expected that the game will grow to this proportions.[9] The latest version of the game was published in 2013[10]. The game remains very influential to this day. According to website https://worldbeyondwar.org, video game *The America's Army* has millions of passionate fans. It is one of the most downloaded games ever. According to a research by MIT, „the game has more influence on recruits that all the other forms of military advertisement combined."[11]

Soon another game was included in the video game recruitment set, *Virtual Battle space*[12], which simulates military campaigns where mentors follow the rankings of the participants and invite the best of them to serve in the army. *The Combined Arms Training Center*[13] of the US Armed Forces has its own Massive Multiplayer Online Role Playing Game (MMORPG) for training of the new recruits. The system, similar to video game *World of Warcraft*, allows soldiers around the world to log in to a military MMORPG and to play as individuals or units.

Edward Snowden published a document from the NSA in 2013 "Exploiting Terrorist Use of Games & Virtual Environments[14]", where it can be seen that the CIA and teh NSA joined forces with the government staff of the United Kingdom GCHQ[15] in order to deploy real-life agents into virtual environment of *World of Warcraft* and infiltrated them into Xbox Live with tens of millions of players around the world. The two of the most powerful intelligence agencies in the world therefore became able to identify a labyrinth of the game's social networking system and those partial to virtual killing.

III. GAMIFICATION IN SERVICE OF TRAINING OF SOLDIERS

Modern warfare is a very expensive activity. Modern equipment is enormously expensive to purchase, and its maintenance demands vast sums of money. An hour of flight of a combat airplane F-15 Eagle costs nearly $42,000, while an hour of flight of F-16C costs $22,500. The newest American war airplane, F-35 Lightning II costs $42,200 per flight hour, while in F-22 Raptor it costs $68,360.[16]

Armament is also very expensive. The best Western air-to-air missile „Meteor" costs $2,6 million per unit. The Russian peer, R 37M is cheaper, but no Russian air-to-air missile of medium and long range costs less than $1 million. Large armies have hundreds of airplanes and thousands of pilots, and if each one of them fire just one missile during training, the cost is obvious. Infantry weapons and armament is not much cheaper. Live firing of a tank

their interests and abilities. *America's Army* represents the first large-scale use of game technology by the U.S. government as a platform for strategic communication and recruitment, and the first use of game technology in support of U.S. Army recruiting. The Windows version 1.0, subtitled *Recon*, was the first released version on July 4, 2002. As of January 2014, there have been over 41 versions and updates released including updates to *America's Army: Proving Grounds,* which was released on August 2013. All versions have been developed on the Unreal Engine. The game is financed by the U.S. government and distributed by free download. *America's Army* has also been used to deliver virtual military experiences to participants at events, such as: air shows, amusement parks, and sporting events around the country.

[9] Wolf, M. J. P. (2008) *The Video Game Explosion: A History from PONG to PlayStation and Beyond,* ABC-CLIO, Santa Barbara p. 380

[10] https://store.steampowered.com/app/203290/Americas_Army_Proving_Grounds/

[11] https://worldbeyondwar.org/gi-nik-cruz/, retrieved 10.11. 2019

[12] https://www.bohemia.net/, retrieved 11.11.2019

[13] https://www.7atc.army.mil/CATC/, retrieved 11.11.2019

[14] https://www.documentcloud.org/documents/889134-gam es, retrieved 11.11.2019

[15] Government Communications Headquarters, commonly known as GCHQ, is an intelligence and security organization responsible for providing signals intelligence (SIGINT) and information assurance to the government and armed forces of the United Kingdom.

[16] Thompson, Mark, *Costly Flight price*, http://nation.time.com/ 2013/04/02/costly-flight-hours/, retrieved 11.11.2019

batallion costs between $5 million to $10 million[17].

As with the recruitment, large armies seeked and found help in video games. There is almost no combat segment where for primary military training and maintaining the preparedness level video games software upgraded with original surroundings is not used. These are not only simulators of flight, firing or military vehicles.

Video games like *Mortal Kombat* or *Ultimate fight teach hand-to-hand combat, Wolfenstein, Quake, Doom* or *Perfect Assassin simulate indivudual combat in real war situations. For other organizational types and potential future manegers or soldiers there are strategy video games like Command & Conquer: Generals, Tiberian Sun, Company of Heroes, Age of Empires, Civilization, Caesar.* In thees games soldiers learn how to organize citizens, troops, how to build structurtes and cities, how to defeat their enemies and take their structures, buildings, cities, how to subjugate their citizens and workers. In addition, there are various programs of training and teaching, such as: *F/A-18 Korea, F-22 Air Dominance Fighter, F-16 Fighting Falcon, Euro Fighter2000, Back To Baghdad, Flashpoint Kosovo* – for war conflict simulations, *Armored Fist 2 - M1A2 Abrams* – for tanks, *688(I) Hunter/Killer* – for nuclear submarine[18].

Other titles shall also be mentioned: *Warcraft, Heroes of Might and Magic Lands of Lore: Guardians of Destiny, Realms of Arkania, Diablo, Legacy of Kain, Warlords, Lords of Magic, Blood & Magic, Lords of Realm, Warhammer, Dark Omen, Arthur's Knight's - Secrets of Merlin*. New games constantly appear, and they more or less repeat established militaristic model. In addition to *The America's Army*, which helps in recruitment of young Americans, *Kuma Reality Games* is a new online project where registered players can relive war campaigns in form of missions: assault on Al-Qaeda' stronghold, arrest of Saddam Hussein, battle of Fallujah. A project called *Full Spectrum Warrior,* is a co-production sponsored by Institute for Creative Technologies of Entertainment Industry Department of the Pentagon. Department of Defense Game Development Community funded by DARPA (Defense Advanced Research Projects Agency) and the Agency for Advanced Defense Development Projects financed more than 100 video games specifically made for military use, or are deemed useful while not being directly created for military needs[19].

Since 2006 American soldiers train using video game DARVARS Ambush as well, specially modified by the DARPA. The armed forces purchased more than 3,000 licensed copies for training of infantry units, air force, parachuters, coast guard and other units. As this game is becoming obsolete, upgrade is under way. Among requests put before the new engine is ability to edit maps, support for communication with the command center, availability of mobile version of the game and online support. A game code-named Game After Ambush is installed in 70 gaming centers in 53 American military units around the world, including Germany, Italy and South Korea. Each gaming center has 52 computers with special equipment. Soldiers can control combat vehicles, airplanes and helicopters, and fire weapons on virtual maps up to 100x100 km large. The new game will fully emulate real activities of soldiers, including real missions of escort, urban combat and reaction to sudden strikes[20].

IV. Gamification as a Method for Desensitization of Killing

Psychologists claim that repulsion to killing its own species is innate to the ontological being of human. Military psychologists tell about nightmares young soldiers had after their first killing of another human being, whether they killed them by their own hand, or participated in the killing in any other way.

Similar to problems of recruitment and training, the military found solution in video games. First-person shooter games were instrumental in solving this problem. Games like *Counterstrike*, *Doom*, *Call of Duty*, *Halo*,

[17] Branković, Živojin, *Najbolje opcije opremanja lovačkih aviona raketama vazduh-vazduh,* https://tangosix.rs/2017/29/11/hrvatska-sa-meteorom-srbija-sa-r-77-najbolje-opcije-opremanja-lovackih-aviona-raketama-vazduh-vazduh/, retrieved 11.11.2019

[18] Lukić, K. (2006) Kritičke perspektive umetnosti digitalnih igara – prilog istraživanju fenomena, *E-Volucija, 14*, Centar za proučavanje informacionih tehnologija Beogradske otvorene škole, http://old.bos.rs/cepit/evolucija/html/14/ igre.htm

[19] Vuksanović, D. (2017) *Filozofija medija II: ontologija, estetika, kritika,* Čigoja štampa, Beograd

[20] Robson, S. (2008) *Not Playing Around: Army to invest $50M in combat training games,* https://www.stripes.com/news/not-playing-around-army-to-invest-50m-in-combat-training-games-1.85595, retrieved 10.11.2019

Crysis, *Grand Theft Auto* series, *Manhunt* and similar games train in excessive and systematic killing with firearms. The game content includes humiliation, torture and mutilation, and killed and dismembered people on displays have psychological effect on young soldiers. The most destructive games come from professional program of the US Army, and aside from killing, they include practicing firing techniques, precision and automatic response. In that way soldiers are desensitized and their repulsion of killing is dissolved in an efficient way.

Military psychologist Dave Grossman [21], former professor at the United States Military Academy at West Point, after his military career turned to studies of killing. In his book Grossman wrote:

„Three things are necessary for killing: to have weapons, to know how and to have a will for killing. Two of these conditions are fulfilled by video games, technical readiness and will. We all have innate biological resistance to killing of our own species which is broken by years of dedicated training. Simulators of killing were created for training purposes, which save ammunition and battlefield situations are recreated, where the enemy is being killed in virtual surrounding. Throughout history it was shown that soldiers easily enter the combat, they are ready to die, but the majority had hard time to be the killers. Therefore the killing simulators were developed[22].

US Marine Corps got rights to use video game *Doom* as a teaching material. One of the older games, Duck Hunt originally had people instead of ducks for targets, and a plastic M-16 rifle was used for shooting. It is similar with the police forces.

V. CONCLUSION

Here we shall point out to certain ethical dillemmas gamification brings, particularly in its segment of using games and its elements for destructive, non-gaming purposes. The problem occured when the games originated from the professional program of teh US Army found their way to teenage gamer population. The army has an efficient control of its members, and every soldier who trains via video games has his mentor. With civilian gamers it is not the case. Therefore the problem of promotion of militarism as lifestyle and problem solving method appeared.

By gladly accepting military needs, the video game industry consciously creates ideological discourse through militarism present in video games that create narratives, parallel history and form the world view of young generations. The cult of war nurtured by the best-selling video games was not seen since the times of fascism between the two World Wars [23]. Such openly militaristic ideology does not look abnormal in the present day, because armed conflicts are normalized in the state of perpetual global latent War on Terror. Militarism present in video games has children and young adults as its target group and represents an alternative or additional educational framework to official education system [24]. The nihilism of contemporary technology endangers sensibility, solidarity and critical thought of the millennials. They are obsessed with virtual worlds in contrast to real existing space[25]. One of the attributes of gamer ideology of neoimperialism and manipulation of gamer population is exactly in promotion of militarism as a dominant world view, in contrast to officially proclaimed pacifism as state policy and desired behavior of countries of Western democracy[26].

Unlike ethics of video games that was built on ethical principles of civilization, and therefore subjected to criticism and discussion, ethics of the world (or being) of video game is non-ethics, meaning that video game world is a world without morals, meaning it is outside of morals. Naturally, it is a world without laws and other social regulations. There are many reasons for that. Non-ethics of video game world is closest to ethics of natural law from the beginning og civilization, and the essence of nearly all laws brought since Hammurabi to the

[21] David Allen Grossman (1956) an American author who has specialized in the study of the psychology of killing (a discipline which he labels "killology"). He is a retired lieutenant colonel in the US Army

[22] Grossman, D. (1996) *On Killing: The Psychological Cost of Learning to Kill in War and Society,* Back Bay Books, New York

[23] Filipović, A. (2016) *Paradigma kulturološkog pozicioniranja video igre,* doctoral dissertation, Fakultet dramskih umetnosti, Univerzitet umetnosti u Beogradu

[24] Lukić, K. (2006) Kritičke perspektive umetnosti digitalnih igara – prilog istraživanju fenomena, *E-Volucija, 14*, Centar za proučavanje informacionih tehnologija Beogradske otvorene škole, http://old.bos.rs/cepit/evolucija/html/ 14/igre.htm

[25] Bjelajac, Ž. (2017) *Bezbednosna kultura - umeće življenja,* Pravni Fakultet za privredu i pravosuđe, Novi Sad, Novi Sad, pp. 598-599.

[26] Filipović, A (2013) Etički izazovi video-igre*, Zbornik radova Fakulteta dramskih umetnosti*, 24, pp. 145 - 163

present day are to limit and supress natural law, meaning complete and wide freedom of activity. Consequently, video game world is a world without democracy, without human rights, a world where only the player, sitting on this side of display and within borders set by the narrative and the gameplay of the game, performs the most extreme absolute dictatorship while relativizing morals. Video game creators certainly set the borders and the frame, but such frame has to be wide and flexible. This brings us to dichotomy of divine on one side and diabolical possibilites and functions of video game players on the other.

Relativization of morals on both sides of the display cannot pass without consequences. It brings to supremacy of total game[27] on one side, and paradoxical „game without playing" on the other side, and its inescapable movement to self-elimination from primary string of humanity as simplification of moral principle at the lowest level causes erosion of game borders in the real world, and consequently to negation of the game. When there is no constitutive moral principle in the real lofe, then the game easily penetrates all the spheres of life, while suppressing other, more important principles of relationship to life. The game is an importan part of life, but the life is not only a game. There is no gaming civilization and it is hard to even imagine one. Utopian and dystopian writers thought about and wrote on evey possible kinds of organization of society, but there is hardly a civilization as a game, even within endless boundaries of imagination[28]. This is the case due to dialectical opposition of terms „state" and „game". Immanuel Kant concluded that game is „free from goals, needs and survival struggle". Game is, according to Kant, „free from responsibility and consequences[29]", in other words of everything that makes up the essence of state without which any civilization is not possible. *Raison d' être* of every state is interest, while *conditio sine qua non* of every game is absolute absence of interest, aside from gamer's interest to play. Game cannot play life, it can only imitate, emulate and simulate it, and all the elements of game, „including the spectators must be warned in advance that it is only a game without consequences, and not the real and serious life[30]".

References

1. Bateson, G. (1972). S*teps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*. University of Chicago Press. Chicago
2. Беловсяк Н. (2015). Геймификация: как повысить успешность серьёзного бизнеса при помощи игры, Электронные данные http://internetno.net/category/analitika/gamification_about/
3. Bjelajac, Ž. (2017). *Bezbednosna kultura - umeće življenja,* Pravni Fakultet za privredu i pravosuđe, Novi Sad
4. Filipović, A. (2013). Etički izazovi video-igre*, Zbornik radova Fakulteta dramskih umetnosti*, 24
5. Filipović, A. (2016). Paradigma kulturološkog pozicioniranja video igre, doctoral dissertation, Fakultet dramskih umetnosti, Univerzitet umetnosti u Beogradu
6. Fink, E. (1984). *Osnovni fenomeni ljudskog postojanja,* Nolit, Beograd
7. Grossman, D. (1996). *On Killing: The Psychological Cost of Learning to Kill in War and Society.* Back Bay Books, New York
8. Robson, S. (2008). Not Playing Around: Army to invest $50M in combat training games*,* Stars and Stripes*,* https://www.stripes.com/news/not-playing-aroun d-army-to-invest-50m-in-combat-training-games -1.85595
9. Kant, I. (1975). *Kritika moći suđenja*, BIGZ, Beograd
10. Lukić, K. (2006). Kritičke perspektive umetnosti digitalnih igara – prilog istraživanju fenomena, *E-Volucija, 14*, Centar za proučavanje informacionih tehnologija Beogradske otvorene škole, http://old.bos.rs/cepit/evolucija/html/14/igre.htm
11. Radovanović, T. (2019). Sve može postati igra, Studentski dnevni list*,* https://www.studnel.com/it/item/1948-sve-moze-postati-igra
12. Vuksanović, D. (2017). *Filozofija medija II: ontologija, estetika, kritika,* Čigoja štampa, Beograd
13. Wolf, M. J. P. (2008). *The Video Game Explosion: A History from PONG to PlayStation and Beyond,* ABC-CLIO, Santa Barbara

[27] The state of game as a phenomenon depicted in film Rolerball from 1975, directed by Norman Jewison

[28] Filipović, A. (2016) *Paradigma kulturološkog pozicioniranja video igre,* doctoral dissertation, Fakultet dramskih umetnosti, Univerzitet umetnosti u Beogradu

[29] Kant, I. (1975) *Kritika moći suđenja*, BIGZ, Beograd, p.109

[30] Bateson, G. (1972) S*teps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, And Epistemology*. University of Chicago Press. pp. 150 – 166

Innovative Strategy Entrepreneurial Management

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Abstract—**Entrepreneurship and entrepreneurs are terms that are primarily related to enterprise and interact with each other. But there is a difference between them - entrepreneur (entity) is a carrier of entrepreneurship, which means that he performs certain activity and behavior directed to achieving the set goals; the company emerges as an" organizational tool" (the object) by which the entrepreneur realizes entrepreneurship. Entrepreneurial management has a major role in achieving the final business results. For entrepreneurial management it can be said that it identifies with successful ways of business processes regarding on small and medium scale of working process. Entrepreneurial management is a key development factor of business and modern technology. It is not just a simple form of entrepreneurship and management – but Entrepreneurial management is the form where these two factors have a synergistic effect on business. However, the same cannot be practically achieved without certain theoretical base. For this reason, the paper gives an overview of some entrepreneurial strategies management that are also innovative. Innovation of leadership as well as strategic awareness, have important impact on realization of technological and management innovations. The paper also focuses on strategy promotions of management.**

Keywords - entrepreneurship, enterprise, management strategies, innovation.

I. INTRODUCTION

Entrepreneurial strategy is a way of entrepreneurial decisions related to risk. It is not entirely scientific, but it can be said that innovates are based on the results of scientific research. That is not a game of chance – it is a matter of deep deliberation and judgment. This confirms the practice of the most developed countries in the world. According to numerous researches the best results recorded companies managed in an entrepreneurial way. "Gazellese", as most dynamic businesses organizations when we talk about growth and development, their dynamics owe to entrepreneurial management. This fact imposes the conclusion that entrepreneurial management should be developed and applied in business practices of countries that are in the transitions or post-transitions process in which this sector is not sufficiently developed. In almost all developed and middle developed countries, the entrepreneurial management notes significant contributions in economic growth and development [1,2].

Author Jovan Brekić discusses two very important things of business strategies: innovative strategy management and promotion strategy management [3]. These strategies management can be accepted as entrepreneurial strategy, regardless on the way "who is (their) bearer" [4]. In this two strategies it can be exactly seen how the elements combine in two functions: managerial and entrepreneurial, becoming entrepreneurial strategies management. Peter Drucker, a famous American, whose writings contributed to the philosophical and practical foundations of the modern business corporation wrote about entrepreneurial strategies. In many of his papers Drucker described the connection between innovation and entrepreneurship [5,6,7,8], offering speculation on the future impact of developments as technological change.

Author Brekić among the other, take a point on: strategy business benefits, strategic awareness, strategies influence on technological innovation, strategic steps, strategic interactions and strategic teamwork collaboration [9].

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A. *Strategic Awareness and Research Interactions*

The business opportunity strategy is based on the researching and learning of business opportunities that can be hidden in the company environment, business scope and competition challenge, making the opportunities of more profit. Business opportunities are founding by the strategic research [10]. Strategic awareness is a requirement of achieving innovative strategy entrepreneurial management, especially management team. Based on the fact that the strategy means the skill of designing, consciousness has a crucial role in making key decisions and in finding a way out of the existing into the desired dynamic state. It is necessary to establish the link between strategic awareness and other key variables of strategies model - aligning perceptions of management team and environmental factors [11]. Strategic alignment important factors and strategy makers are narrow of the business performance success [12].

Perception alignment is achieved by the encouraging development of the strategic thinking. The following sentences are important for strategic thinking and perception:

- experts are the most important factors of development,
- strategic perception depends on executives and
- development strategy must integrated staff development strategy and innovations strategy [13].

II. Impact of Strategy on Technological Innovation

Impact of strategy on technological innovation is reflected in the choice of the strategy which develops and applies those innovations (offensive, defensive, imitative, traditional, opportunity and dependent strategies). Among them a special place takes a choice between offensive and defensive strategies, especially because they involve investing of big funds in “changes”, including those in education, i.e. in intellectual capital. Well, other strategies should not be underestimated, because they support successful implementation that is already accomplished, such as form of know-how. For smaller businesses, it is important to understand the nature of competition, profitability of firms in their branch and the economies of scale which they face with [14]. The success of an innovative strategy entrepreneurial management depends on successful development and realization of individual phases of innovative introduction [15].

This process usually involves seven stages, which accomplishes seven essential requirements, such as [16]:

- Making managers who are aware of the business goals and who want to adopt the principles of participation in the realization of the strategy;
- Understanding goals, processes, motivation, actions; identified necessary realization of the innovation;
- Set clear goals, identify problems, tasks and define criteria for achievement of the goals;
- Estimate the lead time with PERT networks or other techniques;
- Determine priorities and codes of responsibility for innovations;
- Anticipate and overcome occurring problems with development of a communication program managers and employees (associates) and
- Develop manuals that provide a brief overview of philosophy, guidance, means, instruments, planning techniques, managing technological change process, and participation and communication skills.

To follow those strategies means activating all enterprise potential in innovative changes as well as motivating employees to initiate and implement the program strategies [17].

III. Strategic Steps in Innovative Strategies

Strategic steps indicate monitoring the achievement of strategic innovation plans which usually takes place in the next seven steps [18]:

- Identification of the list of success factors from environments that are important to push up productivity and quality of service as well as for motivating employees;
- Revision of enterprise strategic plan in relation to competition that refers to lowering costs, cheaper products, satisfaction, lending customers and improving working conditions;

- Establish success criteria and request for project team expertise;
- Motivating of managers and employees;
- Identification of basic performance individuals and groups indicators that are focused on innovative actions and communication;
- Development of output indicators;
- Modeling preparations for information systems.

Those strategic steps are being realized through an interaction strategy that encompasses more factors. The interaction strategy is focused to resolve misunderstandings leading to successful cooperation. The creative practice knows five strategies of Entrepreneurial management:

- reconciliation strategy;
- defense strategy;
- compromise strategy;
- conflict resolution strategy and
- Problem solving strategy.

The reconciliation strategy is based on the need to establish good interpersonal relationships, forcing conflicting sides to give up from their antagonism.

A defense strategy requires giving up from some views in order to satisfy or reconcile opposing sides. An active strategist tries to minimize the possibility of losing his position or a complete defeat, and the passive strategist pursues to limit the goals by responding to his opponent's demands, trying to keep as much as he can.

A compromise strategy is often synonymous of the negotiating opposing sides whose wishes cannot be fully realized. It is an act of pragmatic and common sense.

In this strategy, the active strategist determines the direction of the negotiation, taking the initiative, and the passive strategist adapts the initiative, in other words he is ready to yield ("better than nothing").

A conflict resolution strategy is actually a way to resolving a conflict. Negotiation is based on the concept of victory over the opponent. Since such conflict also causes strong emotions and neglects logic, some tactics are needed to the conflict step by step, with new arguments, presenting the negative consequences that could arise from the conflict situation. The strategy for resolving problems assumes that between the two sides is possible synergistic relationship. In fact, both sides in the negotiations have some common goals, but both of the sides has different approaches and views on the achievements of these goals. This situation, seeks neither defeat nor victory but it seeks to harmonize the interests of both sides. In the case of conflict, problems are attacked not personalities. The goal is not reconciliation; it is the finding the best solution to a particular problem of mutual interest. The strategy of cooperation by team action is extremely important for the successful business of modern entrepreneurial management, so team building is one of the most important skills of the main entrepreneur i.e. the manager of the company. The team formation is preceded by careful planning of the necessary experts for individual organizational units of the company. Selection of team members take dominant places according establishing criteria, in which the knowledge and ability are confirmed in practice, [19].

Team members are ranked according to the principle that they are most comfortable with, which they can give the most, who are committed to the idea of leading and committed to the job, and at the same time motivated to perform it. The role of the team leader is very important because he or she must have at least some knowledge of the language of complementary knowledge on which the team action will be based, and above all, he or she must have the ability to communicate with team members; lead them in activities, know how to synthesize results, attitudes, opinions and other attributes of team members, know how to evaluate their results, reward and motivate them for individual and overall team results. Team members need to have clear team goals, that is, messages.

Ideas can mutually confront each other, but in the sense of tolerance. Criticism must be tactical, creative and instructive.

Its aim should be to repair and reconcile parties, not to discredit persons. The manager, by his own example, must encourage the members by giving them the desire to succeed. Every employee wants to be a personality, to belong to a team and to be loyal to the company, but also confident in its perspective. Features such as

plotting, labeling and division into clans must remain outside the modern teamwork. An honest cooperation strategy is an important factor in innovative entrepreneurial management [20].

In the paper, the authors will describe one of the more important and desirable strategies, known as "Who will be faster, who will be better", a strategy that belongs to the offensive types of strategies.

A. Strategy" Who will be faster, who will be better"

Every business, in order to survive and grow, must constantly innovate, which means taking risks and learning a strategy for innovative entrepreneurial management. "Who's going faster and better," is the slogan of an innovative strategy. It is based on a scientific basis, with clearly defined goals and defined tasks for each participant in the process, especially inventive - innovation activities. It involves the application of innovation and the constant encouragement of the new. New products, new properties, quality, new materials, new markets, new customers are desirable before competition can succeed. In addition, this strategy takes care of "dichotomous plus one" connections: lower costs, better quality, and contemporary design. It is a high-risk strategy in a very complex market mechanism. It is a process where several types of markets are intertwined in market relations: goods, services, capital, labor, technology, knowledge, information, entrepreneurship and management [21].

According to this strategy, the entrepreneur aims to reach a leading position or dominance in a new market and thus permanently secure his position. This is one of the most desirable but also the most risky strategies. However, if this strategy succeeds the reward is rich. This strategy presupposes a thorough reflection and careful analysis of all relevant factors and circumstances, extreme concentration and unwavering persistence and goal orientation, as well as the willingness and ability to provide all the necessary resources at the right time. After reaching a leading role in the market, all forces of the enterprise must be directed to maintain this role; otherwise it may happen to create a market for competitors.

Namely, the entrepreneur who succeeded with this strategy must not stop and become self-satisfied; he must continue to search for a newer type of own products or processes, which will replace the existing, no matter how much the existing product shows successful. So, after the introduction of a novelty, business should immediately be more concentrated on the introduction of better condition than the already existing one [22].

Experience shows that those who did not succeed with this strategy, did not prepare sufficiently for this type of strategy and simply disappeared. In the strategy "Who will be faster, who will be better", there are no half-successes - there is only success or failure [23].

In Tab. 1, it is presented for each major decision category, a standout practice that can yield outsize improvements in both decision quality and speed [24].

TABLE I. STANDOUT DECISION PRACTICE

Key practices by decission type	**Who makes it?**	**How to make it better?**
Big-bet decissions Interquent, high risk, futur shaping (eg.M&A)	Top team board;	Sour productive debate- eg, assign someone to argue tha case for and against a potential decission
Cross – cutting decissions Frequent, often high risk, collaborative (eg, operations planning, pricing)	Business-unit heads; senior managers	**Double-down on process**- one that helps clarify objectives, measures, and targets
Delegated decissions Frequent, low risk, day- to day (er, hiring, marketing)	Individuals; working teams	**Ensure commitment** – not just consensus

Managerial decisions are the most important elements in the success of "Who will be faster, who will be better" strategy. Decisions are made on the basis of proper, deep reflection and experience.

IV. Management Promotion Strategy

Nowadays, when human potential, especially intellectual, is increasingly important in business and business development, the promotion of entrepreneurial managers becomes a strategic issue [25, 26]. This regards on two approaches of promotion:

- analysis of knowledge and skills of staff and
- implementing a promotion program that is much more important than the first. This approach also resulted in the need for a staff promotion strategy, especially for entrepreneurs and managers.

When designing their promotion model, it is very important to answer the following questions: Can managers achieve best results, i.e. in which kind of sort organization? Which type of leadership style is needed? Several skills need to be combined to answer those questions.

- ability to organize and combine,
- initiative and
- flexibility.

Promotion is the final and initial stage in the promotion process, and it is closely linked to the allocation of staff to certain functions for which the candidate is qualified. It is necessary to adhere to the principle of every man in the right place at the right time [27]. Of course, the level of earnings of entrepreneurs and managers also depends on the success of the business and the socio-psychological climate that prevails in a given social environment, as well as the degree of socio-economic development of the country and the size of the enterprise [28].

Example: In US companies, the ratio between a manager's and a worker's salary is high, 100: 1, and in Japan, 17:1. In Europe, this ratio is slightly smaller, but the directors' additional earnings are much higher, so the ratio between the total earnings of the CEOs and the basic earnings is from 18:1 to 30:1 [29]. In Japan, there are three types of salaries: First, individual salary, which depends on years of service and acquired qualifications.

Second, complex salary, depending on the mode and quality of work performed in connection with serving and qualifications. And third, salaries to work, depending on the skills demonstrated in the performance of tasks, especially as a function of management. And, a fourth salary is introduced, which signifies the stimulation of original ideas and the attainment of greater qualification [30].

Specialist professional development in Japan is divided into three phases of the life cycle, within which develops career. Each cycle lasts for 10 years. The first ten years require postgraduate specialist work at home and abroad, so that between the ages of 25 and 30, there is a promotion from a lower to a higher hierarchical status.

The second decade was marked by matches in proving knowledge and skills in the form of the results achieved in practice, in terms of a kind of preparation for the new promotion and distribution, to the Deputy Director, and even the director. The third decade is a time of affirmation, steadying in a particular area, and further advancement, to top management positions.

For the successful implementation of this strategy, the evaluation of the manager's performance is also important, and the purpose of the evaluation is to find the most capable personnel to assume key functions in the company [31]. One of the most important criteria for the assessment of (potential) managers is their attitude towards associates. Particular attention should be paid on [32]:

- handling associates in the business;
- making employees aware of their rights and obligations;
- timely reporting to employees of planned changes;
- making optimal use of the knowledge and capabilities of employees;
- motivating workers to work, educate and stimulate them for better results;
- giving deserved honors and awards;
- striking a balance of common interests;
- enabling creative atmosphere and mutual trust.

The performance of a manager is judged on the basis of his/her intellectual and organizational skills, temperament and personality traits, and respect and application of ethical principles and moral behaviors, especially in interpersonal relationships [33].

Managers' performance should be evaluated by:

- his/her planning, decision making and control;
- organizing and coordinating;
- the effectiveness of the work and business of the units he/she manages;
- about how he or she interacts and
- how much attention is paid to self-education and/or self-improvement.
- besides mentioned, the mental abilities of managers, such as intelligence above all, (tests, in-depth interviews, etc.) are evaluated [34].

Conclusion

Starting from the fact that implementation of an entrepreneurial orientation is crucial for achieving competitive advantage, then it entails, first, raising awareness of the importance of innovation, and then an innovative way of thinking and doing business. In order to be sustained, the entrepreneurial spirit must become an integral part of the vision, mission, goals, strategies, structure, process and organizational culture.

Creating new ventures within an organization becomes a central challenge for management and requires strong, active and dedicated leadership. Innovations aim to advance: product, process flexibility, organization and management, and above all technology and technological process. When top management clearly promotes entrepreneurial strategic vision, employees will have more courage, landmark and moral justification to entrepreneurial behavior.

Based on all the above, we can conclude that the long-term success of any company, regardless of its size and age, cannot be expected without entrepreneurial management and a proactive approach to change, as well as an appropriate strategy aimed at anticipating the future.

References

1. Kostić, V. (2009). Entrepreneurial management of small business – problems in theoretical and practical field, on line: http://www.repec.mnje.com/mje/2009/v05-n09/mje_2009_v05-n09-a16.pdf)
2. Lukocs, V. (2005). *The economic role of SMEs in world economy, especially in Europe*. Institut of business sciences, University of Miskolc.
3. Brekić, J. (1995). *Innovation management, [Inovativni menadžment]*. "Alineja", Zagreb.
4. Brekić, J. (1983). *Personnel theory and practice, [Kadrovska teorija i praksa]*. Informator, Zagreb.
5. Drucker, P. (1946). *Concept of the Corporation*
6. Drucker, P. (1954). *The Practice of Management.*
7. Drucker, P. (1957). *America's Next Twenty Years.*
8. Drucker, P. (1970). *Technology, Management and Society.*
9. Brekić, J. (1991). *Strategic management, [Strateški management]*. Megatrend, London - Belgrade.
10. Mitić, B. (2012). *Marketing of non-profit organizations, [Marketing neptofitnih organizacija]*. Banja Luka.
11. Ćamilović, S. & Vujić, V. (2007). *Basics Human Resources Management.* Tekon, Belgrade.
12. Milisavljevic, M. (2003). *Marketing.* Contemporary administration. Belgrade.
13. De Cenzo D. A. & Robbins S. P. (2002). *Human Resource Management*, 7th edition, John Wiley & amp. Sons, Danvers.
14. Avlias, R. (2010). *Entrepreneurship*. Singidunum University, Belgrade.
15. Tidd, J., Besant, J. & Pavitt, K. (2001) *Management innovation, second edition*. John Walley & Sons, Chichester, England.
16. Stefanovic, V., Vojnovic. B. & Urosevic, S. (2012). *Human Management resources-contemporary strategies and controversies*. Institute for Agricultural Economics, Belgrade.
17. Fiedler, F. E. (1978). Contigency model and the leadership process. U. L. Barkowitz (Ed.), *Advances in experimental social psychology*, New York Academic Press.
18. Stefanovic, V. & Stojkovic, Z. (2011). Innovative enterprise - a condition for survival at market. *Megatrend Review, 8*(1), pp. 325-337.
19. Stefanović, V., Stojković, Z. (2013). Knowledge as the most important enterprise resource, [Znanje kao najvažniji resurs preduzeća]. *Megatrend review*, *10*(2). pp. 229-248.

20. Stefanović, V. (2006). Innovation as a component of a company's business policy , [Inovativnost kao komponenta poslovne politike preduzeća]. *Poslovna politika 11*, pp. 62–67.
21. Stefanović, V. (2006). Inovaciona politka u preduzeću kao faktor kreativnosti. *Poslovna politika* 9*:* pp. 34–40.
22. Stefanović, V. (2005). Technology transfer – Case of Serbia v.s. Serbia case,[Transfer tehnologije – slučaj Srbija v.s. Srbija slučaj]. *Transfer tehnologije za Evropsku Srbiju*, Belgrade: Faculty of Mechanical Engineering, p. 275.
23. Ilić, B. & Nikolić, M. (2019). Management innovation of products and services in strategic management. Economic and Social Development. In *37th International Scientific Conference on Economic and Social Development*, *BAKU*, pp. 179-189.
24. Three keys for faster, better decision. https://www.mckinsey.com/business-functions/organization/our-insights/three-keys-to-faster-better-decisions
25. Ilić, B., Stojanović, D. & Pavićević, N. (in press). Management of life and environment quality in modern technologies*. Journal for Sustainable Development (JSD)*, International journal published by the Integrated Business Faculty – Skopje
26. Radonjić, A. (2016). *The role of communication strategy in promoting renewable energy. [Uloga strategije komunikacije u promociji obnovljivih izvora energije]*. Faculty of management, Zaječar.
27. Mihajlović, D. & Plavšić, A. (2010). Entrepreneurial strategies as generating forces of changes in companies. In *Proceedings, VIII International scientific conference Forces Driving the Revival of the Companies and Economy*, pp. 421-429. Megatrend University, Belgrade.
28. Nikolic, M., Ilic, B. & Cogoljevic, M. (2019). The Situation And A Proposal For Development Of Small And Medium Enterprises In Serbia. In *Thematic Proceedings: Employment, Education And Entrepreneurship* 17-19. Belgrade, Serbia, pp. 295-302.
29. Stefanović, V. (2005). *Entrepreneurial Management, [Preduzetnički Menadžment]*. Faculty of Management, Zaječar.
30. Zakić, K. (2008). Japanese Management - A Synthesis of Domestic Heritage and Foreign Experiences, [Japanski menadžment – sinteza domaćeg nasleđa i stranih iskustava]. *Megatrend review*, *5*(2), pp. 91-109.
31. Jovanović, M., & Langović-Milićević, A. (2006). *The Intercultural Challenges of Globalization, [Interkulturni izazovi globalizacije]*. Megatrend University, Belgrade.
32. Stefanović, V., Mihajlović, D. & Ilić, B. (2017). Transformational leaders - the necessity of modern business, [Transformacioni lideri – neophodnost savremenog poslovanja]. *Megatrend Review, 14*(2), pp. 291-308.
33. Stojković, Z. & Stefanović, V. (2011). Inovative Enterprise condition of survival on the market. *Megatrend review*. pp. 316.
34. Ireland, R. D., Covin, J. G. & Kuratko, D. F. (2009). Conceptualizing corporate entrepreneurship strategy. *Entrepreneurship Theory & Practice*, *33*(1), pp. 19–46.

The Impact Factor of Education on the Public Sector and International Controlled Transactions

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Abstract— **To this thesis is analyzed the impact factor of education to the public sector and the international controlled transactions, through a procedure of theoretical and mathematical analysis, a quantification method, an econometric method and behavioral scrutiny by a real case scenario. This work is about the comparison of the cycle of money with the impact factor of education and without it. The analysis is based on the cycle of money and on the impact factor of education. Therefore, the appropriate education to the economy supports the market and in general the economy. Thence, the impact factor of education enforces the economic dynamic of any economy. The study of cases when there is the factor of education and when this factor is omitted allows the extraction of the appropriate conclusions. Moreover, for the purposes of this analysis is used for the Q.E. method through the R.B.Q. model.**

Keywords - the cycle of money, the velocity of liquidity, the velocity of savings, R.B.Q. model, Q.E. method

I. INTRODUCTION

This work aims to study the impact factor of education on the cycle of money through the view of international controlled transactions. The paper analyzes the case of the cycle of money with and without all the impact factors of the education. Then, to the one case is used the impact factor of the education and in the other case is avoided. Thus, using the Q.E. method extracted conclusions, about the importance of this impact factor in the economy. Moreover, this impact factor is about the administration of the public sector to the private sector and the returns of taxes to the market. Additionally should be mentioned that any other rewarding taxes are excluded from this study to estimate the utility of this factor. Therefore, this analysis has scrutinized the comparison between the cycle of money with and without the impact factor of education [1] (The analysis which followed is based on the R.B.Q. - Rational Behavioral and Quantified model). This means that initially, the paper starts with the theoretical concepts and the mathematical structure. In addition, we proceed to the behavioral approach using here real data from the Greek educational system for the period between 2009 and 2015. Finally, we are compiled virtual quantity data to confirm the compliance between the theoretical approaches with a real case study.

Therefore, is used a theoretical background, a mathematical structure, econometric scrutiny, a quantity procedure and a real case scenario for the importance of education on the GDP. Thus, there are three steps, the theoretical and mathematical background (rational step – step 1), the quantification analysis (quantity step – step 2) and the econometric scrutiny plus the real case scenario (behavioral step –step 3).

II. THE COST ALLOCATION LITERATURE REVIEW AND THE APPLIED METHODOLOGY

The contracts of companies and the agreements of companies with the authorities are very important for their profits and losses. The agreements should be notified of the changes in the contracts. This is crucial for the procedure as the changes that companies make plausibly could affect their relationship with the government authorities. This is the reason why the tax authorities should make periodic inspections. The periodic specification of contracts is critical for the comparability analysis. This analysis is about the comparison of the indexed aims that the government puts with the real data which provides the enterprises. The periodic inspections of the companies which participate in controlled transactions are taken seriously from the arm's length principle procedure. Then, the determination of the cost-sharing depends on the

periodic check of companies which are tested parties.[1] The aim of the companies of controlled transactions is to face the themes that are connected with the taxation of their activities [2]. Hence, the requirements for the enterprises of controlled transactions with the tax authorities should be in the range of the arm's length principle. The comparability analysis serves this scope, meaning that through this scrutiny the enterprises determine if they comply with the requirements of the public and tax authorities [3]. Inasmuch as, the appropriate agreement of the companies of controlled transactions is that which permits them the maximization of their profits in tax environments with the low tax rate, and the maximization of costs in economic environments with the high tax rate. Thence, the allocation of taxable profits and losses clarify the maximization of the utility of the companies, which participate in controlled transactions.

Additionally, should be mentioned that the enterprises of controlled transactions and at the same time the inspections of tax authorities are done under the condition of the proportional adjustments[2] [4]. The proportional adjustments are a term that shows that the companies should adjust their data under conditions of lack of information [5]. The interpretation of the condition of the proportional adjustments is that which followed by the companies of controlled transactions many times when they don't have the appropriate data to make comparisons with the uncontrolled transactions of similar circumstances to perceive their condition and therefore to adjust their data with proportional way [6]. Thereupon, companies which are tested parties obtain 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 production of goods creates profits and costs to the enterprises (the following information comes from the paper [7, 8]). The same thing happens and for the services, where the profits and losses come from the services which offer to the companies of controlled transactions. Stand on the prior analysis we have that:

$$u = s(zf + \tilde{z}d), \tag{1}$$

$$z = \left|\tilde{z} - 1\right| . \tag{2}$$

The symbol u is about the impact factor of the comparability analysis which has any method to the s [9]. 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 eq. from (1) to (2) is plausible to determine the following eq.:

$$u_c = zf + \tilde{z}d , \tag{3}$$

and

$$b = (p - u_c) * f_1 . \tag{4}$$

The symbol of b in the prior eq. 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, the eq. 4 shows the case of the arm's length principle. In addition the case of fixed length principle we have the next equation:

$$v = p * j_2 . \tag{5}$$

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 fixed length principle. Thereupon, we conclude according to the prior theory that:

$$v \geq b . \tag{6}$$

[1] As tested parties considered the companies which participate in control transactions.

[2] Sections II and III are almost the same with those of paper [4] as used the same base for their analysis.

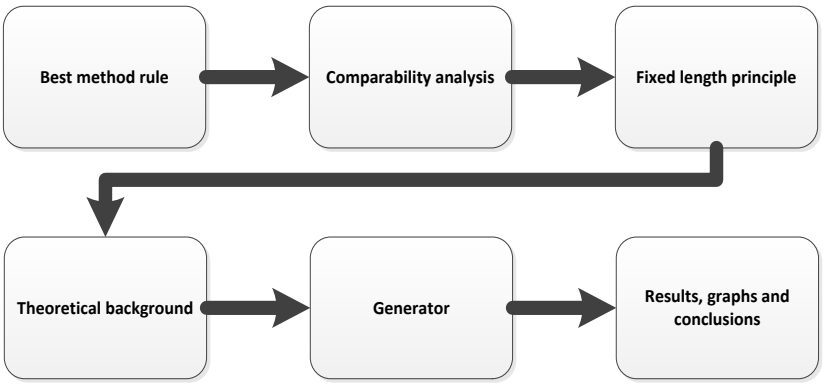

Figure 1. Cost sharing and application of fixed length principle

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 are able to tackle issues that come from the allocation of the profits and losses. Thence, the tax authorities are able to face the transfer pricing effects to the global tax revenue. The fixed length principle permits to recover the tax losses of the global tax revenue from the controlled transactions of the transfer pricing. The next scheme is illustrated the procedure that companies of controlled transactions follow for their allocations of profits and losses, the proportional adjustments of data, and the fixed length principle. In Fig. 1 is determined the procedure of the fixed length principle and its quantity analysis for the determination of the behavior of the model. The next section is presented the theory of the cycle of money. Moreover, the methodology which followed stands on the Q.E. method. The Q.E. method is affiliated with the theory of axiomatics [10].

The hypothesis of economic theory is the basis for the further study of each economic model that is under examination. Videlicet, the axiomatics are trying to answer to the background of economic analysis and to confirm that the initial hypothesis of the model is fine. If the hypothesis is satisfied then the model is consistent with the principles of the model that is under examination. Thence, we have two facets of the axiomatics:

- If the results comply with the hypothesis, then the model is satisfied. In that case, the study stops as the model doesn't need any further examination.
- In the second case, if axiomatics is not satisfied, it should be made further analysis, until to have the adequate model.

Videlicet, we conclude that the economic model is not sufficient. Thence, the main concept of axiomatics stands in compliance with the initial hypothesis with the final results of the study. Forasmuch as is plausible with that way to clarify and modify the theory of the chosen model.

The method of the Q.E. theory stands on a methodology based on the determination of mathematic equations subject to conditions which also be considered. One more important thing is the determination of the upper and the lower limit of the values of the independent variables. The dependent variable represents the behavior of the selected model. Therefore are used two facets to the application of the Q.E. method, which are:

- The analysis of the behavior of the model which stands on the scrutiny of the structural characteristics of each model accordingly allowing with that way the extraction of general conclusions about the model which is under examination. There is plausible the analysis of data into a two and three-dimensional analysis pending on the case.
- The frequency analysis behavior scrutinizes the behavior of the dependent variables, but from the view of the number of appearances of a variable than another, estimating basically the impact that one

independent variable has with one or more other independent variables [11].

Hence, the Q.E. methodology follows as index four basic steps. These steps are described below:

- Initially, to the first step, we have the hypothesis. The hypothesis determines the aims and the scope of each study. Moreover, the hypothesis is the key element of the reliability of a model.
- Forward, to the second step we have the generator. The generator belongs to the hardcore of the Q.E. methodology. This means that the generator is the source of the Q.E. method, as at this stage produced random numbers which used according to fuzzy logic to determine the form of the model. Based on the results of this second step we proceed to the next step [12].
- The third step is about the conclusions. The conclusions are the final stage of the analysis, except in the case that the scientist obtains that needed further modifications. To serve the readjustments to model is needed the next step, of the feedback.
- The fourth step is the case of the feedback and is about the iterations and the appropriate adjustments of the model [7].

Through these four steps, the Q.E. method applied to the examination study, of the research.

III. The Cycle of Money and the Ideal Case of the Cycle of Money

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:

$$\alpha = \alpha_s + \alpha_t, \eta', \frac{1}{v} + \alpha_t , \quad (7)$$

$$x_m = m - a , \quad (8)$$

$$m = \mu + \alpha_p , \quad (9)$$

$$\mu = \sum_{t=0}^{n} \mu_t , \quad (10)$$

$$\alpha_p = \sum_{j=0}^{m} \alpha_{pj} , \quad (11)$$

$$c_m = \frac{dx_m}{da} , \quad (12)$$

$$c_\alpha = \frac{dx_m}{dm} , \quad (13)$$

$$c_y = c_m - c_\alpha . \quad (14)$$

The variable of α has symbolized the case of the escaped savings. This means that we have savings that are not returned back 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 from any other commercial activity. For instance α_t could refer to the commercial activities which come from the uncontrolled transactions. The variable of m symbolizes the financial liquidity in an economy [13]. 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 from small and medium-sized enterprises. The variable of x_m symbolizes the condition of financial liquidity in an economy [14]. The variable 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.

Then, we have the following basic principles about the cycle of money (Those issues are extensively analyzed in [4]). Therefore, we have that:

- 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 of 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 a lack of financial liquidity in an economy.
- The substitution of controlled transactions is not substituted by the citizens and from the small and middle-size companies when there is not plausible to offer the same added value to the products and to the services. This case happens especially in the instance of factories, in the research centers, etc. There from, 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 the 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 the well-structured tax system, and in general the dynamic of the economy. It 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.

Therefrom, we obtain that the cycle of money grows when there is a tax system like the case of fixed length principle which permits the low taxation of the uncontrolled transactions and the higher taxation of controlled transactions. It should be mentioned that as uncontrolled transactions are considered the same happens and with the cases of the financial liquidity of citizens and of the small and middle-size companies.

Moreover, there are three basic impact factors for rewarding taxes. The rewarding taxes are the only taxes that have an immediate and important role in the market of any economy. These factors are affiliated with the education, with the health system of each society, and with the rest relevant structural economic factors of the prior two impact factors. This issue is illustrated in the scheme in Fig. 2.

In Fig. 2, we have the case that in the tax system are included all the tax factors and with all the rewarding tax factors. In this study used only one impact factor as seems to the Fig. 3.

We obtain from the previous scheme that we have the case of only one impact factor, which is about education. Therefore, it is able to proceed to a mathematical and quantitative analysis of the cycle of money in the case of rewarding taxes.

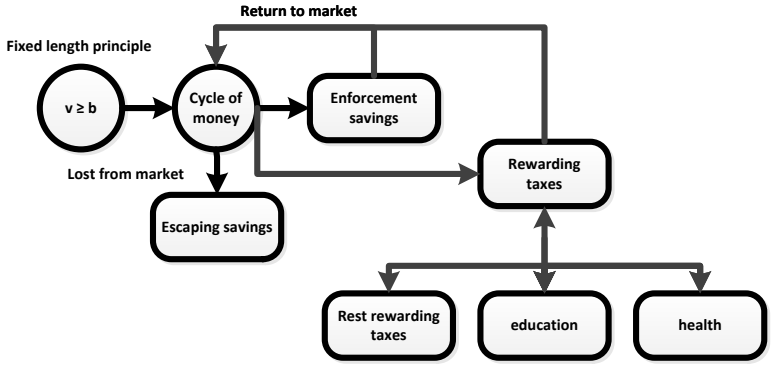

Figure 2. The cycle of money with rewarding taxes

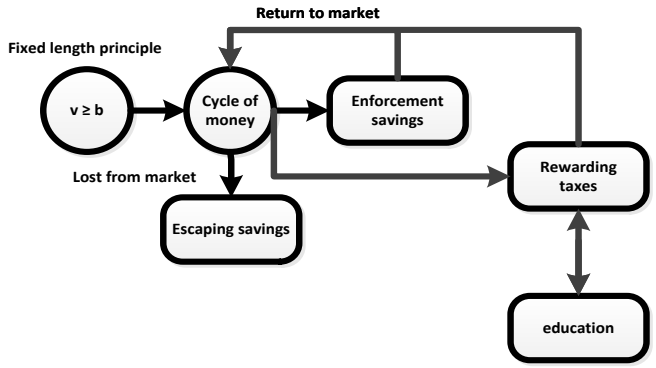

Figure 3. The cycle of money only with the impact factor of education

IV. Definition and Mathematical Approach of the Cycle of Money with and without the Impact Factor of the Education

For the purposes of the mathematical approach of the cycle of money we use the prior equations subject to the next conditions which are about rewarding taxes:

$$\alpha_p = \alpha_r + \alpha_n * h_n + \alpha_m * h\,, \qquad (15)$$

and

$$\alpha_r \geq \alpha_n * h_n \geq \alpha_m * h\,. \qquad (16)$$

In the prior two equations used some impact factors, which are the a_p which also demonstrated in the eq. (11), moreover the variables α_r, α_n, h_n, α_m and the h_m. The variable α_r symbolizes the impact factor for the rest of rewarding taxes. The symbol of α_n is the impact factor of education and any technical knowledge. The symbol of α_m is about the impact factor of health anything relevant and supportive of this issue. The symbol of h_n, and of the h_m, are the coefficients of the education and the health impact factor accordingly. Therefore, we use the eq. from (7) to (16) and the next table for the coefficients of the values of the cycle of money with and without some impact factors of the rewarding taxes.

TABLE I. Compiling Coefficients (see Appendix II)

Factors	Values	Values'
α_s	0.6	0.6
α_t	0.7	0.7
μ	0.9	0.9
α_r	-	-
$\alpha_n * h_n$	0.3	-
$\alpha_m * h_m$	-	-

The generator of this procedure used the coefficients which appeared on the previous table. Therefrom, the factors have an upper limit of 1, and a lower limit 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 diagram (Fig. 4).

According to the prior figure, we obtain that the impact factor of education has an impact on the cycle of money (blue line). An economy with the absence of the appropriate education services has a declined cycle of money (red line), showing that the distribution of money is lower than in the case that there exist the appropriate educational services for the citizens. Inasmuch as this economy would have lower consumption and lower investments.

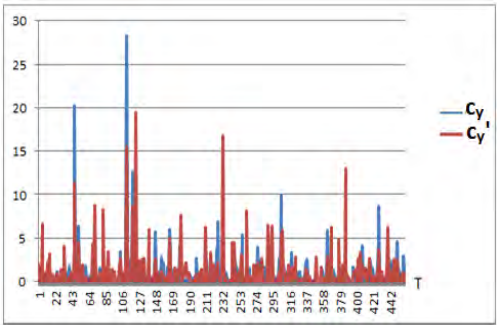

Figure 4. Comparison of the cycle of money with and without the impact factor of education.

V. The Case of Greece for the Period of 2009-2015

First, we study the relevant factors of education. This means that at this stage we determine the important factors of the model, standing on the theory. Therefore, we have (see Tab. 2):

TABLE II. Estimated Variables

Year	GDP/capita	Imports/capita	Exports/capita	Education /capita
2009	30.365	6.503	2.203	5.224
2010	28.128	6.041	2.508	5.097
2011	26.141	6.063	3.034	5.176
2012	25.284	5.682	2.286	5.248
2013	26.098	5.559	3.297	4.859
2014	26.839	5.653	3.250	4.879
2015	26.902	4.297	2.572	5.072
p-value	0.0489***	0.7642	0.5713	dependent variable
p-value'	-	0.0164***	0.2774	dependent variable
p-value''	-	-	$9.31*10^{-6}$***	dependent variable

From the prior table, we receive that the GDP/capita is rejected the null hypothesis, therefore it is statistically significant. We obtain that and the other variables are significant. The model is the following one:

$$Education = f(GDP, imports, Exports), \quad (17)$$

$$Education = \beta_0 + \beta_1 GDP + \beta_2 imports + \beta_3 Exports + \varepsilon \quad (18)$$

Thus, we proceed to the clarification of the real case scenario according to the theory, with the most significant variable of the education, meaning the GDP as there is a direct connection between these two factors, according to the theory, the mathematical structure, the quantification approach, and the econometric data.

Based on the prior analysis, we proceed to a paradigm about the case of Greece using data from the OECD [15]. We proceed to a comparison between two different periods. We use basically two elements because these are the explaining factors. The trend between them is proven through the work of OECD [16]. Then, for the explaining variables of Greece we have that:

1. Education spending = 5.224 US dollars/capita, for 2009 (initially)
2. Education spending = 5.072 US dollars/capita for 2015 (finally)

3. GDP = 30.365 US dollars/capita for 2009 (initially)
4. GDP = 26.098 US dollars/capita for 2015(finally)

According to OECD even in the recent economic downturn, the tertiary graduates generated a positive impact on GDP of more than half a percentage point per year, for the period of 2008 - 2010. The education and the GDP are directly connected. Therefore, we have from eq. (7) to (16), that:

$$c_m = \frac{dx_m}{da} \cong GDP\,, \tag{19}$$

includes at least four factors, like exports, investments, imports, consumption etc.),

$$da = a\,, \tag{20}$$

$$dx_m = x_m\,, \tag{21}$$

$$c_a = \frac{dx_m}{dm}\,, \tag{22}$$

$$c_y = c_m\,. \tag{23}$$

Then,

$$c_y = f(\alpha_n * h_n)\ or\ c_y = f(Education)\,. \tag{24}$$

From the prior data, and equations, we have the next table (Tab. III).

TABLE III. APPLICATION OF REAL EXPLAINING VALUES TO THE EXTRACTED MODEL

Factors	Values (dollars/capita, 2009)	Values' (dollars/capita, for 2015)
c_m, c_y	30.365	26.098
$\alpha_n * h_n$	5.224	5.072 (it is 0.3 in the Q.E. approach of Tab. 1)

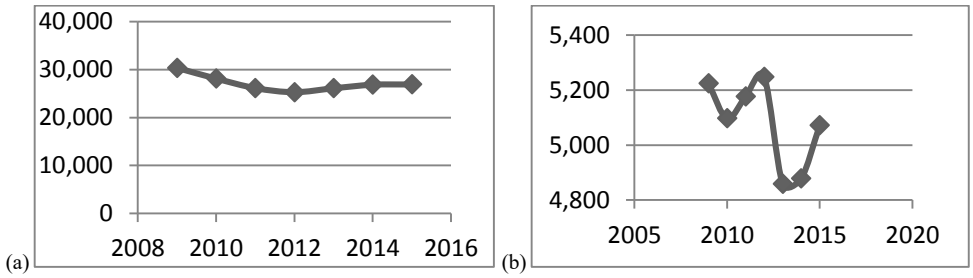

Figure 5. (a) GDP/capita diagram of Greece [15], (b) Education/capita spending diagram of Greece [17]

According to Tab. 3, we have the following graphs (Fig. 5). We perceive that the real case scenario complies with the quantification method. The graph of education expenditures follows the GDP, as we expected from the results of the quantified model. We see from Fig. 4 and Fig. 5 that the education system supports the cycle of money of Greece, as the general quality-quantified method adjusts to the real data under the constraints presented in the previous section.

VI. CONCLUSIONS

This paper showed the relation of the dynamic of the economy using the cycle of money with the public sector and the international controlled transactions. We obtain using R.B.Q. model, as we expected, that an economy with the absence of the education has a lower economic dynamic, in contradiction with an economy without this problem. The taxes of this economy do not return to the market. Thence, the consumption and the investments of this economy would be lower. Then, an economy without taxes will be in a lower dynamic than an economy that has the appropriate education system. This means that as the most taxes have a bad effect on the economy, on the other hand, the education taxes have a positive effect on the economy, as they return back to the economy, for consumption and

investments. This is the difference in general between the three rewarding taxes (rest-structural taxes, education taxes, and health taxes), and the taxes. In this analysis showed that the education taxes help the economy. Therefore, we perceive that the economies which estimate education receive more utility than to the case that there does not be a proper education system. Videlicet, education advances the dynamic of the economy according to the theory of the cycle of money.

REFERENCES

1. Challoumis, C. (2019). The arm's length principle and the fixed length principle economic analysis. *World Scientific News, 115-118*, pp. 1–12.
2. Zax, J. S. (1988). Fringe benefits, income tax exemptions, and implicit subsidies. *Journal of Public Economics,* pp. 171-183.
3. Boland, Lawrence A. (1991). *The Methodology of Economic Model Building*. London and New York: Routledge.
4. Challoumis, C. (2018). The Theory of Cycle of Money. Available at SSRN: https://ssrn.com/abstract=3149156 or http://dx.doi.org/10.2139/ssrn.3149156
5. King, M. A., & Fullerton, D. (1984). *The Taxation of Income from Capital.* University of Chicago Press, Chicago. https://doi.org/10.7208/chicago/9780226436319.001.0001
6. Wilson, J. D. (1986). A theory of interregional tax competition. *Journal of Urban Economics, 19*(3), pp. 296–315, https://doi.org/10.1016/0094-1190(86)90045-8
7. Challoumis, C. (2018). Arm's Length Principle and Fix Length Principle Mathematical Approach. Available at SSRN: https://ssrn.com/abstract=3148276 or http://dx.doi.org/10.2139/ssrn.3148276
8. Challoumis, C. (2018). Impact factor of education. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3155238
9. Challoumis, C. (2018). Analysis of Tangibles and Intangibles Transactions Subject to the Fixed Length Principle. Available at SSRN: https://ssrn.com/abstract=3142960
10. Challoumis C. (2018). The Role of Risk to International Controlled Transactions. *Annals of Dunarea de Jos, University of Galati Fascicle I. Economics and Applied Informatics, 3*, pp. 2–5
11. Challoumis, C. (2018). Analysis of Axiomatic Methods in Economics. Available at SSRN: https://ssrn.com/abstract=3168087 or http://dx.doi.org/10.2139/ssrn.3168087
12. Challoumis, C. (2015). Fuzzy Logic Concepts in Economics. Available at SSRN 3185732.
13. OECD (2017). Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations. OECD Publishing, Paris.
14. Feinschreiber, R. (2004). *Transfer pricing methods: an applications guide*. John Wiley & Sons.
15. OECD, www.oecd.org
16. OECD (2012), Education at a Glance 2012: Highlights, OECD Publishing. http://dx.doi.org/10.1787/eag_highlights-2012-en
17. Foundation for Economic and Industrial Research. (2019). Education in Greece: Crisis and Development of Public and Private Expenditures, FEIR, p.83, http://iobe.gr/docs/research/RES_05_F_14032019_REP.pdf

APPENDIX 1

Following the R.B.Q. model, we have that:

Step I: Determination of the theoretical background and of the mathematical structure.
Step II: Application of the Q.E. method, meaning the quantification procedure.
Step III: Econometric analysis and behavioral study of a real case scenario.

APPENDIX 2

Code of the Q.E. method, about the quantification of the model:

```
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
   ap1=0.4*rand();
end
if rand()<9
   ap2=0.3*rand();
end
if rand()<9
   ap3=0.2*rand();
end
a=as+at;
apk1=ap1+ap2+ap3;
apk2=ap2+ap3;
apk3=ap1+ap3;
apk4=ap1;
apk5=ap2;
apk6=ap3;
apk7=ap1+ap2;

mk1=m1+apk1;
xmk1=mk1-a;
cmk1=xmk1/a;
cak1=xmk1/mk1;
cyk1=cmk1-cak1;

mk2=m1+apk2;
xmk2=mk2-a;
cmk2=xmk2/a;
cak2=xmk2/mk2;
cyk2=cmk2-cak2;

mk3=m1+apk3;
```

```
xmk3=mk3-a;
cmk3=xmk3/a;
cak3=xmk3/mk3;
cyk3=cmk3-cak3;

mk4=m1+apk4;
xmk4=mk4-a;
cmk4=xmk4/a;
cak4=xmk4/mk4;
cyk4=cmk4-cak4;

mk5=m1+apk5;
xmk5=mk5-a;
cmk5=xmk5/a;
cak5=xmk5/mk5;
cyk5=cmk5-cak1;

mk6=m1+apk6;
xmk6=mk6-a;
cmk6=xmk6/a;
cak6=xmk6/mk6;
cyk6=cmk6-cak6;

mk7=m1+apk7;
xmk7=mk7-a;
cmk7=xmk7/a;
cak7=xmk7/mk7;
cyk7=cmk7-cak7;
%;tab for the first compile is not used
tab=[apk1,apk2,apk3,apk4,apk5,apk6,apk7,xm
k1,xmk2,xmk3,xmk4,xmk5,xmk6,xmk7,cmk1,
cmk2,cmk3,cmk4,cmk5,cmk6,cmk7,cak1,cak2,
cak3,cak4,cak5,cak6,cak7,cyk1,cyk2,cyk3,cyk4
,cyk5,cyk6,cyk7;tab];
end
```

Employer Branding as an HR Tool for Talent Management – Case study Serbian Y generation

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Abstract—**Employer branding is a relatively new but necessary tool for HR managers, especially today when Y generations steps on the job market. The Y generation is goal-oriented, tech-savvy, engaged and demands a lot of flexibility. The shift in the traditional forms of recruitment and retention fast becoming the lifeline of companies around the world. Through the exploration of the Y generation, we analyze how employers need to innovate their company in order to attract but also retain talent.**

Keywords – employer brand, Y generation, HR management

I. INTRODUCTION

Today, in the era of Globalization and 4th Industrial Revolution staying on top of the "food chain" is a struggle. Companies are in constant pursuit of new and talented employees on a market where talent is in a short supply. It is not enough to focus on bringing the new talent into the company, with a new generation of workforce, HR managers face the challenge of retaining talented employees.

The Y generation or Millennials differ from what was considered a standard until recently. This is not surprising if we take into consideration that this generation is the first one connected to the Internet. They are the first generation to grow up with all the perks of the globally connected society; it shaped them, making them fit to navigate in the fast-paced changes of today.

In a time when society is turned to innovation and progress, companies must follow or fall behind. A talented workforce is a crux of today's company assets, and this is the place where employer branding comes in. HR's are hard-pressed to develop and promote not only the company as a brand but also to place the company as a desirable employer brand on the talent market.

This paper explores how employer branding can aid HR managers as a tool to attract and retain talent. To understand this tool, there is a need to understand the concept of employer branding and Y generation.

II. EMPLOYER BRANDING AND Y GENERATION

A. Employer branding

Employer branding is a relatively novel concept, introduced by Ambler and Barrow (1996) as a "package of functional, economic and psychological benefits provided through employment which is associated with the hiring organization." [1]. Employer branding derivates from the marketing strategy of branding and merges with recruitment [1], the aim is positioning the company in the perception of employees and potential employees as a sought-out place to work. By creating a company image and the message in accordance with the target audience is one of the crucial steps in employer branding [1]. But employer branding is so much more than that, it is a long-term strategy [2] which encompasses company goals, mission and vision [3], and company work environment [4]. The influence of employer branding is best shown in the graph, made by [5] (Fig. 1).

It is an all-encompassing, two-way, strategy turned:

•Externally, towards the public image
•Internally, towards already existing employees.

Since the introduction of employer branding as a concept and strategy, researches delved into

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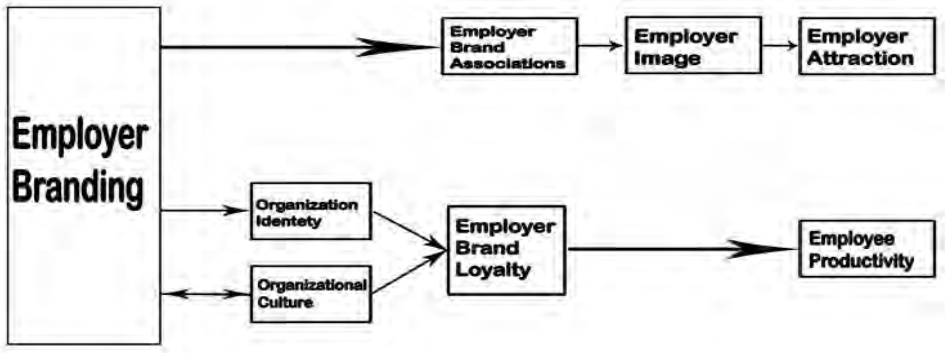

Figure 1. Employer branding framework [5].

this topic, and yet, the field is still considered insufficiently explored.

Researchers approached the subject of employer branding from various aspects Most of the research in this field are recognized as a tool for attracting the target group, both from the viewpoint of potential employees pursuing the company as a desirable workplace, and from the perspective of competitiveness while actively head-hunting for new talents. A few studies have focused on employer brand as a tactic to gain a competitive edge. Some researchers emphasize the dangers between the disparity in what is promised and the reality, or rather, the subjective viewpoint of employees how those promises are fulfilled. But, in recent years, the more focus was placed on the research of employer branding as a tool in the retention of already acquired talent. In that regard, importance is placed on the aspect of gaining employee loyalty through a set of benefits that correspond to talent's need and goals.

With increased progress and fast development of the Internet, researchers also focus on the importance and the role of the Internet in employer branding. The presence of a company on the Internet today is imperative. But with the influx of the new generations of the workforce, the Internet is not only the place to present a company, but it is also the place where new talents seek for a workplace and where they can reach out. Company profile on the Internet, but also a "word-of-mouth" reputation on the Internet can have a huge impact on employer branding. Companies present themselves through career websites, but career websites work for both sides. In Serbia, one of the largest career websites Infostud offers to all who seek employment advice how to look for work, often the emphasis is on guidance to "check out the company" [6, 7] before applying for the job.

To understand further how HR managers can use employer branding as a tool to attract and retain fresh and new talents on the market, a deep understanding of the new generation of potential employees is needed.

B. The Y generation

The Y generation or Millennials are a new generation of workforce. There is no clear definition, but the consensus is that Y generation is born between early 1980 and early 2000. A generation that was born when the Internet started to gain popularity (those from the 1980s), or when the entire world went online (those born in early 2000). The span of 20 years in this cohort initiate thinking that behavior of this generation should not be generalized and there are differences among segments of Millennials. [10].

Millennials differ from the other two generations (Baby Boomers and X generation) with whom they share workforce and talent pool. Regardless of the values that transfer from each generation to the next one, Millennials had an advantage. The advantage that their parents lacked, even with the expansion of more traditional media. Growing up connected, not only among themselves - locally but also connected to their age group through the entire world. They grew up partially shaped by the interactive culture on the Internet where sharing and asking questions is a regular occurrence. Ever-changing and growing creativity of the Internet culture [8] is not a challenge but a playground. But to understand the wider context

Figure 2. The context in which lived Baby Boomers, X and Y generations [10].

is necessary, we present context by comparing Millennials with Baby Boomers and Generation X [9] in Fig. 2.

Millennials gravitate toward: shared learning, collaboration, multitasking, relevance, engagement. They have creative and "do it yourself" way of thinking which leads to innovation. Millennials are highly interactive. In a work environment, they thrive when they are mentored, presented with a challenge Millennials are ready to step out of their comfort zone. However, Millennials as employees tend to accumulate the criticism from other generations. While Baby boomers are considered as diligent workers, and Generation X has the reputation of good team players, Millennials are perceived as professionally cruel and somewhat lazy [10], in addition to that there is a general perception that Millennials gravitate towards short-term employment [11]. The wrong perceptions come from misunderstanding because of a generation gap.

When considering Millennials, we must understand their need to customize everything. One of the things is to understand and accept their style of clothing which is more comfortable than anything else [12]. Expectations, staying in a traditionally structured job or staying overtime out of pure loyalty, are unreal. They need flexible working hours. They can turn every place that has Internet signal into a workplace. As a generation in constant communication, they will surround themselves with "screens"- laptop, tablet, mobile phone [13]. On the meetings Millennials can actively participate - listen and even ask questions, all while looking at the mobile phone, multitasking is something they are adept at [10].

Millennials highly value their free time. The Y generation is social online and offline, and yet they are individualistic. One of their key features is open-mindedness, which goes hand in hand with the tendency to support diversity. This generation has a strong need to travel, to experience new things. Millennials have highly developed an appreciation for money, but they are more inclined to spend it on travel than on status symbols. The Y generation "wants all, and now": to be good parents, to keep learning and self-improving, to travel and gain new experiences, a good marriage, successful carrier and to be socially active and engaged [14]. In the process of decision making, they rely on recommendations from friends more than on expert opinion [10].

Constant change is a necessity, they don't avert from it even if the change scares them. As task-oriented and fast thinkers, Millennials are natural problem-solvers, their creative innovativeness place them as desirable employees. Underlining everything already said is one of most defining traits of the Y generation, the never-ending need to learn and self-improve.

III. A New Challenge for HR Managers

In 2020 Millennials will make up for more than half working-age population in the world, in Serbia by 2021 up to 48% of the working-age population [14]. In 2016, every third employee belonged to the Y generation. With their tech-

savvy and innovativeness, Millennials are the new drive force on the job market, they are the injection needed among now sparse and highly sought talent.

HR Managers are facing a challenging task of finding, recruiting, and retaining talent.

First, we will tackle the positioning of the company as an attractive place to work. Maintaining the company's image as an employer brand in the eyes of potential employees demands a good knowledge and understanding of the targeted segment. Tools are necessary to track, and measure how is good from the perspective of talent [15, 16]. The set of values used to determine an employer's attractiveness uses five dimensions: interest value, social value, economic value, development value and application value [17].

One of the aspects of company attractiveness is active participation and promotion of company social responsibility. Millennials, as highly engaged and socially aware generation measure companies based on their engagement. According to the study in the US, climate/environment on a global scale is the top concerns [18, 19]. Even if this aspect holds only a small portion of a company's attractiveness it still helps, on an emotional level it builds the company's image as engaged and responsible.

Company's presence on the Internet and especially social media for Millennials is a starting point when they seek employment. An active presence on the Internet helps companies in the recruitment process through the communication of an employee's benefits. The Y generation judge employers attractiveness based on seven parameters: website design, employer value proposition, how directly these employer value propositions are communicated, everyday experience of employer value proposition, Social Media rating, employer value proposition on Social Media and recruitment communication [20]. Through employer value proposition employers communicate imagination, personality, and emotions. More than one study shows that Company website with active carrier website or page where employees share images and stories presents an effective means to attract talent [17, 19, 21]. High level of Social Media engagement and active, dynamic presence corresponds to active and communicative nature of Millennials. How employer communicates on a website and Social Media also serves as a presentation of employer's creativity, which appeals to the creative and innovative nature of Millennials.

However, attraction and active communication is only a part of the process. What employer communicates determines the level of success. Appealing to generational traits demands balancing between those traits and company values and culture. Common traits of the generation as an employee detected by researchers, both academic and marketing, agree on some common denominators. These denominators might vary depending on the country's economic power, but not by much. In Serbia, several studies are done on the same subject and presented results correspond to the local environment.

When considering employment Millennials expect from the employer following: possibility to advance, secure job, the possibility to learn and develop new skills, pleasant working environment, a good balance between work and private life [22]. In addition to these key expectations flexible working hours, the possibility for remote working and modern, innovative, and interesting work surroundings holds an important level of attractiveness [13]. While on the job interview Millennials will ask questions that correspond to this set of values and expectation, more so if employer promotes them. It is understood that all communicated must be delivered.

After the talent is successfully recruited, talent retention is a priority.

A. Talent retention

It is already established that "organizations, where employees feel valued, recognized, respected and supported, can have a higher percentage of retention" [10]. Contrary to popular belief, Millennials seek a secure job and want to stay in the same company for longer periods of time [11, 22, 23]. This creates an opening for HR Managers and employers. In order to successfully retain Millennials, HR and company must work on constant self-improvement of their communication and leading skills. Millennials do not react positively to orders without explanation, blind obedience without context is not in their nature. Millennials want to advance, but holding a title has no value to them they take initiative and the lead, naturally. They ask questions and expect meaningful and to-the-point answers. Feedback

is something they seek, either in the form of praise or critique. The shift from the more traditional leading and working style is the key.

As previously mentioned, companies have multigenerational employees. In most companies, more than a few employees on managerial position fall into the group of older generations (Baby boomers or Generation X). To avoid any misunderstanding that might create an unpleasant working environment, and risk losing talent, it is necessary to create an environment with clear and constant communication. Paying attention to their ideas, giving them space to contribute to the company, asking for their opinion and guiding them through mentoring (and reverse mentoring where there is an option) along with constant feedback creates a basis for the retention.

In the work setting, presenting the task in a form of challenge and giving them space and freedom to complete the task, appeal to Millennials. The employer should base a managing style on mentoring, providing the employee with a sense of value and care. The constant need to learn new skills to improve presents an opportunity for retention of talent, if done correctly. The concept of lifelong learning is tightly connected to this generation, employers without training management system risk to lose acquired talent. Sites like Coursera offer learning at a distance and at the time most suitable for the student, similar to that employers can create a network that offers additional learning materials and courses in a digital setting. For Y generation even learning must be at their own rules, this opens possibilities for employers [24]:

a) Learning over mobile phone (MLearning & Nanolearning): this style of learning offers to the employees to set their own goal, plan it and implement it.

b) Learning through games (Gamification): games designed to engage and motivate talented employees mix of pleasure, a sense of leisure time that is educational. This strategy is best for in-company training.

c) Video as a learning material: video materials on the blog or website can keep Millennial's attention for longer periods. As an educational tool video has great potential for the company, most eLearning today has a section with video lectures.

d) Storytelling: as a technique offers a development of expressiveness but also engages the reader. This tool is also useful for in-company training.

e) E-coaching: by asking carefully tailored questions, the coach provokes thinking and reflection of experiences, thus developing potential options and creativity. Coaching could be done over the phone or through the Internet, it offers fast feedback but also in-time support and encouragement.

Millennials are not only passive gatherers of knowledge, as a generation used to sharing they can contribute to the employer by sharing their knowledge with the older colleagues, and in that way contributing to the overall performance in the company.

Last but not least, regardless of the tendency of Millennials towards alternative and flexible work models, the employer must have clearly defined work positions with a structured set of measures for employee performance and defined advancement plan based on employee performance. Feedback in the form of formal and informal recognition is a must.

The company that follows this path creates invested and engaged employees, willing to stay for longer periods in the same company. More so, highly engaged employees are also unofficial company ambassadors that can help the company in attracting new talent through the recommendation [25].

By 2020 in Serbia 9% working population will be Zed generation, 48% Y generation and 40% X population. Joining to working scene Zed generation will initiate human resource management to pay attention on their behavior, motives and values more intensively and proactively [26].

IV. CASE OF MILLENIALS IN SERBIA

The research conducted in 2018. In Serbia on the sample of 1000 Millenials. shows that majority of Millenials who left their employer done so because of:

a) Better job in another company (66%)
b) Low income (62)
c) Poor interpersonal relationships (29%)
d) Lack of possibilities for further learning (23%)
e) Bad work-private life balance (22%)
f) Unstable job (22%)
g) Boring job (19%)
h) No advancement possibilities (18%)
i) Poor management and unclear vision of the company (13%)
j) To many responsibilities (5%)

Better job and low income are the most common reason for leaving the employer. Following previous researches done in Serbia. Medium to a low rate of employer leaving because of a lack further education and improvement, poor of work/life balance, job instability or job being boring is positive but still signals that in Serbia companies need to work more on retention plan for their talent.

As a opposite when asked what attracts them to the employer, Serbian Millennials are most motivated by high income (60%), good interpersonal relationships (43%), less likely to advance (33%) and personal development opportunities (32%).

In the perception of Serbian Millennials, the most south-out skill from future employees are work commitment (69%), work efficiency (52%), computer literacy (46%), problem solving skills (44%), and teamwork (40%). These requirements do not scare them, 94% thinks that they are dedicated to work, 93% believes that they are efficient at work and 90% is ready for teamwork. Where Serbian Millennials lack is an academic knowledge of the profession (68%).

V. Conclusion

In today's economy attraction and retention both talented and experienced, skilled, and creative employees have become a top priority. There is clear evidence to suggest that what employees look for in their work is a mixture of both tangible and intangible elements that create a stimulating environment where their contribution is recognized and appropriately rewarded, where they have the chance to develop and participate, and where the leadership of the organization supports their efforts.

Managers are nowadays faced with the need to understand motives, expectations, and requirements of their employees, measure and predict their behavior, and are familiar with the factors which influence the level of engagement of employees at work.

Employer branding is important and integral part of every HR and every company that wants to get a competitive edge on the job market. Attraction of talent demands good knowledge of target group but also employer's willingness to be flexible and self-improve.

When trying to attract and retain talent from Y generation HR must work on improvement of communication skill inside the company as well as on the Internet and Social Media. Recent studies show that employer branding is stronger via mentoring and coaching style of management and engaging learning, training and career plan. All these factors combined create engaged employees that want to stay in the company.

References

1. The impact of Employer Branding on talent acquisition in banking sector of Pakistan (2014) Dissertation Presented for the degree of Msc Human Resource Management 2012-2013, University of Edinburgh, Business School, Edinburgh.
2. Mahesh R. & Suresh, B.H. (2019). Employer Branding as an HR Tool for Talent Management – An Overview. In *International Journal of Management Studies*, *1*(5), pp. 74-80.
3. Pavlović, G., Savić, J., & Vrcelj, N. (2017). Brend poslodavca kao faktor konkurentske prednosti. In *Third international scientific conference eraz 2017s: Knowledge based sustainable economic development conference proceeding*, pp. 410-418.
4. Fasih, S. T., Jalees, T. & Khan, M. M. (2019). Antecedents to Employer Branding. In *Market Forces College of Management Sciences*, *14*(1), pp. 81-106.
5. Backhaus, K. & Tikoo, S. (2004). Conceptualizing and researching employer branding. In *Career Development International*, 9 (4/5), ABI/INFORM Global, pp. 501-517
6. Stantić, N. (2019). Dva odlična razloga da istražiš poslodavca pre intervjua. Poslovi infostud.com/Blog. Available at: https://poslovi.infostud.com/blog/dva-odlicna-razloga-da-istrazis-poslodavca-pre-intervjua/ (Accessed on: 18.11.2019.)
7. Stantić, N. (2019). Kako da proverite kompaniju za koju želite da konkurišete. Poslovi infostud.com/Blog. Available at: https://poslovi.infostud.com/blog/trazim-posao/1503/ (Accessed: 18.11.2019.)
8. Nećak, M. (2019). Master rad Digitalni aktivizam u EU: studija slučaja reakcije Internet zajednice na pravila EU o autorskom pravu. Univerzitet u Beogradu Fakultet političkih nauka, odbranjen 29. Oktobra 2019, pp. 18-23.
9. Mamula, T. (2016). Koja je Vaša strategija za obraćanje generaciji potrošača i lidera koja dolazi. Available at: https://www.slideshare.net/TanjaMamula/koja-je-vaa-strategija-za-obraanje-generaciji-potroaa-i-lidera-koja-dolazi-57450056 (Accessed on: 20.11.2019.)

10. Mamula, T. (2016). Izazov i prilika: razumevanje generacije Y. Udruženje ekonomista i menadžera Balkana - UdEkoM Balkan HR konferencija Upravljanje kvalitetnim ljudskim resursima - savremeni trendovi Zbornik radova, HR konferencija 2016.
11. Overfelt, M. (2017). Millennial employees are a lot more loyal than their job-hopping stereotype. CNBC. Available at: https://www.cnbc.com/2017/05/10/90-of-millennials-will-stay-in-a-job-for-10-years-if-two-needs-met.html (Accessed on: 25.11.2019.)
12. Perić. N., Mamula T. & Slijepčević M. (2019). Clothes Consumption in Republic of Serbia: Customer Behaviour Overview, Izvirni znanstveni članek/Original Scientific Article, *Tekstilec*, 2019, *62*(2), pp. 137-147, DOI: 10.14502/Tekstilec2019.62.137-147
13. Kako zaposliti i zadržati milenijalsa?. Kužet, N (2016) *ACT2B*. Available at: https://act2b.rs/donec-at-mauris-enim-duis-nisi-tellus/ (Accessed on: 25.11.2019.)
14. Milenijalsi pod istraživačkom lupom. Baucal, I. (2016) *ACT2B*. Available at: https://act2b.rs/milenijalsi-pod-istrazivackom-lupom/ (Accessed on: 25.11.2019.)
15. Puri, D. (2018). Developing the Scale to Measure Employer Attractiveness. In Annals of "Dunarea de Jos" University of Galati Fascicle I. Economics and Applied Informatics Years XXIII – no3/2018, pp. 99-123.
16. Reis, G. G. & Braga, B. M. (2016). Employer attractiveness from a generational perspective: Implications for employer branding. In Revista de Administração - RAUSP, 51(1), pp. 103-116.
17. Eger, L., Mičík, M. & Řehoř, P. (2018). Employer branding on social media and recruitment websites: Symbolic traits of an ideal employer. In *E a M: Ekonomie a Management, 21*(1), pp. 224-237.
18. The Deloitte Global Millennial Survey 2019: Societal discord and technological transformation create a "generation disrupted". (2019) Deloitte. Available at: https://www2.deloitte.com/global/en/pages/about-deloitte/articles/millennialsurvey.html (Accessed on: 25.11.2019.)
19. Pavlíček, A. & Doucek, P. (2015) Corporate Social Responsibility in Social Media environment. Conference paper. RG Available at: https://www.researchgate.net/publication/300252173_Corporate_Social_Responsibility_in_Social_Media_Environment (Accessed on: 25.11.2019.)
20. Krishnan, S. K., (2016) The 'Social' Employer Branding. Available at: https://www.researchgate.net/publication/301289654_The_Social_Employer_Branding (Accessed on: 25.11.2019.)
21. Arriscado, P., Quesado, H., & Sousa, B. (2018). Employer Branding in the Digital Era Attracting and Retaining Millennials Using Digital Media. In Communication: Innovation & Quality. Studies in Systems, Decision and Control, *154*, pp. 391-403.
22. Od škole do uspeha: milenijalci i generacija X (2016) MASMI. Available at: https://masmi.rs/vesti/od-skole-uspeha-milenijalci-generacija-x/ (Accessed on: 26.11.2019.)
23. Millennial Careers: 2020 Vision Facts, Figures and Practical Advice from Workforce Experts (2019) ManpowerGroup. Available at: http://www.manpowergroup.cl/wps/wcm/connect/manpowergroup/e8611255-2e23-4cce-8825-6d0f6b011691/MillennialsVision2020.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=e8611255-2e23-4cce-8825-6d0f6b011691 (Accessed on: 26.11.2019.)
24. Mamula, T. & Ćoso, D. (2015). Millennials' way of e-learning and communication in the digital era. The Sixth International Conference on e-Learning (eLearning-2015), 22-23 September 2015, Belgrade, Serbia.
25. Mamula Nikolić, T., Perić, N. & Nećak, M. (2019). The Role of Employee Engagement in Performance Management. *In World Applied Sciences Journal 37*(7), pp. 609-616.
26. Mamula T., Perić. N. & Vujić N. (2019). The Contribution of Innovative Leadership Style as an Answer to Global and Business Changes, Access to Success. *QAS*, *Vol.20, No.170* p-ISSN 1582-2559; e-ISSN 2668-4861; ISSN-L 2668-4861, pp. 9-14.

The Importance of Technological and Industrial Innovation for Achieving Competitiveness of Domestic Enterprises

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Abstract—**The globalization of markets and the technological advances within the framework of the fourth industrial revolution - Industry 4.0 put additional pressure on enterprises who compete on the global market. Small and medium-sized enterprises (SMEs) are becoming competitors to big corporations. Technological and industrial innovation play a crucial part in achieving a competitive position on the market. In this paper the importance of innovation in the context of technology and industry for increasing competitiveness analyzed. The main goal of this research is to define and propose potential solutions for improving the competitiveness of domestic enterprises, and the national competitiveness of Serbia. The paper addresses the present changes which are brought by globalization and the advances within the fourth industrial revolution. The paper contributes to the existing body of literature and represents a basis for future research in this domain.**

Keywords - technological innovation, industrial innovation, competitiveness, domestic enterprises, SMEs

I. INTRODUCTION

Globalization has brought big changes to enterprises. The globalization of markets directly affected enterprises who face additional challenges when it comes to achieving and maintaining competitiveness on these markets [1]. Is was discussed that globalization created competition between small and medium-sized enterprises (SMEs) and big corporations. However, globalization also allowed SMEs to reach distant markets through various forms of e-commerce [2]. Therefore, it can be noted that the globalization of markets certainly puts pressure additional pressure on enterprises, but also creates opportunities for SMEs which couldn't reach other markets beside their domestic ones. Now, the issue with SMEs and domestic enterprises in Serbia is the lack of competitive ability. The majority of domestic enterprises lack several competitiveness factors including technological and industrial innovation and as well as low productivity and low product quality [3]. From here, further issues arise, as domestic enterprises can't successfully compete on international markets, which further negatively affects the national competitiveness of Serbia. The situation of domestic enterprises is even more grim, if the modern technology framework of the fourth industrial revolution - Industry 4.0 is added into the "equation", as domestic enterprises face serious challenges in the domain of equipment and tools used in manufacturing. As the technology in manufacturing is "old" with the average of 20 to 30 years, and hence almost obsolete, product quality and production costs suffer greatly [3]. It is evident that domestic enterprises lack technological, industrial and organizational innovation.

In this paper the importance of technological and industrial innovation for achieving and maintaining competitiveness on the global market is analyzed. As domestic enterprises face challenges amidst the globalization of markets and the technological advancements within the framework of the fourth industrial revolution, this paper aims at proposing potential solutions

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to the competitiveness issues that these enterprises face. Furthermore, the paper outlines the background on globalization and Industry 4.0 in order to provide a broader overview on why enterprises "struggle" to successfully conduct business on the international market. As mentioned, the main goal is defining potential solutions on a micro and macro-level which could increase the competitive ability of domestic enterprises and the competitiveness of Serbia overall. The paper consists of four main sections (excluding the *Introduction* and *Conclusion* sections). First, the effects of globalization and Industry 4.0 are discussed. Second, the concept and importance of innovation is addressed. In the third section the competitiveness of Serbia and the competitiveness of domestic enterprises is analyzed. Finally, suggestions are proposed and guidelines are outlined for improving competitiveness.

II. GLOBALIZATION, INDUSTRY 4.0 AND COMPETITIVENESS

Globalization as a phenomenon is a result of the rapid development of information-communication technologies (ICTs) and it massively contributed to the homogenization of markets, production standards and the increased number of off-shore financial markets [4]. The globalization of markets affects enterprises on various levels. There is a higher demand for implementing and applying international standards for quality management, environmental protection, and safety in the workplace. Globalization doesn't affect only markets, and from an economic standpoint there is the globalization of manufacturing (outsourcing to countries where labor is affordable), the globalization of competition (as mentioned previously, SMEs are becoming competitors to big international corporations), the globalization technology, the globalization of corporations and the globalization of industry [5]. Due to the widespread adoption of ICT, there is an increase of products and services which are object of trade, thus increasing market saturation and competition intensity. The negative effects of globalization on the business performance of domestic enterprises, are also present in the EU and US. Currently, it seems that Asian countries (China, North Korea, Singapore, Taiwan and others) adapted to the globalization of markets more successfully compared to the west [6]. Even though the EU has issues when it comes to globalization, Serbia is far behind the west, when it comes to productivity and product quality. This may be the reason why domestic enterprises have a more difficult time achieving competitiveness on the international market compared to enterprises in developed countries.

Furthermore, besides globalization the concept of the fourth industrial revolution - Industry 4.0 affects enterprises from developed, but also enterprises from transitional countries. The concept of Industry 4.0 integrates business activities, procedures and processes which are managed and organized within global manufacturing and distribution networks [7]. ICT is the basis of globalization, and it is the main driving force of technological development within Industry 4.0. Basically, within Industry 4.0, industrial electronics are "evolving" into industrial informatics, and some the characterized technologies of Industry 4.0 include RFID (Radio Frequency Identification), Wireless Sensors, Wireless Business Networks, additive manufacturing, 3D printing, Cyber-security, automated robots and etc. [8]. When it comes to developed countries in the EU, the implementation and application of one or more of the mentioned technologies is far less a challenge compared to enterprises in Serbia where the majority of enterprises and economy as a whole relies on technologies from the second and third industrial revolutions. Therefore, discussing Industry 4.0 in the context of Serbian enterprises is logically adequate only if the issues and challenges are analyzed, and not the application of these technologies. Serbian enterprises have to address technological advancement in the form of innovation, rather than radical implementation of new ICT technologies (as this can be proven counter-productive due to lack of knowledge among employees). This further implies that technological advancement should be "organic" rather than "raw" implementations of ICT technologies. Step-by-step innovations and incremental introduction of modern technologies is a more stable and more sustainable approach to increasing competitiveness of domestic enterprises. well as managerial innovation (as Serbian managers don't apply modern management methods and techniques).

Furthermore, in the next section, the concept and importance of innovation is discussed. This includes technological, industrial innovation as

III. Innovation as a Basis for Improvement

Innovation can be viewed as using resources in order to increase value for the customer and in general it is one of key components of competitive ability [9]. In the same study it was discussed that innovation positively affects economic development, but due to the qualitative nature of innovation metrics, there are difficulties when accessing to measure innovation, therefore, the outputs of innovation, rather than inputs are measured. This approach allows for optimization in the innovation process. The innovation process can depend on the type of product, process, the field of innovation (technology, organization, and marketing), and it can originate from research and development, incorporation, imitation, and experience [10]. Overall, technological and industrial innovation has the potential for increasing the competitive ability of enterprises through proving higher value to customers. Thus, bit can be argued that innovation has the capability of increasing business and market performance of domestic enterprises. In addition, it was found that innovation, or more precisely, a nation's capacity for innovation positively affects national competitiveness [11]. When it comes to the competitiveness of domestic enterprises it was previously noted that due to the lack of productivity and quality, products of domestic enterprises can't compete on the global market. *Now, how can technological and industrial innovation change this situation?*

On a national level it seems that there is a positive relationship between innovation intensity, sustainable development, and competitiveness [12]. Innovation can be viewed as a crucial dimension of economic development and change [13]. Also, regional competitiveness is also affected by innovation [14]. In the same study it was noted that innovation as a potential can arise from technological potential, educational potential, scientific and technical potential, and consumer's sector potential. Based on these studies and another similar studies in the domain of innovation and competitiveness, it can be argued that technological and industrial innovation play an important role in achieving competitiveness on an enterprise-level and on a national level as well. Therefore, domestic enterprises should focus on potential sources of technological innovation. Implementing new technologies may bring benefits to the company but doesn't necessarily indicate a sustainable approach. Therefore, step-by-step organic innovation of within the domain of technology and industry could have more long-term benefits for SMEs. Even if new technologies are implemented as "ready-apply" solutions, there is need for innovation of procedures and processes within an enterprise, as it is unlikely that a new technology can work within the same business procedures framework.

Further, the lack of technological advancement within domestic industries presents a burning issue, and technological innovation as well innovation within industries present a potential solution for achieving and maintaining long-term competitiveness on the market. Technological, industrial and organizational innovation can be strong basis for improving business performance and competitive ability on the market. Before specific suggestions for improving competitiveness of domestic enterprises and national competitiveness are proposed, an overview of competitiveness indicators of Serbia and the competitive ability of domestic enterprises is analyzed.

IV. National Competitiveness and the Competitiveness of Domestic Enterprises

National competitiveness of Serbia and the competitiveness of domestic enterprises is not sufficient compared to member countries of the EU. As mentioned before enterprises in Serbia lack product and service quality, the equipment and tools are old, and there is a severe lack of innovation in almost every industry. Therefore, there is a necessity for a platform that will serve as basis for innovation, development and business improvement in order to increase the competitive ability of domestic enterprises on the global market [15]. Investments into research and technological development in Serbia accounts for 0.93% of the GDP [16]. This is very compared to the West European countries who invest more than 2% from their GDP which multiple times larger than Serbia's. Based on the Competitiveness Report published by the World Economic Forum in 2019, Serbia holds the 72th place (from 141 countries) [17]. Additional ranks of countries in the context of competitiveness are presented in Tab. I.

TABLE I. COMEPTITIVENESS RANKS OF COUNTRIES (WEF, 2019)

Country	Competitiveness rank
Serbia	72
Croatia	63
Slovenia	35
North Macedonia	82
Bosnia and Hercegovina	92
Montenegro	73
Romania	51
Hungary	47
Austria	21
Albania	81
Germany	7
United Kingdom	9
SAD	2

Source: [17]

Based on the data from Tab. I, it can be seen that Serbia and its neighboring countries have lower ranks compared to EU countries. Only countries such as Bosnia and Herzegovina, Albania, North Macedonia and Montenegro are ranked lower than Serbia. EU countries are much higher ranked, even neighboring Hungary and Romania have higher ranks. From 2018 a new methodology is used for defining ranks and it includes the trends and requirement of the fourth industrial revolution - Industry 4.0. Furthermore, the lowest ranks regarding competitiveness indicators are presented in Tab. II.

TABLE II. COMEPTITIVENESS INDICATOR RANKS OF SERBIA

Indicator	Rank
Customer sophistication	124
Opportunity to rely on professional management	114
Efficiency of naval docking services	111
Distortion effect of taxes on competition	110
Attitude towards entrepreneurship	107
Cooperation between employers and employees	107
Security of private property	106
Loans which are not operative (in % compared to the sum of all loans)	105
Law regulation effectiveness	104
Level of cluster development	104
Employee training intensity	104
Mobile phone subscriptions	104

Source: [17]

Based on the data from Tab. II, it can be seen that several mainly innovation intensive indicators such as attitudes towards entrepreneurship, employee and employer cooperation, cluster development, and employee raining intensity have low ranks, which may be a contributing factor to the overall lack of technological, industrial and managerial innovation in domestic enterprises. Namely, without entrepreneurial activities there is less innovation overall in a specific industry, or country for that matter. Similarly, if employees and employers don't communicate effectively, potential innovative solutions which may come from employees are not taken into consideration. Without employee training, intellectual capital remains stagnant, as well the intensity of innovative actions. Clustering of enterprises has shown to bring positive effects regarding business performance and market performance and all this through higher potential in the domain of technological and industrial innovation. Evidently, Serbian enterprises lack these factors, or they are low-ranked, which further indicates low innovation potential.

In the next section, based on the analyzed literature and data, suggestions for improving competitiveness are proposed. The suggestions aim at integrating the "weakest links" of domestic enterprises into actionable potential solutions.

V. SUGGESTIONS FOR IMPROVING COMPETITIVENESS

Based on the analyzed literature and the data presented within the competitiveness report it is evident that Serbia lacks fundamental infrastructure for innovation. However, there is potential and in order to make use of it, the following suggestions are proposed:

- Enterprises should invest in employee training and employee skill development. This would increase the innovation potential within the enterprise.
- Increasing employee skills and knowledge is important, and it is even more important to effectively allocate and manage intellectual capital within an enterprise, as it is one of the main components of innovation.
- Product innovation should be based on market research and customer satisfaction evaluation. This way over-innovating and over-spending on innovations is avoided.
- Application of modern management tools and techniques is important to manage new product or process development.

- The government has to establish an infrastructure which will enhance innovations in all industry sectors. This could be achieved with incentive programs.
- In addition, cluster formation between several enterprises in specific industries could increase technological and industrial innovation.
- IKT should be integrated in enterprises where an adequate infrastructure exists.
- If there is no infrastructure for IKT implementation, actions should be taken in order to make it available.
- Potential sources of innovation should be identified and enhanced within an enterprise, but also on a national scale.
- Incentive programs for entrepreneurship should be introduced.
- Enterprises should establish a motivating environment for entrepreneurial activities.

In sum, the Serbian government should develop a motivating environment for technological and industrial innovation through incentive programs and entrepreneurship programs. On an enterprise level, enterprises should invest in their employees and aim at organic, sustainable, long-term innovations. This implies that improvements and optimizations which are innovation-based, shouldn't be periodic, but continuous with the goal to answer the demands of a globalized market. Domestic enterprises have to address the importance of innovations and the necessity of it for continuous and long-term competitiveness on the market. In the case of Serbia, change has to be two-sided. First, systematic changes on a national-level should be introduced, and then striving to motivate enterprises and potential entrepreneurs to innovate in a sustainable manner.

VI. Conclusion

Competitiveness of domestic enterprises is inadequate and practically non-existent compared to enterprises in the EU. Further, this results in low competitive ability on a national level. The main reason behind this is the lack of modern manufacturing equipment which further results in low product quality and high manufacturing costs which affects product prices on the market. High production costs can't result in competitive prices on the international market. On a national level, there are little "technology rich" products meant for export, and this immensely contributes to the low national competitiveness. It is evident that domestic enterprises face challenges on the international market. Systematic changes on a national level are necessary. In this paper it was noted that technological, industrial and organizational innovation is a necessity for increasing competitive ability. It can be concluded that organic innovation and effective intellectual capital allocation are an imperative for improving competitiveness. Also, a stimulating environment for innovation needs to be established and stronger support for entrepreneurship should be given.

The main limitation of this paper is the lack of an empirical analysis of data obtained from domestic enterprises. However, due to the nature and goal of the paper, this limitation is not severe. The paper itself contributes to the existing body of literature in this domain and it provides a solid basis for future research.

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References

1. Bijaoui, I. (2017). SMEs in an Era of Globalization. *International Business and Market Strategies*. https://doi. org/10.1057/978-1-137-56473-3.
2. Savrul, M., Incekara, A. & Sener, S. (2014). The Potential of E-commerce for SMEs in a Globalizing Business Environment. *Procedia - Social and Behavioral Sciences*, 150, pp. 35–45. doi:10.1016/j.sbspro.2014.09.005
3. Ćoćkalo, D., Đorđević, D., Bogetić, S., Bakator, M. & Bešić, C. (2019). Competitiveness of Domestic Enterprises in Changing Markets and Industry 4.0, *In L. Monostori, V. D. Majstorovic, S. J. Hu & D. Djurdjanovic (Eds.), Proceedings of the 4th International Conference on the Industry 4.0,* 5-7th June, 2019, Springer Nature, pp. 113-127., Switzerland, 2019.
4. Birol, Ö. H. (2012). Globalization in historical perspective. *International Journal of Business and Social Science, 3*(8), pp. 92-98.
5. *Essay on Globalization and Business, Economics Discussion*. Available at:

http://www.economicsdiscussion.net/essays/globalization-essays/essay-on-globalization-and-business/17966 (Accessed on 14.08.2019.)

6. *Why is Asia the Champion of Globalization, The Globalist*. Available at: https://www.theglobalist.com/asia-globalization-development-china-united-states-eu/ (Accessed on: 15.08.2019.)
7. Popkova, E. G., Ragulina, Y. V., & Bogoviz, A. V. (2019). *Industry 4.0: Industrial Revolution of the 21st Century*. Springer International Publishing: Berlin, Germany.
8. Xu, L.D., Xu, E. L. & Li, L. (2018). Industry 4.0: state of the art and future trends. *International Journal of Production Research, 56*(8), pp. 2941–2962. doi:10.1080/00207543.2018.1444806
9. Carayannis, E. & Grigoroudis, E. (2012). Linking innovation, productivity, and competitiveness: implications for policy and practice. *The Journal of Technology Transfer, 39*(2), pp. 199–218. doi: 10.1007/s10961-012-9295-2.
10. Rojas, M. M. A. M., Cerda, M. G. C. P. & Hernández, J. G. V. (2013). Innovation and competitiveness in SMEs: the local experience in San Luis Potosi, México. *International Journal of Business and Social Science, 4*(15).
11. Taranenko, I. (2013). Strategic Analysis Of Innovation-Based Competitiveness In The Global Economy. *Montenegrin Journal of Economics, Economic Laboratory for Transition Research (ELIT), 9*(1), pp. 127-134.
12. Fonseca, L. M. & Lima, V. M. (2015). Countries three wise men: Sustainability, Innovation, and Competitiveness. *Journal of industrial engineering and management, 8*(4), pp. 1288-1302.
13. Ciocanel, A. B. & Pavelescu, F. M. (2015). Innovation and Competitiveness in European Context. *Procedia Economics and Finance, 32*, pp. 728–737. doi:10.1016/s2212-5671(15)01455-0
14. Rodionov, D. G., Guzikova, L. A. & Rudskaya, I. A. (2014). Innovation potential of regions as a factor of national economy competitiveness. *Актуальні проблеми економіки,* (8), pp. 215-223.
15. Domazet, I., Zubović, J. & Lazić, M. (2018). Driving Factors of Serbian Competitiveness–Digital Economy and ICT. *Strategic management: International Journal of Strategic Management and Decision Support Systems in Strategic Management, 23*(1), pp. 20-28. ISSN: 0354-8414.
16. *Research and development expenditure*. World Bank Group. Available at: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS (Accessed on: 22.09.2019.)
17. World Economic Forum (WEF). *The Global Competitiveness Report 2019*. Available at: http://reports.weforum.org/global-competitiveness-report-2019/ (Accessed on: 16.10.2019.)

The Realm of Sustainability of Business Models

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Abstract—**The business world is ripe for change. Changes in the environmental conditions of an organization call for strategic responses from management. This has brought a major shift in the way management deals with the complexities of decision making. Businesses today are described by their business models rather than just a product or technology. Entrepreneurs have been able to create extraordinarily successful business by designing & implementing successful sustainable business models. To ensure sustainability of business models, businesses practice certain set of interrelated activities. They initiate with the process to attain sustainability and the process continues, for nothing is ultimate for all times in today's business world.**

Keywords - business models, sustainability, innovation

I.INTRODUCTION

Business Environment is highly dynamic, increasingly uncertain & fiercely competitive. It is characterized by the acronym 'VUCA' for volatility, uncertainty, complexity and ambiguity. The major driving forces of Information & Communication Technology, increasing globalization, shorter product life cycles due to product innovation, emerging marketing practices, are in motion and create incentives or pressures for changes. All this has raised the complexity & difficulty in business decision making process. Managing business is become an ever-harder task. To deal with the manageability of these issues, managers perceive the business model concept. Business can be managed well, to enhance overall performance, profitability, sustainability by adopting a "Business Model" view of the organization. It must be described, assessed for viability, discussed, measured, communicated, modified & reviewed on continuous basis to meet changing demands of competitive world.

Business Model orientation in organizations help them develop core competencies, empowers their products and enacts commercial opportunities. The difference between accomplishments and failure for similar technology or product can be referred as Business Model and hence, organizations are moving towards building Business Model Portfolios rather than just product portfolio.

In the following research paper, the researcher first has explained concept, subsequently the pursuit of long-term sustainability has been discussed and finally analyzed the relevant information to reveal what lies at the realm of sustainable business models.

II.RESEARCH PROBLEM

The following research problems have been raised in the research paper:

- Why has this concept gained importance in today's competitive business world?
- What determines the success of business models?
- Is there any one key objective that ensures fulfillment of all other objectives of a business model?
- Which procedure is adapted by organizations to ensure sustainability of their respective business models?
- What lies at the origin of process applied by organization to sustainability?

III.OBJECTIVES OF THE STUDY

- To study the growing importance of business models in today's competitive world.

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- To study the indicators determining success of business models.
- To identify key objective of business models that ensures fulfillment of other objectives.
- To establish a logical procedure adapted by existing businesses to achieve sustainability of their business models.
- To identify the realm or origin of sustainability of business models.

IV. Need/Relevance of the Study

The success of businesses today is depended on how successful their business models are. Hence it is important to get an insight into what this model aims at, how it deliberates processes for sustainability. The procedure the researcher has sought to establish is very much in existence and is practiced by businesses today. But it's important to recognize such algorithms in business to raise the scope for further enhancements.

V. Research Methodology

This research is an exploratory research and is based on secondary data collected from other research papers, thesis', and books.

VI. Concept of Business Models

This concept is still young and researches in this domain add on to the meaning, ways to map, modify, test, business models altogether. After a careful literature review, the researcher has interpreted the concept of business model concept in the following way:

"Business Model is a representation of businesses structures and mechanisms that are involved in creating, delivering and capturing value for, to and from the customers, with the motive to earn profits and grow substantially ensuring sustainability."

Every company has to form its own business model which relates its distinctive mixture of assets and activities to value creation.

VII. Elements/Components of Business Model

Researchers and Authors have proposed different business model Ontology's specifying its elements, their properties and also their relations. However, [1] proposes single reference model ontology depending upon the similarities of a broad range of other Business Model Ontologies.

Accordingly, [1] the following four pillars of business model split in Nine Building Blocks of Business Model.

TABLE I. Components of Business Model by Osterwalder

Pillar	Value proposition
Product	Target Customer
Customer Interface	
	Distribution Channel
	Relationship
Infrastructure Management	
	Value Configuration
	Capability
Financial Aspects	
	Partnership

VIII. Indicators of Successful Business Models

All entrepreneurs strive to attain success and hence make attempts to devise and put into practice successful models for their organizations. However, success is seen as various things from varying viewpoints. The success of Business Model can be analyzed on different grounds, through varied indicators. The field of Business Model which concerns with appraisal of business models is known as Business Model Evaluation. Various authors have provided with literature regarding indicators for BME.

In [2] wealth potential of Business Models that covers four factors is discussed:

- Extent of efficiency in delivering customers benefits.
- Extent of differentiation.
- Degree of fit along with elements of business concept.
- Extent to which Business concept exploits profit boosters

In [3] three levels of these models, namely: Profitability Measures (firm's earnings and cash flows), Profitability predictor measures (profit margins revenue market share and growth) and Business model component attribute measures (provides benchmark questions for each Afuah & Tucci's Business Model Components) are given. One of the components being

sustainability, the benchmark question for sustainability is “Has the firm been able to maintain or extend its lead in its industry?” On the analysis of various definitions and evaluation indicators proposed by authors, it can be said that a direct relationship exists between the revenue generation capacity of the organization and sustainability. The attainment of sustainability thus ensures all other objectives of business model are met with. Hence sustainability is the key objective/indicator of successful business models.

IX. The Concept of Sustainability

It is possible to interpret the term sustainability in various ways. In 1987, it was commonly used in an ecological context. Brundtland described sustainable development as "meeting today's needs without compromising future generations ' ability to meet their needs. Business leaders used the word "sustainability" before that time to connote a company with steady growth in its earnings. Sustainability is also often used to describe an organization's philanthropic efforts to protect the environment.

Adam Werbach, a global CEO of the world’s largest sustainability agencies, Saatchi and Saatchi’s has realized true sustainability coequal components to be:

- Social (acting as if other people matter)
- Economic (operating profitably)
- Environmental (protecting and restoring the ecosystem)
- Cultural (protecting and valuing cultural diversity)

For the purpose of this research paper, Sustainability has been interpreted as the tendency to continue to exist and also the capacity to remain competitive. It focuses moreover on the economic aspect that aims at operating profitability. In today’s business world, where changes occur on all business fronts, organizations are mainly guided by the objective of sustainability that fosters them to plan, build and put into practice the sustainable business models.

X. The Realm of Sustainability of Business Model

In [4] the nature’s simple rules for sustainability is enlisted. These rules are derived from the various studies conducted on Darwinism- Theory of natural selection. These Natures rules of sustainability include:

- Diversity across generations: diversity in hereditary structure and behavior maintains long term survival.
- Settle in and concentrate to the ever-changing environment: ordinary organism practice adaptive navigation, adjusting to variations in weather, foodstuff, and predators.
- Improve with each cycle: Evolution can be harsh, but it’s a strategy for long term survival.

The rules mentioned above are all focusing on one common element and that is “change”. Change to Adapt, Improve, Specialize and Diversity.

Also, the very derivation of these rules is from the behavior of the organisms that are part of the nature. Business Organizations too, have evolved in the nature, interact with nature, use natural resources, create values for societies that prevail in nature These nature’s rules of sustainability hence are valid for business, have an implication on business organizations too.

Hence to ensure sustainability, business organizations should change to adapt, improve, specialize and diversify in the dynamic, competitive business environment. While it is important to change, creativity has to be inculcated in the process to adapt, improve, specialize or diversify and that calls for innovation.

Moving ahead, in context of business models that are very much inherent to business organizations, the entrepreneurs should strive to design, build innovative business models to ensure sustainability.

From the previous discussions it is clear that it's necessary for organizations to maintain or extend their position/lead in the industry they compete to ensure sustainability. Maintaining or extending its lead in the industry is a result of increasing revenue generations'. To raise the revenues, Organization's margin and/or market share should be increasing. The increase in the market share is an outcome of a competitive advantage that is necessary to beat competition in the market. Competitive advantage allows a firm to gain an edge over rivals when competing, raising profitability to level greater than the average profitability of other firms in the industry. The source of competitive advantage is core competencies. Core competencies are capabilities, knowledge, skills, facilities necessary to design and produce core product. They represent distinctive skills as well as intangible, invisible, intellectual assets and other capabilities. These competencies are built through differentiation and uniqueness from its competitors. The organizations should be able to differentiate from its competitors that have to have a real impact on customer's choice and company's market position.

To differentiate from its competitors, organizations should look beyond the conventional way of doing things and innovate in designing, building, modifying its Business Model. Innovation in business model does not necessarily require completely new ideas creation; it can be attained through learning from existing models and recombining them. Only around 10% of innovative business models are completely new patterns, whereas 90% of them adapt, refine and combine the existing business models. Innovation helps in envisioning future opportunities and helps businesses build competitive advantage. However, all competitive advantages have a limited life since the benefits created by any differentiation can be duplicated by its competitors. Hence, business should constantly analyze their business models, check their viability and modify business model through innovation.

After careful examination of the above discussion the researcher has been able to derive the following circular flowchart depicting the cyclic procedure adopted by businesses to thrive in perpetuity i.e. attain sustainability of business models:

Figure 1. Circular flow diagram for attaining sustainability in business models.

For innovating business models, the components or elements of business model are considered separately for innovation. Elements as proposed in Osterwalder's thesis on business model ontology of value proposition, Division of customers, customer relationship, supply channels, key resources, key activities, key partnerships, revenue structure and cost structure for example are considered separately for innovation.

While it's necessary to address all elements for examining business model viability, innovation in one or more has made business models successful and difficult to imitate, ensuring sustainability. Some examples of such businesses are discussed below:

Apple's transformation to a consumer electronics and music trend from an innovative yet declining personal computer market. It's a clear outcome of redefining the business model. Apple focuses on innovation in its **value proposition** by product innovation. Its products are not only differentiated but are highly outstanding. Apple was thus able to deliver higher value products to its customers. Also, the company has innovated in maintain **customer relations** so extensively Through handling face-to-face interaction and growing brand awareness through the tech support system of Apple Genius.

INTEL: Intel has a business model focused on innovations in the **key activity** of research and development. Intel enjoys first mover advantage more than once because of its rare fast research and development cycle time. Capability that brought SRAM and DRAM integrated circuit technology and brought microprocessors to market well ahead of competitor. The products could be imitated but it's difficult to imitate research and development cycle time capability.

GOOGLE: Google's innovative business model has innovative product delivering highest value to people today "search engine", but its success was defined by innovation in **revenue model**. Initially, there was just a free search engine, then Google licensed its technology to other websites, wasn't a winner either. Then Google provided paid search listings alongside the 'objective' ones which were quiet a success. But even more successful was its plan to build on its proprietary search engine algorithms to deliver targeted ads. To other websites, this has generated more than half of Google's revenue since 2004.

LOS GROBO: An agribusiness initiated by a Russian- Jewish farmer in Argentina Gustavo Grobocopatel. It exercised focused innovation in bringing the **key resources** for conducting business. The farmer initially faced a shortage of arable land, labor, capital to start with his business. All these challenges were conceived by Grobocopatel and an ingenious business model was developed through innovation. To deal with scarcity of land it was leased rather than acquiring, for scarcity of labor it was subcontracted for every aspect of farm work giving him access to 'freelance' laborer's hired only when needed, the problem of scarcity of capital for acquiring equipment was overcome by renting equipment from small local companies. Soon, Los Grobo started operating as an asset-light company, leveraging a grass root network of 3800 small and medium sized agriculture suppliers and became the second largest grain manufacturer.

All these and many more organizations like Walmart, Amazon, etc., and so on have innovated in one or more of the elements of business model and attained a competitive edge to raise revenues and attain sustainability.

XI. Conclusion

Innovation is critical to business models of companies today. Without innovation it will be difficult to survive and sustain in current competitive business environment. Various components of the business model should be innovated and then integrated to establish a strengthened business model that is truly sustainability. Also as rightly stated by Sir Winston Churchill "Success is not final, failure is not fatal, it is the courage to continue that counts." Sustainability is not attained with single attempt to innovate in business models. It is a gradual process that requires breaking through different innovative business models to derive the best that results in best outcomes. Hence organizations should constantly foster to design innovative business models. Describe, understand, modify, refine, test, challenge, and remodify existing business models. Hence it is conclusive to state that Innovation lies at the realm of sustainability of business models.

References

1. Osterwalder. (2004). *The Business Model Ontology: The proposition in a design science approach*.
2. Hamel, G. (2000). *Leading the revolution*. Boston, Harvard Business School Press.
3. Afuah, A. & Tucci, C. (2003). *Internet Business Models and Strategies*. Boston, McGraw Hill.
4. Werbach. A. (2009). *Strategy for sustainability*.
5. Gordijn, J. (2002). *Value-based Requirements Engineering - Exploring Innovative e-Commerce Ideas*. Amsterdam, NL, Vrije Universiteit.
6. Hawkins, R. (2001). *The "Business Model" as a Research Problem in Electronic*.
7. Rappa, M. (2001). *Managing the digital enterprise - Business models on the Web*, North Carolina State University.
8. Mullins, J. (2010). *The New Business Road Test: What entrepreneurs and executives should do before writing a business plan*, (3rd ed.).
9. Radjou, Prabhu, Ahuja. (2012). *Jugaad Innovation: A frugal & flexible approach to innovation for the 21st century.*
10. The Institute of Chartered Accountants of India, Intermediate course, Study material, *Strategic Management*, July 2017.

Possibilities for Quadruple Helix Model Approach in an Inclusive Regional Innovation Systems

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Abstract—**As much as possible we strive to the more balanced regional development, trying to reduce discrepancies in all indicators of living standards, welfare and other measures of economic and social development. To achieve this goal of equal developing opportunities, as the key for long-term and sustainable development, we need to detect what are the specific needs of less developed regions in terms of innovations for creating close-fitting innovation systems. The aim of this paper is to connect and emphasize the potential of quadruple helix model actors (local government, university, private sector and civil society) for inclusive regional innovation systems.**

Keywords – innovation system, knowledge management, sustainable regional development, quadruple helix model

I. INTRODUCTION

The concept of regional innovation systems began to attract the attention of economic policy makers and academia in the early 1990s, above all, as a very promising analytical framework to advance understanding of the innovation process in regional contexts. Although there is no one generally accepted definition for a regional innovation system, it is usually understood as a set of interactive public and private interests, formal institutions and other organizations that function in accordance with defined organizational and institutional relationships and thus contribute to the generation, use and dissemination of knowledge [1]. As an "institutional infrastructure that supports innovation in the production structure of the region", a regional innovation system consists of subsystems that create and exploit knowledge by interacting with other regional, national and global systems for the convergence of new knowledge [2].

An indispensable step for using institutional infrastructure that should help creating tangible benefits for regional development is to introduce inclusive innovation for all who doesn't have stable enough starting point and have been excluded from the development mainstream.

Creating and consolidating knowledge-based regional innovation systems is one of the key goals of Triple/Quadruple Helix model theory and practice. Knowledge-based regions such as Silicon Valley, Emilia Romagna or Baden-Wurttemberg did not emerge spontaneously - their development is the result of decades of effort toward success. In contrast to biological evolution, arising from different mutations and natural selection, social evolution is created by the conscious action, formation, and development of different institutions [3].

Smart, sustainable and inclusive growth is the key goal of several EU initiatives, strategies and programs in the short, medium and long term and at the regional, national and pan-European levels [4,5]. In this paper, we will explore, explain and emphasize the conceptual (potential of quadruple helix model actors - local government, university, private sector and civil society), as well as possible practical connections between them (inclusive regional innovation systems) with an accent to rural areas of developing countries.

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II. QUADRUPLE HELIX MODEL AS AN SUSTAINABLE REGIONAL DEVELOPMENT APPROACH

Both the Triple Helix (TH) concept and the Quadruple Helix (QH) approach are grounded on the idea that innovation is the outcome of an interactive process involving different spheres of actors, each contributing according to its 'institutional' function in society. Traditional protagonists of the TH are University (UNI), Industry (IND), and Government (GOV). Civil society (CIV) is the additional sphere included in the QH. Contribution to innovation is envisaged in terms of sharing of knowledge and transfer of know-how, with the helices models assigning and formalising a precise role to each sphere in supporting economic growth through innovation. As society becomes more and more interactive, the role of knowledge as well as the number and scope of spheres to be included in the innovation-generating process have been increasing over time [6]. But, what does it mean for rural regions of developing countries which don't even have basic infrastructure for configuring some innovative structure for starting point. The good side of this problem is that the ICT interaction in globalized world makes it easier to connect and absorb the knowledge that we need. The dark sides of this situation in developing countries are motivation of the local people, trained professionals for dissemination of skills, financial support for infrastructure and improvement of technology, local governments making extenuating framework for rural inclusive innovative development.

A new form of innovation that has been given the label 'inclusive innovation' is growing in developing countries. It has different names that reflects different emphases and has also been given other labels including 'pro-poor innovation', 'below-the-radar innovation', 'grassroots innovation', 'BoP (base-of-the pyramid) innovation', and more [7, 8, 9, 10, 11, 12]. Mainstream innovation was promoting development and creating wealth, while has in fact increased inequality between rich and poor, but inclusive innovation is trying to reduce inequality and poverty. Growth in the reality of this alternative or modified form of innovation has been matched by a growth of political and academic interests, driven particularly by both an actuality and a heightened perception of rising inequality. That inequality – as well as being inherently problematic– is also seen as holding back social and economic development in the long run [13].

By promoting an innovation system where marginalised groups play central roles, the Quadruple Helix model provides an interesting example of how to bridge the gender gap of entrepreneurship and innovation in future innovation systems initiatives. These experiences can guide future policy programs on regional growth and innovation when aspiring to create more inclusive ways of "doing entrepreneurship" [14].

One such aspect is the consequences of the regionalisation of innovation system concepts that tend to make weak and under-developed regions subject to the same policies as highly competitive nations and industry clusters. The Quadruple Helix model is a response to the calls for civil society involvement and emphasis in weak regions [15].

Therefore, a new connection between science and society can be achieved within the national/regional innovation system as a model of integrating education with other elements of the system: economy, financial sector, government institutions, research institutes, all in accordance with market needs. The task of this system is precisely to restore the process of technological change to their natural environment - enterprises and create the conditions for their endogenization. This involves creating such integration links (knowledge flows) between science and the economy that will lead to the enhancement of technological capabilities and accelerate technological change [16].

The real challenges for implementing the quadruple helix model in rural areas in developing countries are remoteness of university or other knowledge-intensive institution present which makes a difference from the point of view of local development agendas. In many regions, also the business community may be scattered and insufficiently developed in terms of innovation. And furthermore, this kind of region may also have a weak public sector to enhance innovativeness. In such regions, social and community groups may often play the dominant entrepreneurial role [9].

III. Inclusive Regional Innovation System for Under-Developed Regions

No matter how to define 'inclusive innovation', however, it focused on the structures and processes required to develop and deliver innovative technologies (goods and services) incorporating the needs and interests of the poor. Meanwhile, it has novel features including significant involvement of the private sector and global value chains, the development of poor consumers as an accessible mass market, growth of technological capabilities within developing countries and the involvement of new technologies [10,11]. Within the literature, one finds four aspects of inclusivity that are highlighted [16,17,11,7]:

- Inclusivity of innovation precursors: for example that problems to be addressed by innovation are of relevance to the poor.
- Inclusivity of innovation processes: for example that the poor are involved in the development of innovative goods and services.
- Inclusivity of innovation adoption: for example that poor consumers have the capabilities to absorb innovations.
- Inclusivity of innovation impacts: for example that innovative goods and services have a beneficial effect on the livelihoods of the poor.

Figure 1. The logical starting points of inclusive innovation (Source: [18])

IV. Regional Innovation System Performance Assessment

With its Communication 'Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth', the Commission is committed to boosting innovation-led growth and helping regions seize the opportunities brought by technological change and industrial modernisation. The Commission has identified four main challenges to regional innovation as well as some pilot actions to tackle them. These actions will be launched by the end of 2017 to promote larger investments in interregional innovation projects and accompany the industrial modernisation of less-developed regions [19]:

1. Boosting innovation capacity in less-developed regions,
2. Increasing cooperation in innovation investment across regions,
3. Further reforming research and innovation systems within regions,
4. Facilitating synergies between EU policies and instruments.

According to Committee of the regions various approaches are implemented at the European level to quantitatively assess a territory's innovation performance. Each of these approaches relies on different types of data and focuses on specific aspects of the innovation process. Table 1 indicates data availability within the main sources identified. In fact, the number of sources providing quantitative information on innovation performance (including enabling and hampering factors) at the regional level is limited.

TABLE I. Sources of Data for Innovation Performance Assessment

Source	Geographical level	Type of information
Regional Innovation Scoreboard (RIS)	Mainly NUTS2. NUTS1 for some Member States.	Each region is classified as modest innovator, moderate innovator, innovation follower, or innovation leader. Innovation scores by region are given on the basis of 11 indicators grouped under three headings (Enablers, Firm Activities and Outcomes). Sources of data for the indicators include Eurostat and the Community Innovation Survey.
Innovation Union Scoreboard (IUS)	Country level (NUTS0).	Each country is classified as modest innovator, moderate innovator,innovation follower, or innovation leader. Innovation scores by country are given on the basis of 25 indicators grouped

		under three headings (Enablers, Firm Activities and Outcomes).
Innobarometer	Country level (NUTS0).	Survey on activities and attitudes related to innovation within European businesses and civil society. Every year the specific focus/topic of the survey changes.
Digital Economy and Society Index (DESI)	Country level (NUTS0).	The index reflects 30 indicators on Europe's digital performance grouped into five dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, and Digital Public Services.
Eurostat	NUTS2.	Several datasets, especially from the domains of regional education (t_reg_educ), regional science and technology (t_reg_sct), and regional information society (t_reg_isoc).
EU Regional Competitiveness Index (RCI)	NUTS2 and country level (NUTS0).	The index reflects 73 variables related to different domains: Institutions, Macroeconomic Stability, Infrastructure, Health, Basic Education, Higher Education and Lifelong Learning, Labour Market Efficiency, Market Size, Technological Readiness, Business Sophistication, and Innovation.
Regional Innovation Monitor Plus (RIM+)	200 regions (NUTS2) of 20 Member States (NUTS1 and NUTS2 level).	Information on regional innovation policy measures, policy documents, organisations, good practices in regional innovation, mapping of advanced manufacturing and relevant pilot/demo projects.
RIS3 Smart Specialisation platform	167 regions (NUTS2) and 18 countries (NUTS0).	Guidance material and good practice examples for smart specialisation and innovation strategies, targeted information divided into six sections (S3 Themes, S3 Governance, S3 Targeted Support, S3 Actors, S3 Co-operation and S3 Communities), tools for regional comparison on structural similarities (Regional Benchmarking), Priorities (EYE@RIS3), and Inter-regional trade flows.
OECD database	Large regions, mostly consistent with the NUTS2 level.	Among the most relevant datasets related to innovation performance are education level of labour force, R&D personnel by sector, R&D expenditure by sector, and patents applications.

Source: European Union, Committee of the Regions (2016) Using the Quadruple Helix Approach to Accelerate the Transfer of Research and Innovation Results to Regional Growth.

After determinating a classification of European regions into 'innovator types' (ADV - advanced, MED - medium and MOD – modest, for developing countries we should add more classes because the innovation systems in developing countries are different in its basis and maturity. For example, Altenburg [17] asserts and points out "the need to cater for different needs for all specific cases; they should be build on institutional frameworks that tend to be much less formalized, and rules that are less enforceable; and the key agents as well as the incentives that determine their behavior tend to be very distinct. The innovation systems literature explicitly recognizes that policies need to be context-specific. Institutions develop in response to changing economic and social conditions, and vice versa. The choice of technologies depends on initial socio-economic conditions, and, as technological learning is cumulative in nature, the decisions that are taken at the start of evolutionary processes give rise to particular trajectories." As Nelson [20] has put it, technologies, industrial structures, and supporting institutions co-evolve. This explains why technological knowledge is deeply rooted in the specific institutions of societies, and its content and availability varies across societies, even when factor endowments are similar. A growing body of literature deals with innovation in developing countries. After analysis of numerous policies and cases in practice, we could underline that imperative for implementing the quadruple helix model approach in inclusive

regional systems for developing countries are: systematically research and discovering the specific needs for motivating the local citizens for socially inclusive types of innovation, investigating distributional effects of policies, strategies and action plans in similar EU regions, strengthen the role of governments as agents of resource allocation, making nurturing framework for more local private sector investments in innovations and R&D intended for under-developed sectors in particular areas.

V. Concluding Remarks

As a concept whose value is seen in adaptability and applicability at many different levels and forms, the aim of the paper is to highlight the potential of the model as a catalyst for innovation processes and the transfer of usable knowledge, relevant for the development of society in less developed regions. The dynamics of knowledge-based development of rural and under-developed regions need to be specifically `tailor made` approach, sustained by local government, universities and research centers, private firms and civil sector. Regional policies, strategies and action plans for operationalizing innovation systems on regional/local level usually arise from policymakers in urban centres and capitals. Expecting to be universally applicable, those actions (e. g. classical "triple helix" model and its successors for economic development based around the idea of universities, business and public sector organisations all coming together to foster innovation and economic prosperity) may be impracticable in many rural and under-developed areas. Those actions may fail, if they're not adjusted to local needs and circumstances. In this kind of regions, usually there is no university, research centres or other knowledge-intensive institution, private sector in majority is insufficiently developed in terms of innovation. Furthermore, in those regions there is not formed public sector to motivate community and individuals to enhance innovativeness. After the regional innovation system performance assessment is set, the costum-made strategies for resilient, inclusive and sustainable growth should be made, close-fitting to every local community. Opportunities brought by technological change and industrial modernization becomes the real practical opportunities for under-developed regions when the local governments apply the right model for sectoral development which are potential for every single region, motivating the private sector to enhance the innovation development by re-investing their profits for education and knowledge base of their employees. At the same time, universities, research institutions and knowledge-intensive centers from urban areas should make local consultative centers for innovation and entrepreneurial skills creation. The local community may also play a significant role in rural and under-developed regions, in making entrepreneurial impulse and innovative consciousness in local society. If the basic of innovation system at regional level is set on elements of triple helix model and if there is a presence of individual institutional elements, innovation processes are becoming increasingly open to different interests of stakeholders. In this respect a quadruple helix model approach is highly beneficial for inclusive regional innovation systems, including the fourth helix – civil society and local community, as an inseparable part of sustainable development for rural areas in developing countries.

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References

1. Doloreux, D. (2003). Regional innovation systems in the periphery: The case of the Beauce in Québec (Canada). *International Journal of Innovation Management*, *7*(1), pp. 67-94.
2. Leydesdorff, L. & Fritsch, M. (2006). Measuring the knowledge base of regional innovation systems in Germany in terms of a Triple Helix dynamics. *Research Policy*, *35*(10), pp. 1538-1553.
3. Jesic, J., (2016) Quadruple helix model as a basis of national innovation system, *doctoral thesis,* Educons University, Novi Sad.

4. Kolehmainen, J., Irvine, J., Stewart, L., Karacsonyi, Z., Szabó, T., Alarinta, J. & Norberg, A. (2016). Quadruple Helix, Innovation and the Knowledge-Based Development: Lessons from Remote, Rural and Less-Favoured Regions, *Journal of Knowledge Economy, 7*(23), pp. 23-42.
5. Carayannis, E. G. & Rakhmatullin, R. (2014). The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond. *Journal of the Knowledge Economy, 5*(2), pp. 212–239.
6. European Union, Committee of the Regions, (2016). Using the Quadruple Helix Approach to Accelerate the Transfer of Research and Innovation Results to Regional Growth.
7. Yao, W., Li, H. & Weng, M. (2018). The Role the University Could Play in an Inclusive Regional Innovation System. *Triple Helix, 5*(12), pp. 1-21.
8. Horton, D. (2008). Facilitating pro-poor market chain innovation: An assessment of the participatory market chain approach in Uganda, Papa Andina, International Potato Center, Lima.
9. Kaplinsky, R., Chataway, J., Clark, N., Hanlin, R., Kale, D., Muraguri, L., Papaioannou, T., Robbins, P. & Wamae, W. (2009). Below the radar: what does innovation in emerging economies have to offer other low-income economies? *International Journal of Technology Management and Sustainable Development, 8*(3), pp. 177–197.
10. Kaplinsky, R. (2011). Schumacher meets Schumpeter: appropriate technology below the radar. *Research Policy, 40*(2), pp. 193–203.
11. Cozzens, S. & Sutz, J. (2012). Innovation in informal settings: a research agenda. International Development Research Center, Ottawa.
12. Ramani, S. V., Sadreghazi, S. & Duysters, G. (2012). On the diffusion of toilets as bottom of the pyramid innovation: lessons from sanitation entrepreneurs. *Technological Forecasting and Social Change, 79*(4), pp. 676–687
13. Stiglitz, J. E. (2012). The Price of inequality. WW Norton, New York.
14. Pejanovic, R. & Jesic, J. (2019). Fostering rural tourism development – quadruple helix model approach. In *The Fourth International Scientific Conference - Tourism in function of development of the republic of serbia - Tourism as a Generator of Employment - Thematic Proceedings II*, 4(2), pp. 118-135.
15. Cornett, A. P. (2009). Aims and strategies in regional innovation and growth policy: a Danish perspective. *Entrepreneurship and Regional Development*, *21*(4), pp. 399–420.
16. Utz, A. & Dahlman, C. (2007). Promoting inclusive innovation. In: Dutz MA (ed). *Unleashing India's innovation: toward sustainable and inclusive growth*. World Bank, Washington DC, pp. 105–129.
17. Altenburg, T. (2009). Building inclusive innovation systems in developing countries: challenges for IS research. In: Lundvall BA, Joseph KJ, Chaminade C (eds) *Handbook on innovation systems and developing countries: building domestic capabilities in a global context*. Cheltenham. Edward Elgar, UK, pp. 33–57.
18. Yao, W., Li, H. & Weng, M. (2018). The Role the University Could Play in an Inclusive Regional Innovation System, *Triple Helix, 5*(12), pp. 1-21
19. European Commission. Smarter growth for Europe's regions through innovation. https://ec.europa.eu/regional_policy/en/newsroom/news/2017/10/23-10-2017-smarter-growth-for-europe-s-regions-through-innovation
20. Nelson, R., R. (1994). The Co-evolution of Technology, Industrial Structure, and Supporting Institutions, *Industrial and Corporate Change, 3* (1), pp. 47-63.

Utilization Management of Waste Glycerol Obtained in Rapeseed Oil-based Biodiesel Production

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Abstract— **As a result of the need for alternative fuels, it is evident that the industrial production of biodiesel worldwide has increased significantly in the last decade. With the great rise in biodiesel production, great amounts of waste glycerol have been generated. In order to utilize waste glycerol as a suitable raw material, it is necessary to implement an adequate waste management model based on the principles of sustainable development. Waste glycerol corresponds as a promising raw material for some innovative and new processes. A very popular topic is its usage as an ingredient in media for microbial cultivation in the fermentative industry. Also, the very popular topic is the production of microbial oil using algae and the utilization of waste glycerol with algae, especially in recent years. There are many published results of researches with marine microalgae but significantly less with freshwater microalgae. In this paper, results of the researching the impact of waste glycerol from rapeseed oil-based biodiesel production on the metabolism of isolated freshwater microalgae and obtaining the microbial oil as a raw material for further biodiesel production are presented.**

Keywords – waste glycerol, biodiesel, freshwater microalgae, oil

I. INTRODUCTION

Production of inedible oils for energy purposes, especially as a stock for biodiesel production is in the focus of many researchers [1]. Microbial biomass can be used as a feedstock for biodiesel production and "Single-cell oil" or microbial lipids are becoming very popular for the industrial applications and have the great potential to replace plant lipids. It is expected that Semi-continuous systems allow for increased microbial and lipid yields but some experiments showed that production in batch systems was higher [1]. It was reported that oil concentration, above 70 %, was obtained by batch cultivation of *Thamnidium elegans* [2], which is higher than it was obtained in a semi-continuous system (60.7 %) using the yeast *Rhodotorula glutinis* [3].

The use of algae for biotechnological utilization is in the spotlight for a long time because, among other things, they have the ability to grow rapidly [4]. Algae are a great alternative biofuel in order to they are suitable producers of oil, especially as a starting material for biodiesel production. They can grow in different and adverse habitat as freshwater, seawater, wastewater, sewage, and uncultivated land. Also, they can be cultivated under controlled conditions in bioreactors and farms [1].

During the process of biodiesel production, about 10 % of by-product glycerol is generating [5]. The glycerol, thus obtained, contains a large amount of impurities, which make it a limited usable material. In the case of microbial conversions, it is not necessary to purify it before usage. Many valuable products such as 1,3-propanediol, *n*-butanol, ethanol, lactic acid, citric acid, and others can be produced utilizing waste glycerol by bacteria *Escherichia coli*, *Klebsiella*, *Enterobacter*, *Gluconobacter* and *Clostridium*, yeast of the genus *Candida*, mold *Aspergillus* and others [6, 7]. Also, microalgae can successfully grow and produce microbial oil by utilizing waste glycerol [8, 9] therefore, they can solve two problems at once, they can produce oil as astarting material and they can solve problem of large amounts of waste glycerol as a by-product [8].

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II. EXPERIMENT

In this study, four isolated strains of microalgae, identified as members of the *Chlorococcum*, *Chlorella, Desmodesmus* and *Scenedesmus* genera, were used [10]. Algae were cultivated in Bolds Basal Medium [11], and waste glycerol obtained in rapeseed oil-based biodiesel production. Waste glycerol was obtained in Laboratory for chemical engineering of Faculty of Technology in Leskovac, (University of Niš). Cultures were grown under the constant light (30 days) in a chamber with an orbital shaker (140 min^{-1}, 22 °C). Microbial growth was monitored spectrophotometrically by measuring optical density (OD_{620}), and the concentration of dry biomass was measured gravimetrically at the end of the process. Using the HPLC method, change in glycerol concentration was determined and the content of algal oil was determined using the Bligh-Dayer method [12].

III. RESULTS AND DISCUSSION

The results of studying the utilization possibility of waste glycerol from rapeseed oil-based biodiesel production by isolated freshwater microalgae are presented in Tab. 1. All obtained results are compared with results obtained in fermentations with pure glycerol [13]. The kinetics of microalgal growth and change in glycerol are presented in Fig 1.

It is well known that under the proper conditions (brightness, temperature, and nutrition content) algae are growing very fast and have the ability to double their biomass in 3-12 h, and they do not need an organic carbon source to grow because they use carbon (IV) – oxide [14]. In this case, glycerol was not a limiting substrate.

The highest growth of algae was observed with *Chlorococcum* sp. where is achieved 1,3 g/dm^3 of dry biomass while the *Chlorella* sp. grew the weakest (0,7 g/dm^3). During the cultivation of *Desmodesmus* sp. and *Scenedesmus* sp. the values of 1,0 g/dm^3 and 0,9 g/dm^3 of dry biomass are reached. All achieved values are lower than values obtained in fermentations with pure glycerol (*Chlorella* sp. 1,1 g/dm^3, *Chlorococcum* sp. 1,7 g/dm^3, *Desmodesmus* sp. 1,4 g/dm^3 and *Scenedesmus* sp. 1,0 g/dm^3) [13]. The kinetics of microbial growth is shown in Fig. 1a. It was observed that all four strains grew moderately and constantly by the end of the process.

The changes in glycerol concentration during the cultivation of algae in BBM media with waste glycerol from rapeseed oil-based biodiesel production are shown in Fig. 1b. It is noticed that all strains of microalgae have consumed glycerol during the fermentation process. The highest consumption rate, 61 % of available amount, was reached with *Chlorococcum* sp., *Chlorella* sp. and *Desmodesmus* sp. have spent 44 % and 42 % while *Scenedesmus* sp. have spent the least glycerol (32 %). A constant decrease in glycerol concentration was evident for all four strains in the first 18 days followed by a moderate decrease. It was not observed that glycerol consumption was in accordance with the growth of algae and no dependency was established with consumption rate and growth. Thus confirming the fact that for algal growth is not necessary presence of organic carbon source [15].

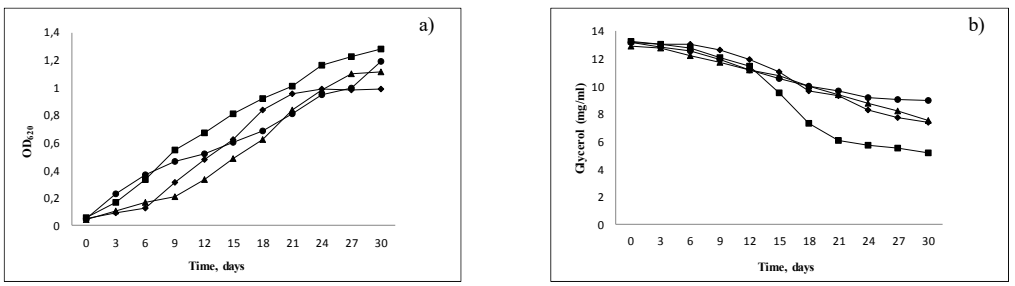

Figure 1. Change in optical density (biomass content) (a) and glycerol concentration (b) during the cultivation of isolated microalgae from the genera *Chlorella* (♦), *Chlorococcum* (■), *Desmodesmus* (▲) and *Scenedesmus* (●) in BBM media with waste glycerol obtained in rapeseed oil-based biodiesel production

TABLE I. ACHIEVED MAXIMUM VALUES OF DRY BIOMASS (DBM), CONSUMPTION RATE OF GLYCEROL (ΔGLYC), YIELD ($Y_{P/X}$) AND OIL CONTENT IN DRY BIOMASS CONTENT, DURING THE CULTIVATING OF ALGAE IN MEDIA WITH PURE AND WASTE GLYCEROL OBTAINED IN SUNFLOWER OIL-BASED BIODIESEL PRODUCTION

Isolated strain	Characteristics of bioprocess														
	Pure glycerol [14]								Waste glycerol (Rapeseed oil)						
	DBM		Δglyc		Oil				DBM		Δglyc		Oil		
	g/l		mg/ml		%	$Y_{P/X}$ g/l		%	g/l		mg/ml		%	$Y_{P/X}$ g/l		%
Chlorella sp.	1.1	±0.026	6.97	±0.060	51	0.4	±0.026	34	0.7	±0.11	5.79	±0.69	44	0.2	±0.046	30
Chlorococcum sp.	1.7	±0.036	13.77	±0.376	100	0.3	±0.017	17	1.3	±0.05	8.07	±0.20	61	0.3	±0.030	23
Desmodesmus sp.	1.4	±0.010	6.80	±0.130	51	0.3	±0.010	22	1.0	±0.36	5.43	±0.24	42	0.3	±0.026	28
Scenedesmus sp.	1.0	±0.046	8.31	±0.062	59	0.3	±0.030	27	0.9	±0.36	4.23	±0.17	32	0.3	±0.044	31

Independent of the microbial growth rate, isolated strains produce different amounts of oil during the cultivating in media with glycerol. It is well known that algae accumulate oil reserves in less favorable conditions for growth [16]. A significant amount of microbial oil in dry biomass was produced by *Chlorella* sp. (30 %) and *Scenedesmus* sp. (31 %). Despite the good growth and glycerol consumption, *Chlorococcum* sp. and *Desmodesmus* sp. have produced less oil in media with waste glycerol from rapeseed oil-based biodiesel production (23 % and 28 %). By comparison with the results obtained in fermentations with pure glycerol, it was noticed that all strains, except *Chlorella* sp. have produced nearly 25 % higher amount of oil. This can be explained as a stimulating effect of waste glycerol from rapeseed oil-based biodiesel production on producing oil by microalgae. All obtained results are in accordance with the results reported in the available literature [1, 4, 15].

IV. CONCLUSIONS

The studied isolated strains of freshwater microalgae offer a dual solution in biodiesel production. They can successfully produce oil as starting material and they can utilize waste glycerol from biodiesel production.

Isolated strains of algae *Chlorococcum* sp., *Desmodesmus* sp. and *Scenedesmus* sp. had a lover growth rate in the media with waste glycerol from rapeseed oil but also produced 35 %, 27 % and 15 % more oil than it was obtained in pure glycerol media. Also, *Chlorococcum* sp. and *Desmodesmus* sp. have consumed a significant amount of waste glycerol, 61 % and 42 % of the available quantity. The obtained results are not as well as it was obtained in previous studies with waste glycerol obtained in biodiesel production from some other plant oil, but still, they are very important for further research.

Waste glycerol obtained in rapeseed oil-based biodiesel production can be a significant ingredient for algal growth media.

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REFERENCES

1. Danilović, B., Avramović, J., Ćirić, J., Savić, D. & Veljković, V. (2014). Production of biodiesel from microalgae. *Chem Ind, 68*(2), pp. 213–232.
2. Chatzifragkou, A., Makri, A., Belka, A., Bellou, S., Mayrou, M., Mastridou, M., Mystrioti, P., Onjaro, G., Aggelis, G. & Papanikolaou, S. (2011). Biotechnological conversion of biodiesel derived waste glycerol by yeast and fungal species. *Energy, 36*, pp. 1097–1108.
3. Saenge, C., Cheirsilp, B., Suksaroge, T.T. & Bourtoom, T. (2011). Potential use of the oleaginous red yeast *Rhodotorula glutinis* for the bioconversion of crude glycerol from biodiesel

plant to lipids and carotenoids. *Process Biochem*, *46*, pp. 210–218.

4. Vijayaraghavan, K. & Hemanathan, K. (2009). Biodiesel production from freshwater algae. *Energ Fuels, 23*, pp. 5448–5453.
5. Johnson, D. T. & Taconi, K. A. (2007). The glycerin glut: Options for the value-added conversion of crude glycerol resulting from biodiesel production. *Environmental Progress, 26*(4), pp. 338-348.
6. Garlapati, V. K., Shankar, U. & Budhiraja, A. (2016). Bioconversion technologies of crude glycerol to value-added industrial products. *Biotechnol Reports*, *9*, pp. 9–14.
7. Konstantinović, S., Danilović, B., Ćirić, J., Ilić, S., Savić, D. & Veljković, V. (2016). Valorization of crude glycerol from biodiesel production. *Chem Ind Chem Eng Q, 22*(4), pp. 461−489.
8. Choi, H. J. & Yu, S.W. (2015). Influence of crude glycerol on the biomass and lipid content of microalgae. *Biotechnol Biotechnol Equip, 29*(3), pp. 506-513.
9. Sharma, Y. C., Singh, B. & Korstad, J. (2011). A critical review on recent methods used for economically viable and eco-friendly development of microalgae as a potential feedstock for synthesis of biodiesel. *Green Chem*, *13*, pp. 2993-3006.
10. Danilović, B., Cvetković-Rakić, J., Ćirić, J., Simeunović, J., Veljković, V. & Savić, D. (2017). The isolation and screening of microalgae for the production of oil. *Chem Ind, 71*(1), pp. 69–74.
11. Stein, J. (1980). *Handbook of Phycological Methods, Culture methods and growth measurements*. Cambridge University Press.
12. Kumari, P., Reddy, C.R.K. & Jha, B. (2012). Comparative evaluation and selection of a method for lipid and fatty acid extraction from macroalgae. *Anal Biochem, 415*(2), pp. 134-144.
13. Ćirić, J., Stanković, N., Živković, M. & Lazarević, Dj. (2019). Producing of microbial oil using waste glycerol from biodiesel production – From by-product to raw material. In *Proceedings of the 5th Virtual International Conference on Science, Technology and Management in Energy - eNergetics*, ISBN-978-86-80616-04-9.
14. Svirčev, Z. (2005). *Microalgae and cyanobacteria in biotechnology. [Mikroalge i cijanobakterije u biotehnologiji]*. University in Novi Sad, Faculty of Sciences, Novi Sad.
15. Makareviciene, V., Skorupskaite, V. & Gumbyte, M. (2014). Biomass and oil content of *Chlorella* sp., *Haematococcus* sp., *Nannochloris* sp. and *Scenedesmus* sp. under mixotrophic growth conditions in the presence of technical glycerol. *J Appl Phycol, 26*, pp. 83–90.
16. Sarmidi, A. (2009). Review on biofuel oil and gas production processes from microalgae. *Energy Convers Manage, 50*, pp. 1834–1840.

E-banking and Fintech Companies' Services in Customers' Perception

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Abstract— **The traditional banks face both at the global level and in Romania the challenge of dealing with the competition brought on the financial services market by the fintech companies. The technological innovation and the consumer expectations regarding the speed of the service delivery and the reduction of transaction costs have forced banks to adapt the service offer to their needs by introducing e-banking services first for payment services and later for investment/lending services. The paper aims to investigate how familiar are the consumers of financial services with the offer of fintech companies and their availability to use the e-banking and financial services offered by the fintech companies according to age, professional status, studies and income. The instrument used in conducting the research was the questionnaire and three hypotheses were tested. The obtained results show that there is a significant connection between the chosen variables.**

Keywords - e-banking, fintech companies, Romanian banking system, financial services

I. INTRODUCTION

The Romanian banking system, as well as the global banking systems, has undergone, during the last 30 years, a complex process of adaptation to an economic environment governed by technological innovation that has led to significant changes in the range of the financial services offered. On the one hand, all banks have introduced in their service offer the possibility of consumers to use internet banking and mobile banking; on the other hand, they have sought solutions to the competition with the fintech companies that come on the market with low costs and speed in providing services.

The present paper considers two directions of analysis. First, the analysis concerns the evolution of the structure of the banking system in the last years, the evolution of the degree of internet access for the purpose of using the internet banking services and the presence of the fintech companies that offer financial services on the Romanian market. The second refers to the investigation of the degree of familiarization of the consumers of financial services with the offer of the fintech companies and the dependence on the use of their services and of the internet banking services in relation to age, professional status, the level of professional training and the income of the consumers.

The study was based on a questionnaire and had 3 main objectives:

- testing the connection between the use of the internet banking and age, professional status, studies and income of the consumers.
- testing the link between the degree of knowledge of fin-tech financial services and age, professional status, studies and income of the consumers.
- testing the connection between the use of fin-tech financial services and age, professional status, education and income of the consumers.

The last section of the paper summarizes the conclusions of the research.

II. THE SIZE AND SHAPE OF THE ROMANIAN BANKING SYSTEM, INTERNET BANKING AND FIN TECH MARKET

The Romanian financial system is dominated by credit institutions that hold two-thirds of its total assets (74.9%), followed by private pension funds (8.2%), investment funds (6.5%) and non-bank financial institutions (6.2%). It is for this reason that we consider important to first analyze the size and structural changes in the activity of credit institutions in the last decade.

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The process of consolidation of the Romanian banking system, that started as a consequence of the financial crisis and continued as a result of capital requirements changes, led to a continuous decrease in the number of credit institutions present on the market, from 43 in 2008 to 36 in 2015 and 34 in 2018. The biggest market shrinkage occurred in 2015 when four banks ceased their activity on the Romanian market, three of them being purchased by other credit institutions (Volksbank taken over by Transilvania Bank, RBS where retail and corporate portfolios were taken over by UniCredit Bank and Millennium Bank bought by OTP Bank). Since the end of 2018, when Transilvania Bank finished the buying process of BancPost, only 34 credit institutions have been active on the Romanian market, the smallest number in the last three decades. The decrease in number of credit institutions however, was not accompanied by a similar evolution of the total net assets value. As Fig. 1 shows, in the last decade, the value of total net assets for the Romanian banking system kept an upward trend, its value at the end of the period being almost one and a half times that of 2008.

If we add to the above evolution the fact that the market share of large banks (defined as banks that hold more than 5% of market share) in the last decade raised from 64 to 76.6 percent, and their contribution to the net financial results of the system was between 65.9% (in 2011) and 90.7% (in 2018), we can conclude that the Romanian banking system tends to be a concentrated one, with large banks dominating the market and leaving little room for competition. In 2018, the first five banks in terms of assets value, totaled a market share of 61.61 percent.

Another major trend in the evolution of the Romanian banking system after the financial crisis is represented by the need for banks to reduce their operating costs. This need arose in the context of decreasing operating revenues as a result of declining interest rates, growth of non-performing loans and tightening credit granting rules. Therefore, banks were forced on the one hand to clean their portfolios off bad loans and on the other hand to reduce their organizational structures.

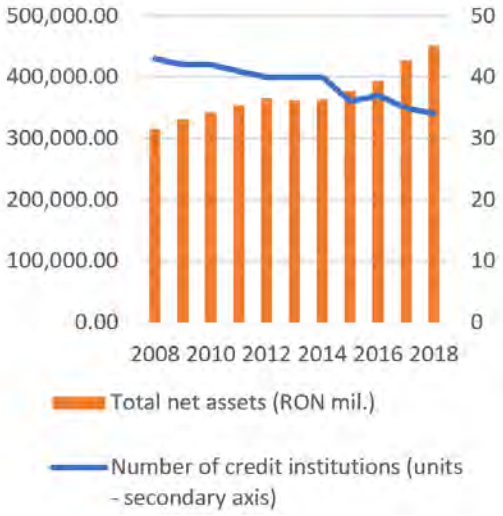

Figure 1. The evolution of the number of credit institutions and their total net assets in Romania between 2008 and 2018 (source: processed based on data released by NBR)

In the last ten years the number of employees in the banking system has reduced by 25% and the number of branches by 40% (figure 2). At the end of 2018 the Romanian banking system had 53737 employees, compared to 71622 employees in December 2008. The network of local branches included 4382 units compared to 7375 units at the end of 2008.

Figure 2. The evolution of the number of employees and local branches of credit institutions in Romania between 2008 and 2018 (source: processed based on data released by ECB)

The immediate consequence of these cuts could be a more difficult access for the population to banking services but, on the other hand, the population no longer feels the need to go to the bank in order to carry out transactions. The increasing presence of banks in the online environment thus becomes both a consequence of the above-mentioned situation, and an influencing factor of this downward trend in the number of bank employees and local branches.

So, how big is the internet banking market in Romania? First, let us consider how many households have internet access. According to the Romanian National Institute of Statistics [1], the share of households that have internet access at home in total households increased significantly in the last ten years from 27.3% in 2008 to 72.4% in 2018. Fig. 3 shows the evolution of the percentage of households that have internet access in total households in Romania between 2008 and 2018, by urban and rural area and in total. As expected, the percentage is higher in the urban area than in the rural area, but by the end of the period, more than half of rural households also have internet access.

Therefore, internet access is not a problem in Romania for those who are interested in using online banking services, either provided by banks or fin-tech companies. Statistics also show that 65.6% of households had, in 2017, access to a computer at home, 75.9% of households in the urban area and 51.9% in the rural area.

In the above-mentioned conditions, the share of persons who accessed the internet in the last three months in order to use internet banking services fluctuated between 8.8% in 2011 to 9.7% in 2018. In the urban area, the percentage of internet banking users is higher (between 11.1% in 2011 and 13.1% in 2018) than the average total and also has a higher growth rate throughout the period. In the rural area, the share of internet banking users is considerably lower, ranging between 1.6% in 2011 and 4.2% in 2018. Figure 4 shows the evolution of internet banking users living in urban and rural areas, between 2011 and 2018.

The distribution of internet banking users by gender, in the same period of time, shows that the share of male users of internet that accessed internet banking services in the last three months is higher than the share of female users (Fig. 5).

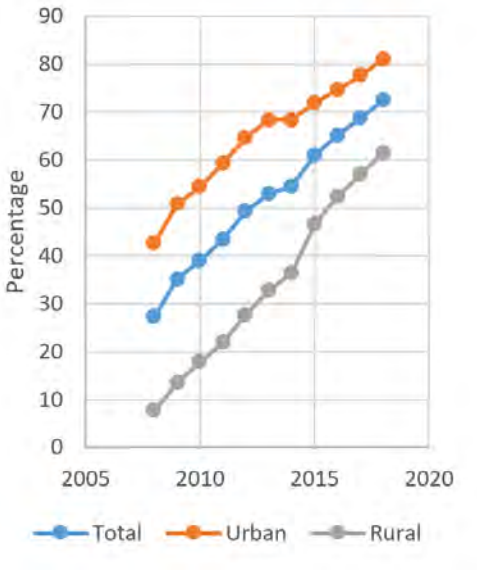

Figure 3. The share of households having internet access at home in total households in Romania between 2008 and 2018 (source: processed based on data released by NIS Romania)

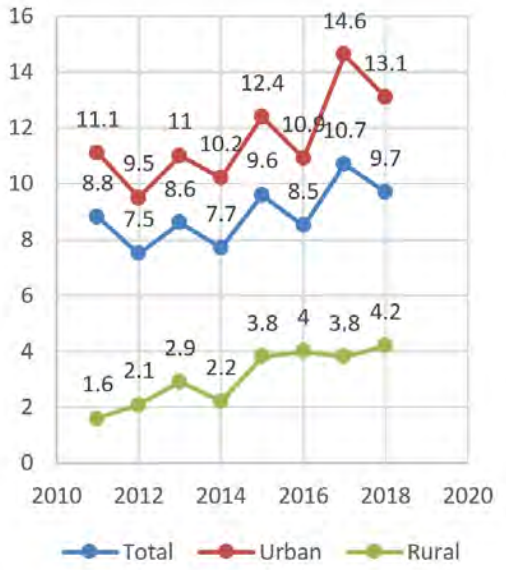

Figure 4. The share of persons who have accessed the Internet in the last 3 months for each year, for using internet banking services by residence area between 2011-2018 (source: processed based on data released by NIS Romania)

Figure 5. The share of persons who have accessed the Internet in the last 3 months for each year, for using internet banking services by gender between 2011-2018 (source: processed based on data released by NIS Romania)

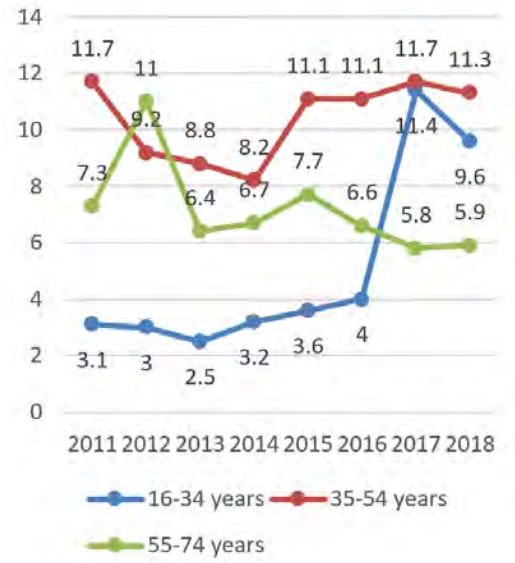

Figure 6. The share of persons who have accessed the Internet in the last 3 months for each year, for using internet banking services by age between 2011-2018 (source: processed based on data released by NIS Romania)

Fig. 6 depicts the distribution of internet banking users by age. In the category between 35-54 years, the share of persons using the internet for online banking services was the highest and the most stable throughout the analyzed period, while in the other two age categories, the share of internet banking users was more variable. The lowest share of internet banking users was registered in the 16 to 34 years category between 2011 and 2016, but starting from 2017, people aged from 55 to 74 years had the smallest percentage of internet banking users amongst them.

One final classification of internet banking users (Fig.7), by occupational status, presented in figure 7, shows that the largest number of internet banking users is located in the self-employed and employers category (38.7% in 2016), followed by the employees category (16% in 2017), students and retired persons (around 3% each).

We can thus conclude that the internet banking market in Romania is slowly growing in size and reaching more categories of persons. If we analyze the statistical distribution of internet banking users in 2018, we can also conclude that the typical internet banking user in Romania is male, between 35 and 54 years of age, lives in a city and is an employer or self-employed.

In the last ten years, numerous studies such as [3-5], show that the financial services market is undergoing a profound change both in structure and in the way of providing services under the influence of the significant increase of the technological innovation used in this regard.

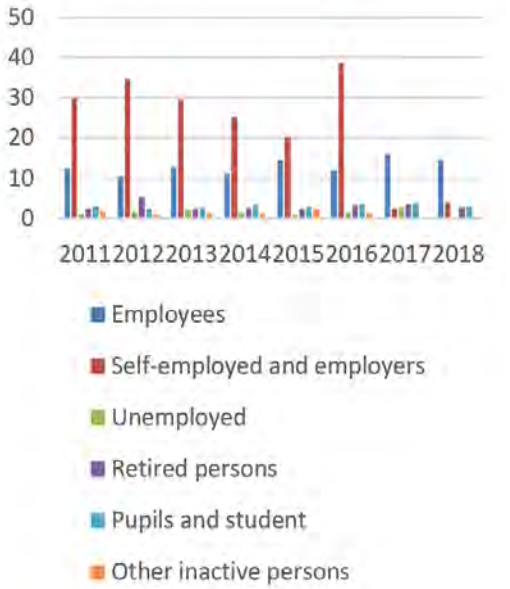

Figure 7. The share of persons who have accessed the Internet in the last 3 months for each year, for using internet banking services by occupational status between 2011-2018 (source: processed based on data released by NIS Romania)

As a result, the specialized literature speaks today of the new approaches to the banking system through digitalization – speaking about them as digital ecosystems, new actors in the financial services market (either from other type of service provision (Facebook, Amazon) or new fintech companies taking over at lower costs services traditionally provided by banks - payments, lending, investments (Revolut).

The proof that the presence of these companies on the financial services market can no longer be ignored is the research regarding the preferences and satisfaction of the consumers of services provided by such companies [6-7].

III. THE METHODOLOGY

We conducted an empirical study based on a questionnaire. An online version of the questionnaire was used and distributed through email addresses and other social media platforms, such as a Google form link.

The period in which we conducted the distribution of questionnaires was November 1-15, 2019 and we considered valid 242 answers. The research involved testing three hypotheses, as mentioned above.

Data processing was done using SPSS version 23.

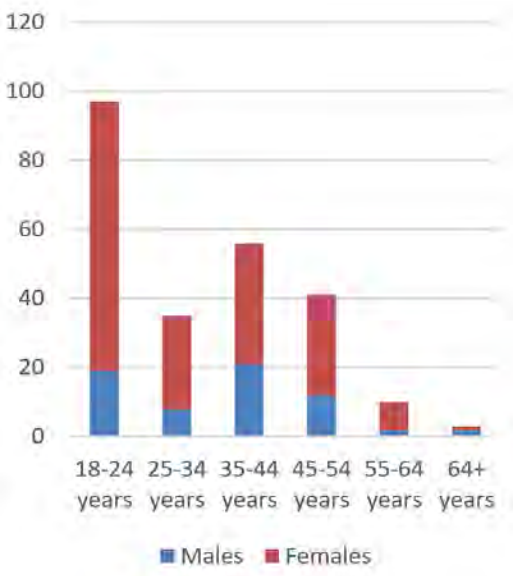

Figure 8. Sample structure by age criteria (source: data from our survey)

Figure 9. Sample structure by professional status criteria (source: data from our survey)

IV. THE SAMPLE

The analyzed sample consists of 242 valid respondents of which 178 females (73.55%) and 64 males (26.45%). The majority of respondents, 97 persons (78 females and 19 males), are aged between 18 and 24 years, representing 40.08% of the sample. 14.46% of the respondents (35 people) are aged between 25 and 34 years, 23.14% (56 people) between 35 and 44 years, 16.94% (41 people) between 45 and 54 years, 4.13% (10 people) between 55 and 64 years, and 1.24% (3 people) are older than 64 years (Fig. 8).

A total number of 203 persons (83.88%) live in the urban area. Also, almost half of the respondents have a bachelor degree (116 people – 47.93%) and another 54 persons have postgraduate studies.

The distribution of the sample by occupational status is as follows: 127 employees, 90 students, 18 employers and self-employed, 4 retired persons and 3 unemployed (Fig. 9).

In order to determine the level of monthly incomes, we used the net minimum and average wage in Romania and divided the respondents into three categories: those with incomes lower or equal to the net minimum wage (1263 RON), those with monthly incomes between the

minimum and the average wage (3020 RON) and those with monthly incomes higher than the average wage. The respondents were almost equally distributed into the three categories, 76 with incomes lower than the minimum wage, 74 with incomes between the minimum and the average wage, and 92 with incomes higher than the average wage.

V. THE HYPOTESES AND RESULTS

We formulated and tested three hypotheses:

H1: There is a statistically significant association between the use of internet banking and respondents' age, professional status, level of education and income.

A chi-square test of independence was performed to examine the relation between age and the use of internet banking services. The relation between these variables was significant, X2 (5, N= 242) = 21.601, p = .001.

A chi-square test of independence was performed to examine the relation between the level of education and the use of internet banking services. The relation between these variables was significant, X2 (2, N= 242) = 7.57, p = .023.

A chi-square test of independence was performed to examine the relation between the professional status and the use of internet banking services. The relation between these variables was significant, X2 (4, N= 242) = 10.964, p = .027.

The test for the relation between income and the use of internet banking services proved that there is no statistically significant connection between these variables.

We can thus conclude that the use of internet banking services is significantly associated to the age, level of education and professional status of the respondents.

H2: There is a statistically significant association between the degree of knowledge of fin-tech financial services and respondents' age, professional status, level of education and income.

A chi-square test of independence was performed to examine the relation between professional status and the degree of knowledge regarding fintech services. The relation between these variables was significant, X2 (16, N= 242) = 34.858, p = .004.

The tests performed for the other three variables showed that there is no statistically significant association between the age, level of education, and income of the respondents and their degree of knowledge of fin-tech financial services.

H3: There is a statistically significant association between the use of fin-tech financial services and the respondents' age, professional status, level of education and income.

A chi-square test of independence was performed to examine the relation between income and the use of fin-tech services. The relation between these variables was significant, X2 (2, N= 242) = 9.364, p = .009.

The tests performed for the other three variables showed that there is no statistically significant association between the age, level of education, and professional status of the respondents and the use of fin-tech financial services.

VI. CONCLUSIONS

In an attempt to create an image of how the Romanian banking system has evolved from the point of view of its structure and total net assets over the last ten years, and of how consumers access e-banking services, in the first part of the paper, we conducted an analysis in this regard, which led us to the following conclusions:

- The Romanian banking market is in a process of consolidation and concentration of the assets, as demonstrated by the significant reduction of the number of banks present on the market between 2008 and 2018 (from 43 to 38) in comparison with the evolution of the total net assets that registered a considerable increase, with over 30%;
- This process was accompanied by a significant reduction in the number of physical banking units (by about 40%) as well as by the number of employees (by about 20%);
- Simultaneously with these trends, the level of access to the Internet services in general and also the percentage of use of the Internet for accessing e-banking services have increased rapidly.

The research conducted using the questionnaire, as described above, showed the following tendencies and links:

- the use of the internet banking services depends significantly on the age, level of education and professional status of the respondents, but the level of income has no influence;
- the degree of familiarization of the respondents with the services offered by the fintech companies depends significantly only on the professional status and not on the other variables taken into account: age, level of education and income.
- regarding the use of fintech financial services, research has proven that the only variable with a significant influence is the level of income.

In conclusion, we can say that, nowadays, in Romania, the internet banking services have a widespread use among consumers of financial services without the level of income having an influence while the use of fintech services depends significantly and directly on the level of income, even if the degree of familiarization with these services depends first and foremost on the professional status.

The research undertaken in this article is part of a broader research plan undertaken by the authors over the last 3 years in the direction of investigating the use of innovative financial services, the satisfaction of consumers of such services and their penetration on the Romanian market. In our future research we intend to deepen the investigation of the consumer's perception of the advantages and disadvantages of using internet banking services and fintech services as well as an analysis of their use by sub-categories of services such as payments, credit products and saving/investments products.

REFERENCES

1. Romanian National Institute of Statistics www.insse.ro
2. Ghita-Mitrescu, S. & Duhnea, C. (2016). Internet Banking in Romania at a Glance. Ovidius University Annals, Economic Scientific Series, 16, pp. 508–514.
3. World Economic Forum (2017). Beyond *Fintech: A Pragmatic Assessment Of Disruptive Potential In Financial Services*, report published online
4. Business Insider (2017). *Wealth front Review 2017: Fees, Returns, Investing Services & Competitors*, Retrieved from http://www. businessinsider.com/wealthfront- review
5. Dapp T. (2015). *Fintech reloaded – Traditional banks as digital ecosystems,* Deutsche Bank Research, Current Issues - Digital economy and structural change
6. Gera, P., McIntyre, A. & Sandquist, E. (2019). *Discover the patterns in personality*, Accenture Global Financial Services Consumer Study, Available at: https://www.accenture.com/us-en/insights/financial-services/financial-services-consumer-study-2019
7. European Commission - Directorate-General for Justice and Consumers - Consumer Policy (2019). - *Behavioural study on the digitalisation of the marketing and distance selling of retail financial services,* ISBN 978-92-9478-097-3, DOI 10.2818/982380

Automatic Rule-based Kitchen Layout Design

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Abstract—**For custom-made furniture such as kitchen, the goal is a rational use of space by taking the maximal available width and height of the space. The aim of this paper is to create rule-based automatic system for I-shape kitchen layout generation, taking into account important parameters of existing interior space. The interview was conducted with interior designers, architects and kitchen producers in order to determinate space information of importance for kitchen layout. On the basis of interviews the list of important input information is created and used for the development of rule-based system. The system is tested and final results evaluated by experts, showing 69.2% accuracy in a kitchen layout generation.**

Keywords – kitchen layout, automatic layout, rule-based system, interior design

I. INTRODUCTION

Kitchen represents a space with great importance for one family. That's why the goal is to have a kitchen with best possible organization, maximal space use and aesthetic appearance in accordance with owner's taste. In order to meet these criteria, homeowners in most cases decide to create fully custom made kitchen. This requires many elements disposition rules to be respected in order to get functional space. Therefor interior designer has to spend time on solving these functional problems and have less time for creative aesthetic work [1].

There are several researches addressing the problem of automatic layout disposition using different principles. One group of authors [1, 2, 3, 4] use rule based parametric principles for automatic layout creation. Another group of researchers [5, 6, 7] are oriented toward Artificial Intelligence based algorithm for automatic layout generation.

In our previous research [1] we create an automatic system for parametric 3D modeling of I-shape kitchen. This system was based on idealistic interior space disregarding position of installations such as water pipes and canalization. Important information which we address in this research.

The aim of this paper is to create rule-based automatic system for I-shape kitchen layout generation taking into account important parameters of existing interior space. During our research we conduct interviews with interior designers, architects and kitchen producers in order to determinate kitchen interior space information of importance. On the basis of interviews the list of important interior space information is created and used for the development of rule-based application for automatic I-shape kitchen layout creation.

II. MATERIAL AND METHODS

The focus of this research is on I-shape kitchens and automatic layout generation. In order to achieve automation it is not enough to use only existing rules, due to designer influence in the process of layout decision.

A. Basic kitchen layout principles

Kitchen layout is determinate by three major factors:

- Rules for safe and comfortable use,
- Existing utilities elements and
- Esthetic appearance,

The main principle of kitchen layout design is that the elements should be organized to ensure a safe and comfortable cooking environment. Therefore the working triangle (Fig. 1) principle was developed in the 1940's by the University Of

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Illinois School Of Architecture which defines rules for mutual position between kitchen elements.

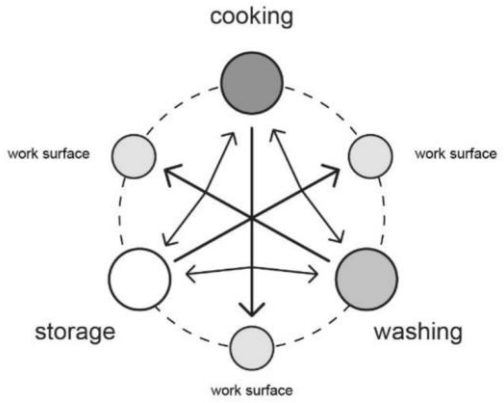

Figure 1. Kitchen working triangle

The work triangle is the imaginary line drawn between the 3 major work stations in a kitchen, separated with work surface [2]:

- Cooking (stove)
- Storage (refrigerator) and
- Washing (sink).

The criteria applied to a triangle design are [3]:

- distance between work stations is1.2m -2.7m;
- the sum of all distances is 4m -7.9m;
- obstacles such as cabinets should not intersect the triangle by more than 30cmand
- there shouldn't be traffic through the triangle

Interior space also defines possible kitchen type. Kitchens can be classified into sixth basic types according to shape that elements form in the floor plan (Fig. 2) [1]:

- I-Shape
- II-Shape
- L-Shape
- U-Shape
- G-Shape
- With island

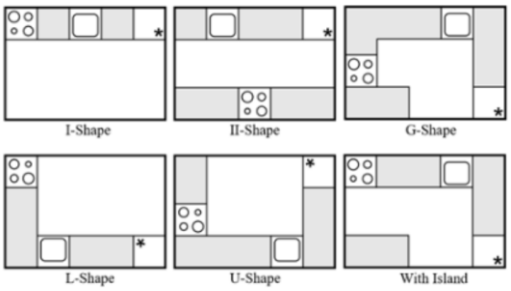

Figure 2. Kitchen type

Another important factor for layout design is existing interior space infrastructural elements. Which determinate positions for some of the kitchen elements:

- Door –fridge (storage of new groceries).
- Water pipes and canalization –sink.
- Extractor pipes –extractor fan and stove.

B. Parameters of importance

To define parameters of importance for automatic rule-based kitchen layout system interview with 43 industry experts from Serbia was conducted. The interview is done with 9 interior designers, 22 architects and 12 kitchen producers. On the basis of interview the list of most important factors for correct kitchen layout are determinate:

- Distance between washing and water pipe have to be minimal.
- Distance between cooking and ventilation have to be minimal.
- Distance between storage and kitchen entry door have to be minimal.
- Distance between cooking and window have to be minimal.
- Distance between cooking and kitchen edge have to be minimal.
- Distance between storage and kitchen edge have to be minimal.
- Cooking should not be next to washing.
- Cooking should not be next to storage.
- Washing should not be next to storage.
- Washing should be in the middle between cooking and storage.

C. Kitchen elements

Creation of rule based system also require definition of kitchen elements to be used. In our previous research [1], we define standard types and sizes for all three major workstation elements in the kitchen.

For Storage (Fig. 3) there are three different types of fridge (width x height x depth):

- S1 - 60 x 90 x 60
- S2 - 90 x 180 x 60
- S3 - 120 x 180 x 60

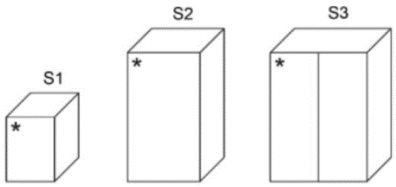

Figure 3. Types of storage elements

For Washing (Fig. 4) there are three different types of sink (width x height x depth):

- W1 - 30 x 90x 60
- W2 - 60 x 90x 60
- W3 - 120 x 90 x 60

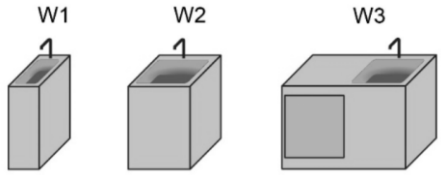

Figure 4. Types of washing elements

For Cooking (Fig.5) there are three different types of stove (width x height x depth):

- C1 -30 x 2x 60
- C2 -60 x 90 x 60
- C3 -120 x 180 x 60

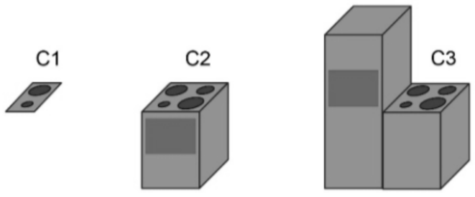

Figure 5. Types of cooking elements

III. RULE-BASED SYSTEM

Rule-based system for automatic kitchen layout is created in the form of windows based computer software, using Unity development engine.

A. Parameters wights determination

Creation of rule-based system for automatic kitchen layout is done by implementation of experts' interview results. With additional help from 5 experts in parameters weights determination. All weights of parameters are determinate empirically by each individual experts using tools developed for this research. (Fig. 6).

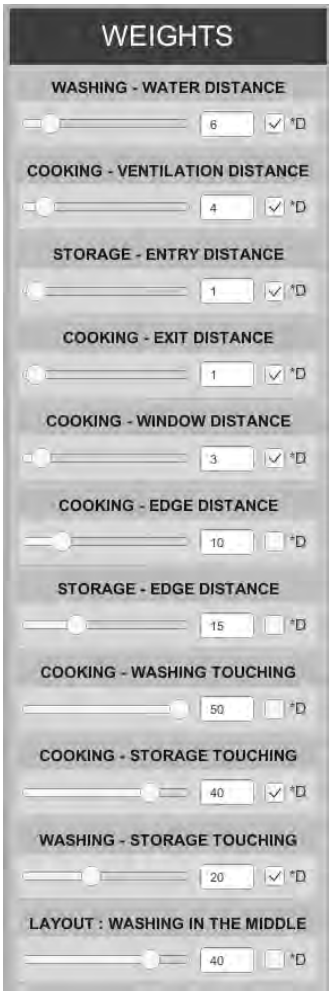

Figure 6. Parameters weight

The average weight for each individual parameter is then calculated and integrated into the software (Fig. 7).

B. Software

Rule-based software for automatic kitchen layout generation is developed using the Unity development platform. The software is made for I-shape kitchen and support kitchen with a minimal length of 90cm and a maximal of 600cm. Input parameters are:

- Ventilation position
- Water pipe position
- Windows position
- Entry door position
- Exit position

Position of the input parameters can be defined manually using slider or by input of exact dimensions in cm on the kitchen layout presented in top view.

The software uses standard types and sizes for all three major workstation elements in the kitchen as defined in section II. Working surfaces which make space between major workstation elements are modular size (60cm) and only one can be smaller than 60cm, but not smaller than 30cm or bigger than 60cm, but not bigger than 90cm.

When the input parameters are defined, using parameter weights, the software creates the best propositions for kitchen layout (Fig.7).

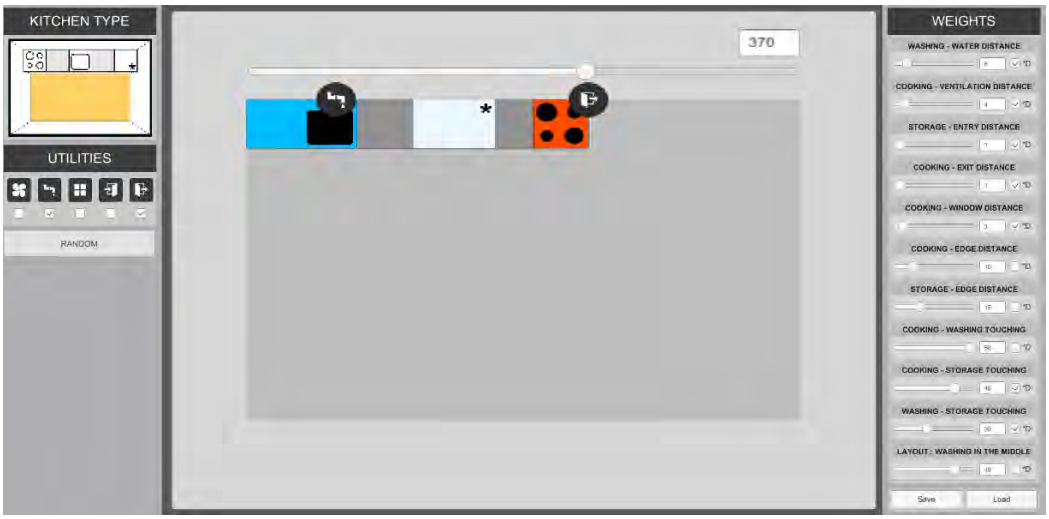

Figure 7. Software for automatic kitchen layout generation

IV. RESULTS

For the purpose of software accuracy determination, test set of 100 samples is created. Test set includes:

- *Subset 1* – different kitchen length, with only one input parameter (entry door).
- *Subset 2* – different kitchen length, with input parameters positioned in same order: entry door at the beginning of kitchen, water pipe, ventilation and exit at the end of the kitchen.
- *Subset 3* – different kitchen length, with different input parameters present without same order.
- *Subset 4* – different kitchen length, with different input parameters and overlapping or very close positioned input positions of water pipe, ventilation and window.

Using the previously developed software, kitchen layout is generated for all samples from the test set. Final layouts are evaluated by 5 experts and results presented in Tab. I.

TABLE I. EVALUATION RESULTS

	Samples	**Correct layout**	
	Number	***Aver. Number***	***%***
Subset 1	10	10	100
Subset 2	20	20	100
Subset 3	30	20.6	68.67
Subset 4	40	18.6	46.50
Total	100	69.2	69.20

V. CONCLUSION

In this paper automatic rule-based system for I-shape kitchen layout generation is created, tested. Final results of testing are evaluated by experts, showing 69.2% accuracy in layout generation. In the simplest case (Subset 1 and Subset 2) without many input data and without complicated positions of utilities, accuracy is 100%. In the more complex cases, with Subset 3 we have 68.67% accuracy and with Subset 4 only 46.5% accuracy. Showing inability of crated rule-based system to deal with more complex samples with overlapping utilities.

Future research should address the same problem of I-shape kitchen layout generation uses different algorithmic approach such as Machine Learning. With the goal to increase the accuracy of generating layouts.

REFERENCES

1. Pejic, P., Jovanovic, D., Marinkovic, J. & Krasic, S. (2019). Parametric 3D modeling of I-shape kitchen, JIDEG, pp. 155-158.
2. Katz, N. (2011). Algorithmic Modelling, Parametric Thinking. *Distributed Intelligence in Design*, pp. 213-231.
3. Schultz, C., Bhatt, M. & Bormann, A. (2017). Bridging qualitative spatial constraints and feature-based parametric modelling: Expressing visibility and movement constraints. *Advanced Engineering Informatics*, *31*, pp. 2-17.
4. Stojakovic, V., Budak, I., Obradovic, R., Koralja, D. & Santosi, Z. (2017). Parametric modeling applied to the virtual reconstruction of the damaged sculpture of St John Nepomuk in Petrovaradin. In *eCAADe*, Rome, Italy.
5. Chaillou, S. (2019). *AI & Architecture, Towards a New Approach*. Harvard GSD.
6. Wang, K., Savva, M., Chang, A. & Ritchie, D. (2018). Deep convolutional priors for indoor scene synthesis. *ACM Transactions on Graphics*.
7. Daniel, R., Wang, K. & Lin, Y. (2018). Fast and Flexible Indoor Scene Synthesis via Deep Convolutional Generative Models. *Computer Vis. and Pat. Rec*.
8. Hall, D. & Giglio, N. (2010). *Architectural Graphic Standards for Residential Construction*. Hoboken, John Wiley & Sons, New Jersy, US
9. Znoy, A. (2004). *Professional interior design: a career guide*. American society of Interior Designers, New York.

Determination of the Adapted Leadership Grid

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Abstract—**Leadership is essential for organizations' effectiveness. Better leadership leads to a more productive organization. One of the problems in practice is the measurement of leadership. As a solution to the aforementioned problem, this paper introduces the Adapted Leadership Grid. The proposed Grid is based on the Managerial Grid developed by Blake and Mouton and can be used for the leadership measurement. The paper can be useful for leaders, members of top management, leadership practitioners and the general public, the professional and scientific public in general.**

Keywords - leadership, leadership measurement, adapted leadership grid, managerial grid, blake and mouton

I. INTRODUCTION

Organizations are more productive if there is open communication between top management and employees. Certain authors [1] imply that a lot of researches have shown that selling is more successful if the organization is characterized by open communication. The relationship between those in leadership positions and employees are very important, but also, dedication to tasks and goals are vital for organization productivity.

To achieve an organization's goal, the leader can have different behavioral approaches. There are two dimensions of leadership behavior: "consideration" and "initiating structure" [2-4]. The term "consideration" describes behavior dedicated to followers' ideas and consideration of their feelings. The phrase "initiating structure" is related to a situation where a leader is defining his role and roles of followers to accomplish the organization's assignments or goals.

The leader can be more dedicated to tasks or relationships with employees. It depends on an organization's goals which is more important and which type of a leader is more preferred for certain organizations or situations.

Firstly, there is a need for understanding leadership and its impact on organization productivity. Implementation of effective leadership is essential for business optimization [5]. To have more exact information if leadership is effective or not, it has to be measured. This paper offers a solution for leadership measurement by introducing Adapted Leadership Grid, based on Blake and Mouton's Managerial Grid.

II. UNDERSTANDING AND DETERMINING LEADERSHIP

Leadership is a phenomenon that is the subject of various researches for more than one century [6]. In [7] leadership is *as a complex process that is difficult to characterize*. Some authors [8,9] point out that there is an almost equal number of leadership definitions and leading researchers. Analyzing leadership approaches, we conclude that there are different leadership approaches and theories [10-17]. Some researchers [18-20] used psychological and quantitative methods is their researches of leadership and the process of social impact.

Leadership exists only if both leader and followers exist. Some authors [21-24] concluded that leaders need followers and followers need leaders.

In [25] leadership is defined *as a process that represents a mutual relationship between leader and followers in which the leader makes an impact on the group to undertake certain activities to achieve a mutual goal.* In [25] a graphical representation of the leadership process is given, as shown in Fig. 1.

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Figure 1. Graphical representation of the leadership process [25].

For this paper and further use, the author proposes a new definition of leadership:

Leadership is a process that represents an interdependent incessant relationship in a group that consists of an individual – leader and a group of individuals – followers, in which leader makes an impact on the followers to undertake some action or perform some activity to achieve a goal that a group perceives as a mutual.

Depending on a leadership style, the leader can be dedicated more to the tasks or the relations with followers. All of the group members can establish external interactions if that is necessary for achieving the determined goal.

III. Introducing Adapted Leadership Grid

A. Managerial Grid as an Influence

The original model of the Managerial Grid was published by [26], and it was further developed [27-29]. In [30] the Managerial Grid is explained as a model that was designed to be used in organizational training and development. The main purpose of this grid was to explain how leaders help their companies to reach their goals through two factors: concern for production and interest for people.

In [31] it is pointed out that the development of Blake and Mouton's Managerial Grid was influenced by Kurt Lewin's work from the 1930s and 1940s, in which he compared using participative and autocratic leadership. In [32] are given conducted researches at the University of Michigan in the 1950s identified two leadership styles, based on the leader's orientation on employee or production. Later theories, such as Theory X and Theory Y by [33] also influenced the development of the Managerial Grid.

Some authors [34] consider Blake and Mouton's managerial grid as the precursor of two-dimensional dual concern models developed to predict conflict and negotiation behaviors developed by other researchers [35-37].

The Managerial Grid (Fig. 2) has two intersecting axes, both divided into nine fields. Each field is marked with numbers from 1 to 9, where 1 symbolizes the lowest score and 9 represents the highest score. On the horizontal axis is a concern for results and on the vertical axis is a concern for people.

The Leadership Grid portrays five major leadership styles: authority–compliance (9,1), country-club management (1,9), impoverished management (1,1), middle-of-the-road management (5,5), and team management (9,9) [38].

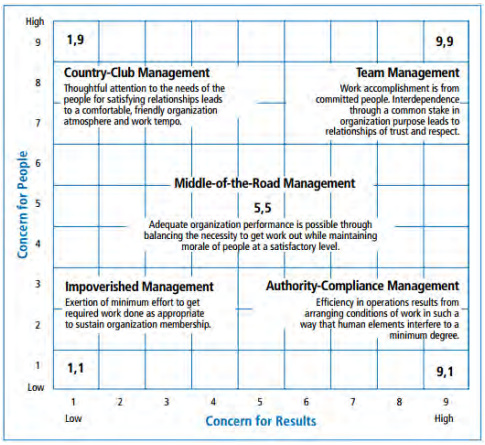

Figure 2. The Managerial Grid [38].

B. Introducing Adapted Leadership Grid

In [38] it is pointed out that *researchers studying the behavioral approach determined that leadership is task behaviors and relationship behaviors* (pp. 96). One of the questionnaires that measures leadership behavior is Leadership Behavior Questionnaire.

By scoring the Leadership Behavior Questionnaire, the respondent can obtain a general profile of his/her leadership behavior. The Leadership Behavior Questionnaire is developed to measure two types of leadership

behaviors, task-oriented behavior, and relationship-oriented behavior.

This questionnaire is consisted of twenty questions, as shown in Fig. 3.

1. Tells group members what they are supposed to do.
2. Acts friendly with members of the group.
3. Sets standards of performance for group members.
4. Helps others in the group feel comfortable.
5. Makes suggestions about how to solve problems.
6. Responds favorably to suggestions made by others.
7. Makes his or her perspective clear to others.
8. Treats others fairly.
9. Develops a plan of action for the group.
10. Behaves in a predictable manner toward group members.
11. Defines role responsibilities for each group member.
12. Communicates actively with group members.
13. Clarifies his or her own role within the group.
14. Shows concern for the well-being of others.
15. Provides a plan for how the work is to be done.
16. Shows flexibility in making decisions.
17. Provides criteria for what is expected of the group.
18. Discloses thoughts and feelings to group members.
19. Encourages group members to do high-quality work.
20. Helps group members get along with each other.

Figure 3. The Leadership Behavior Questionnaire questions [38].

The respondent can indicate a response to each item by selecting one of the five numbers of each item, whereby numbers represent how often that respondent is engaged in the described behavior. A lower number represents less engagement in certain behavior, and a higher number represents more engagement in certain behavior.

The response key is presented in Tab. I.

TABLE I. SCORING INTERPRETATION OF THE LEADERSHIP BEHAVIOR QUESTIONNAIRE

Score	Score interpretation
1	Never
2	Seldom
3	Occasionally
4	Often
5	Always

Summing responses on the odd-numbered items will give the respondent's task score, and summing the responses on the even-numbered items is a relationship score. Scoring interpretation is shown in Tab. II.

TABLE II. SCORING INTERPRETATION OF THE LEADERSHIP BEHAVIOR QUESTIONNAIRE

Score	Task/relationship range
10 – 24	Very low range
25 – 29	Low range
30 – 34	Moderately low range
35 – 39	Moderately high range
40 – 44	High range
45 – 50	Very high range

The Adapted Leadership Grid is using a 10 to 50 scale, where 10 is the lowest score and 50 is the highest score as shown in Fig. 4.

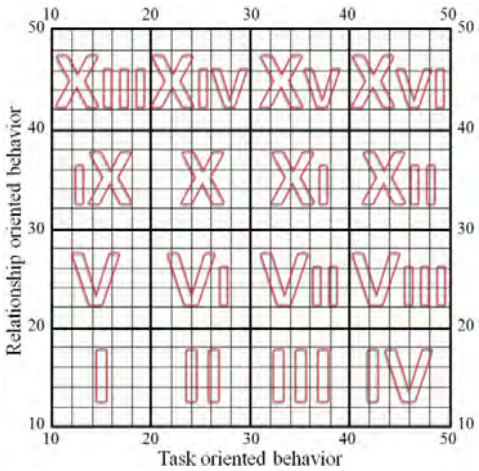

Figure 4. Adapted Leadership Grid.

The Adapted Leadership Grid has two intersecting axes. The horizontal axis represents task-oriented behavior, and the vertical axis represents relationship-oriented behavior. Minimum on the scale is 10 points because 10 is the lowest score respondent can score in The Leadership Behavior Questionnaire. Accordingly, 50 points are the maximum on the scale, because the respondent can score maximally 50 points in the Questionnaire.

The Adapted Leadership Grid is also suitable for more specific analysis. Grid is divided into 16 quadrants, for the simplification of detailed behavior analysis. Researchers can inscribe different results from the same organizations and analyze differences between

task dedication highest and lowest score and relationship dedication highest and lowest scores. Recommended symbols for inscribing mentioned results are given in Tab. III.

TABLE III. SYMBOLS AND THEIR MEANING IN THE ADAPTED LEADERSHIP GRID

Symbol	*Symbol meaning*
	Task dedication highest score
	Relationship dedication highest score
	Task dedication lowest score
	Relationship dedication lowest score
	Individual or organization average

C. *Examples of Using Adapted Leadership Grid*

The Adapted Leadership Grid can be used to graphically present measured leadership based on the scores in The Leadership Behavior Questionnaire. The grid can represent scores of an individual or one whole group, sector or organization.

When labeling results, it is crucial to select a different alphabet letter for each respondent. The letter is followed by two scores in brackets. The first digit in brackets is a task-oriented behavior score and the second is relationship-oriented behavior score.

For example, if respondent A hypothetically scored 34 in task-oriented behavior and 48 in relationship-oriented behavior, it will be noted as A (34,48) and it can be graphically presented as in Fig. 5.

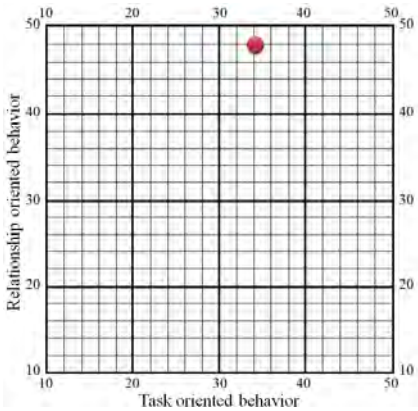

Figure 5. Respondent A hypothetical score.

If respondent B hypothetically scored 42 in task-oriented behavior and 38 in relationship-oriented behavior, it will be noted as B (42,38) and it can be graphically interpreted as in Fig. 6.

Researchers can also use the Adapted Leadership Grid to conduct a more detailed analysis by comparing the results of two or more individuals or organizations. Inscribing results this way gives researchers clearer insight into different leadership behaviors.

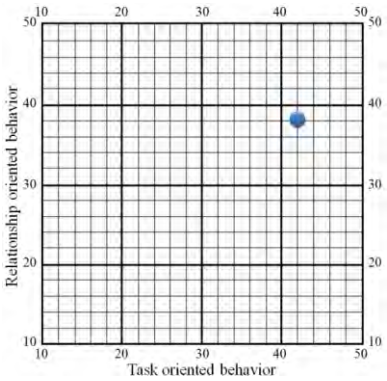

Figure 6. Respondent B hypothetical score.

Additionally, the Grid can be used for examining task-oriented behavior scores and relationship-oriented behavior scores in the same organization and also benchmarking.

Graphical representation of the Grid with two results is shown in Fig. 7.

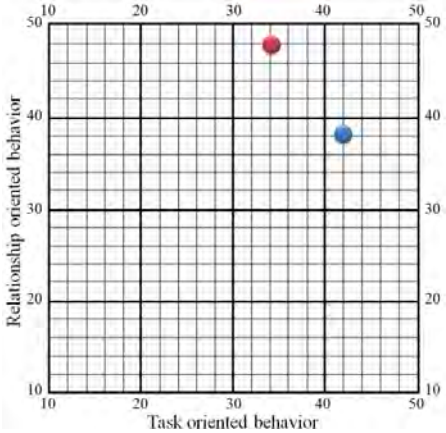

Figure 7. Comparison of hypothetical scores of respondents A and B.

IV. Conclusion

All organizations that want to improve their productivity seek good leaders and work on leadership improvement. The author defined leadership as a process that represents an interdependent incessant relationship in a group, in which leader makes an impact on the followers to undertake some action or perform some activity to achieve a goal that a group perceives as a mutual.

One of the main problems is measuring leadership. The present paper analyzes the need for the measurement of leadership behavior and proposes a solution by defining the Adapted Leadership Grid. Analyzing measured leadership can be used for the improvement of leadership, which will certainly lead to improved productivity of the organization.

The aim of the paper is also to inspire future work to examine further the leadership styles in each of the sixteen quadrants and compare them. This study opens up the possibilities to leaders and top management to have more precise insight on leader's capabilities and dedication to followers and tasks.

Obtained results can be used for comparison between individual results, within and outside of the organization, benchmarking, leadership improvement, and therefore improving the organization's productivity.

References

1. Cvijanović, D., Vukotić, S. & Ivanišević, N. (2017). The Importance of Leadership in Tourism Companies. In *Proceedings of the VI Scientific Conference with International Participation, Strategic Choice and Sustainable Development of Tourist Destinations*, Jahorina Business Forum, 23-24th February 2017, pp. 279-286.
2. Fleishman, E. A. (1957a). A Leader Behavior Description for Industry. In R.M. Stodgill and A.E. Coons (Eds.), *Leader Behavior: Its Description and Measurement*. Columbus O.: Ohio State University, Bureau of Business Research.
3. Fleishman, E. A. (1957b). The Leadership Opinion Questionnaire. In R.M. Stodgill and A.E. Coons (Eds.), *Leader Behavior: Its Description and Measurement*. Columbus O.: Ohio State University, Bureau of Business Research.
4. Fleishman, E. A. & Peters, D. R. (1962). Interpersonal Values, Leadership Attitudes and Managerial Success. *Personnel Psychology, 15*, pp. 127-143.
5. Mirčetić, V., Vukotić, S. & Cvijanović, D. (2019). The concept of business clusters and its impact on tourism business improvement. *Economics of Agriculture, 66*(3), pp. 851-868.
6. Avolio, B. J., Reichard, R. J., Hannah, S. T., Walumbwa, F. O. & Chan, A. (2009). A meta-analytic review of leadership impact research: Experimental and quasi-experimental studies. *The Leadership Quarterly, 20*(5), pp. 764-784.
7. Mirčetić, V. (2018a). Authentic Leadership: Conceptualizing and Development. In N. Žarkić-Joksimović, & S. Marinković (Ed.), *XVI International Symposium SymOrg 2018 – Doing Business in the Digital Age: Challenges, Approaches and Solutions*, pp. 394-399, Zlatibor, 07-10 June 2018: University of Belgrade, Faculty of Organizational Sciences.
8. Bolden, R. (2004). *What is Leadership*. Exeter, UK: Center for Leadership Studies - University of Exeter.
9. Stogdill, R.M. (1974). *Handbook of leadership: A survey of theory and research*. New York: Free Press.
10. Bass, B. (1990). *Bass and Stogdill's handbook of leadership: A survey of theory and research*. New York: Free Press.
11. Gardner, J. W. (1990). *On leadership*. New York: Free Press.
12. Rost, J. C. (1991). *Leadership for the Twenty-First Century*. New York: Praeger.
13. Bryman, A. (1992). *Charisma and leadership in organizations*. London: SAGE Publications.
14. Mumford, M. D. (2006). *Pathways to outstanding leadership: A comparative analysis of charismatic, ideological, and pragmatic leaders*. Mahwah, NJ: Lawrence Erlbaum.
15. Hickman, G. R. (2009). *Leading organizations: Perspectives for a new era*. Thousand Oaks, CA: SAGE Publications.
16. Bryman, A., Collinson, D., Grint, K., Jackson, G. & Uhl-Bien, M. (2011). *The SAGE handbook of leadership*. London: SAGE Publications.
17. Day, D. V. & Antonakis, J. (2012). *The nature of leadership. Thousand Oaks*. CA: SAGE Publications.
18. House, R. J. & Mitchell, T. R. (1977). Path-Goal Theory of Leadership. Journal of Contemporary performance. *Journal of Applied Psychology, 78*, pp. 891–902.

19. Meindl, J. R., Ehrlich, S. B. & Dukerich, J. M. (1985). The Romance of Leadership. *Administrative Science Quarterly, 30*(1), pp. 78-102.
20. Conger, J. A. (1989). *The Charismatic Leader: Behind the Mystique of Exeptional Leadership*. San Francisco: Jossey Bass.
21. Hollander, E. P. (1992). Leadership, followership, self, and others. *Leadership Quarterly, 3*(1), pp. 43–54.
22. Heller, T. & Van Til, J. (1983). Leadership and followership: Some summary propositions. *Journal of Applied Behavioral Science, 18*, pp. 405-414.
23. Jago, A. G. (1982). Leadership: Perspectives in theory and research. *Management Science, 28*(3), pp. 315–336.
24. Burns, J. M. (1978). *Leadership*. New York: Harper & Row.
25. Mirčetić, V. (2018b). Leadership Development and Determination of Modern Approach to Leadership. *FBIM Transactions, 6*(2), 90-97. [in Serbian: Mirčetić, V. (2018b). Razvoj liderstva i determinisanje modernog pristupa liderstvu. *FBIM Transactions, 6*(2), pp. 90-97.]
26. Blake, R. R. & Mouton, J. S. (1964). *The Managerial Grid*. Houston, TX: Gulf Publishing Company.
27. Blake, R. R. & Mouton, J. S. (1978). *The new Managerial Grid*. Houston, TX: Gulf Publishing Company.
28. Blake, R. R. & Mouton, J. S. (1985). *The Managerial Grid III*. Houston, TX: Gulf Publishing Company.
29. Blake, R. R. & McCanse, A. A. (1991). *Leadership dilemmas: Grid solutions*. Houston, TX: Gulf Publishing Company.
30. Northouse, P. (2018). *Leadership – Theory and Practice*. California: SAGE Publications.
31. Burke, W.W. (2017). Robert R. Blake and Jane S. Mouton: Concern for people and production. In D. B. Szabla, W. A. Pasmore, M. A. Barnes, & A.N. Gipson (Eds.), *The Palgrave handbook of organizational change thinkers*, pp. 157–166. New York, NY: Palgrave Macmillan
32. Smith, A., Helm, N., Stark, Z. & Stone, I. (2016). Style theory of leadership. In L. Oakleaf (Ed.), *Organization and administration in recreation, sport, and leisure management*. St. Joseph, MO: Linda Oakleaf.
33. McGregor, D. (1960). *The human side of enterprise*. New York, NY: McGraw-Hill.
34. Cai, D. A., Fink, E. L. & Walker, C. B. (2019). Robert R. Blake, With Recognition of Jane S. Mouton. *Negotiation and Conflict Management Research*. doi:10.1111/ncmr.12151
35. Thomas, K. W. & Kilmann, R. H. (1974). *Thomas-Kilmann Conflict Mode Instrument*. New York, NY: Xicom.
36. Rahim, A. & Bonoma, T. V. (1979). Managing organizational conflict: A model diagnosis and intervention. *Psychological Reports, 44*, pp. 1323-1344.
37. Pruitt, D. & Rubin, J. (1986). *Social conflict: Escalation, stalemate, and settlement*. New York, NY: Random House.
38. Northouse, P. (2016). *Leadership – Theory and Practice*. California: SAGE Publications.

Impact of Competitiveness on Economic Growth (Case Study of WEF Countries)

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Keywords

Competitiveness, economic growth, resource-driven countries, efficiency-driven countries, innovation-driven countries

SUMMARY

Competitiveness is a multidimensional concept that encompasses various aspects of macroeconomic indicators (price and non-price factors related to institutions, infrastructure, and political, social and legal framework), the performance of firms and intercultural aspects on it covers the basis of global value chains. As such, the ability to compete directly and indirectly affects the well-being of a nation and the proper functioning of an economy. There is widespread debate among politicians and scholars today about the meaning and components of competitiveness. Boltho (1996) defines competitiveness as the ability of the economy to provide a higher standard of living. However, Porter (1998) argues that the only meaningful concept of competitiveness is national productivity (2). The World Economic Forum, based on Porter's (1998) definition, has introduced the Global Competitiveness Index (GCI), which is known as the National Competitiveness Measurement Tool. According to this definition, a country's competitiveness is a set of micro and macro-economic factors that determine the extent of a country's productivity and economic growth.

Solow (1957) found, using a gross production function that about 13 percent of GDP growth in the United States was solely due to increases in labor and capital inputs and that, according to him, the majority remained 87 percent. Changes in economic growth have been reflected by changes in technology. However, Solo did not identify the factors that led to technological change, and his study did not prove that technology was a major driver of economic growth. However, over time and in subsequent studies, the main factors of the output of production inputs were expanded through a more general production function by more sophisticated criteria of production inputs including human capital as well as more complex functional relationships. The framework of endogenous growth models has also been broadened and factors such as research and development, patent, entrepreneurship and policies have been incorporated into endogenous growth models. However, less attention has been paid to the role of competitiveness in the economic growth process. Existing studies on the relationship between competitiveness and economic growth have focused mainly on one aspect of competitiveness or on a specific area. Other existing studies have examined one or two dimensions of competitiveness, or discussed competitiveness in a particular year, or assessed competitiveness of selected countries. Previous studies have mainly focused on the relationship between overall economic competitiveness and economic growth, with less emphasis on the effects of different countries' competitiveness on economic growth. In this regard, the key question that this study seeks to answer is whether the different pillars of competitiveness of countries, as a combination and as an ecosystem, explain the economic growth of countries at different stages of economic development. The idea is that the higher the competitiveness of a country, the better the business environment, the higher the entrepreneurship and the more productive technology, and thus the technology will have a stronger impact on economic growth.

According to above statement, many scholars emphasize the importance of the competitiveness of an economy to the improvement of the economic growth. However, studies that quantitatively analyze the interconnection between different components of competitiveness in one economy and its impact on economic growth are very limited. Therefore, the purpose of this study is to fill the gap in the literature on economic growth and to study the effect of these variables in different stages of economic development. In this regard, using the data of 81 countries of the World Economic Forum (WEF) in three groups of resource, efficiency and innovation-driven countries for the years of 2008-2017, the relationship between national competitiveness and economic growth has examined through the econometric model of generalized method of Moments (GMM). The results indicate that the impact of institutions, infrastructure, higher education, business complexity and innovation on economic growth in all three groups of countries is positive and significant. In addition, the impact of labor market efficiency, financial market development and macroeconomic stability has been significant only in efficiency and innovation driven countries, and the impact of primary education and health has been meaningful only in the resource-driven countries. In addition, the effect of the goods market efficiency and market size on economic growth in the innovation driven countries has been significant. In summary, the results of model estimation indicate that the impact of competitiveness factors on the level of economic growth in different countries varies according to the stage of development of countries.

REFERENCES

1. Boltho, A. (1996). The Assessment: International Competitiveness. *Oxford review of economic policy*, *12*(3), pp. 1-16.
2. Porter, M. E. (1998). *The Competitive Advantage of Nations* (2nd ed.). New York: Free Press.
3. World Economic Forum. (2015). Leveraging Entrepreneurial Ambition and Innovation: A Global Perspective on Entrepreneurship, Competitiveness and Development. Geneva: World Economic Forum.
4. World Economic Forum. (2017). The Global Competitiveness Report 2016-2017.
5. Acs, Z. J., Estrin, S., Mickiewicz, T. & Szerb, L. (2018). Entrepreneurship, Institutional Economics, and Economic Growth: an Ecosystem Perspective. *Small Business Economics*, *51*(2), pp. 501-514.
6. Aghion, P. (2017). Entrepreneurship and Growth: Lessons from an Intellectual Journey. *Small Business Economics*, *48*(1), pp. 9-24.
7. Harrison, A. (1996). Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries. *Journal of development Economics*, *48*(2), pp. 419-447.
8. Gardiner, B., Martin, R., & Tyler, P. E. T. E. R. (2006). Competitiveness, Productivity and Economic Growth across the European Regions. *Regional Competitiveness*, *30*, p. 55.
9. Petrariu, I. R., Bumbac, R., & Ciobanu, R. (2013). Innovation: a Path to Competitiveness and Economic Growth. The Case of CEE Countries. Theoretical & Applied Economics, 20(5).
10. Europea Commission. (2014). Reindustrializing Europe. Member states competitiveness report. SWD 278. *Brussels: European Commission.*
11. Niessner, B. (2013). Convergence 2.0. *Erste Group Research–CEE Special Report,* February, 20.

Analysis of the Performance of Knowledge Management in Serbian Public Services

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Keywords

Knowledge management, public services, organizational structure, organizational design, organizational performance

SUMMARY

The goal of modern business is the development of organizational structure and culture in which the knowledge is easily shared among organization members. For the organization that wants to successfully adopt the knowledge management, the practice of knowledge exchange must be integrated in daily routines of employees in an organization. However, there are many factors that may have a negative impact on successful knowledge exchange within an organization.

This study is an attempt to investigate the level of appropriateness of the organizational structure and design of public services in Serbia on the efficiency of knowledge management. The basic of the research were the employees in two dominant public services ″Telecom Serbia″ and ″Serbian Post″. Research cluster implied 300 employees in the territory of Vojvodina, one of regions of Serbia. Basic assumption was that there is a significant correlation between type of the organizational structure and design with the successful functioning of knowledge management, and this study has proven it.

Centralized organizational structure with division of departments, low level of support teamwork and partially trust among employees, represent the causes of mediocre or insufficient cooperation between departments and knowledge exchanges into organization. Research and analysis of the results obtained have indicated that present centralized organizational structure and high hierarchical management of public services do not represent a suitable basis for successful realization of knowledge management, and in same time they represent a relevant factor with negative impact.

REFERENCES

1. Alle, V. (1997). *The Knowledge Evolution*. Expanding Organizational Intelligence, Boston, Butterworth-Heineman.
2. Anand, N., Gardner H. & Morris T. (2007). *Knowledge-based Innovation: Emergence and Embedding of New Practice Areas in Management Consulting Firms*. Academy of Management, *50*, pp. 406-428.
3. Cohen, L. & Prusac, D. (2001). In Good Company. How Social Capital Makes Organization Work, Harvard Business Shool Press.
4. Dalton, D. (2000). Understanding High Perfomance Organizations, Security, *37*.
5. Davenport, T. H. & Prusak, L. (2000). *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press.
6. Fairholm, G. W. (1994). *Leadership and the Culture of Trust*. Westport CT, Praeger.
7. Harman, C. & Brelade, S. (2000). *Knowledge management and the role of HR*. Securing Competitive Advantage in the Knowledge Economy, Prentice Hall.
8. Jensen, P. E. (2005). A Contextual Theory of Learning and the Learning Organization, Knowledge and Process Management, *12(1)*, pp. 53-64.
9. Kezar, A. (2005). What campuses need to know about Organizational Learning and the Learning

Organization. *New Directions for Higher Education*, *131*, pp. 70-72.

10. Philips, C.J. (1997). *Do you Trust me?* Executive Excellence.
11. Schwartz, M. (1995). *Guidelines for Bias-Free Writing*. Indiana University Press, 601 N. Morton, Bloomington, ISBN-0-253-20941-2.

Individual and Policy Mix Effects of Regional and National R&D Subsidies on the Cooperative Behavior of Spanish Manufacturing Firms

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Keywords

Policy mix, behavioral additionality, Spain, R&D subsidies, cooperation

SUMMARY

This study investigates the individual and "policy mix" effects of regional and national R&D subsides on the propensity of Spanish manufacturing firms to cooperate with customers, suppliers, competitors and universities in the period 2010-12. One of the main features of R&D and innovation policy is the existence of a large number of policy instruments [1, 2]. The interplay between policies and instruments is termed policy mix [3, 4]. The concept of policy mix has recently gained ground among researchers and policy makers. Policy mix is associated with different dimensions: policy; governance; geographical; and time [4]. We assess the effectiveness of innovation policy at two governance levels – regional and national. In this context, we also test the hypothesis of complementarity between regional and national public support.

In theory, it is often assumed that the interactions between different policies and instruments are complementary [5], although empirical evidence remains scarce [1,4]. In common with many studies of innovation and the effects of public innovation support, we highlight heterogeneity by firm size. Accordingly, we report separate estimates of regional subsidies, of national subsidies and of the joint effects of regional and national subsidies for both small and medium-sized enterprises (SMEs) and for large firms. We expect that the effects of public support on innovation and, hence, innovation-related activities including cooperation, will be influenced by the resource advantages of large firms – both human and financial – and by SME advantages with respect to flexibility and reaction speeds.

Our panel analysis uses Spanish firm-level dataset, the Encuesta sobre Estrategias Empresariales (ESEE, or Survey on Business Strategies). Dynamic probit models reveals uniformly strong persistence in firms' cooperative behavior, suggesting that cooperation additionality may occur both in the short term and in the long term. Moreover, accounting for the path dependency of firms' cooperative behavior reveals findings otherwise obscured. In particular, among SMEs with a recent history of cooperation with HEIs, we find that R&D subsidies – regional, national and both in a policy mix – induce large positive effects on cooperation with HEIs.

In general, however, we do not find that R&D subsidies promote firms' cooperation and

we find no evidence of systematic complementarities in policy mixes.

We argue that "psychic costs" may help to explain the extreme SME "Cooperators"/"Noncooperators" heterogeneity with respect to cooperation with HEIs. If recent experience of cooperation has attenuated or even eliminated the psychic costs of cooperation, then public policy may have a relatively easier task in moving SME "Cooperators" further along their existing direction of travel than in moving "Non-cooperators" across a behavioral threshold.

A corollary is that public subsidy effects on SME cooperation with HEIs may be an adjustment phenomenon, i.e. acting most strongly while initial experience of cooperation has attenuated the psychic costs of such cooperation but more weakly as the gap closes between actual and private optimum levels of cooperation.

REFERENCES

1. Cunningham, P., Edler, J., Flanagan, K. & Laredo, P. (2016). The innovation policy mix. In *Handbook of Innovation Policy Impact (EuSPRI Forum on Science, Technology and Innovation Policy series)*, pp. 505–542. Edler, J., Cunningham, P., Gök, A., Shapira, P. (eds.), Edward Elgar, Cheltenham.
2. Flanagan, K. & Uyarra, E. (2016). Four dangers in innovation policy studies – and how to avoid them. *Industry and Innovation, 23*(2), pp. 177–188.
3. OECD (2010). The Innovation Policy Mix. In *OECD Science, Technology and Industry*, pp. 251–279. Outlook 2010, OECD, Paris.
4. Flanagan, K., Uyarra, E. & Laranja, M. (2011). Reconceptualising the 'policy mix' for innovation. *Research Policy, 40,* pp. 702–713.
5. Uyarra, E. (2016). The impact of public procurement of innovation. In *Handbook of Innovation Policy Impact*, pp. 355–381, Edler, J., Cunningham, P., Gök, A. and Shapira, P. (eds.). Edward Elgar, Cheltenham.

Social Media and Community: From an Observer to a Participant

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Keywords

Social media, internet, community, participation, libraries

SUMMARY

Information and communications technologies and Web 2.0 environment have significantly improved the possibilities for contemporary audience and users. They have become active participants, content creators, and distributors in various communication processes. The role of audience has shifted from observers to initiators and collaborators. Users and institutions now have significant capacities and potentials for participative practices, so it is necessary that they cooperate and respond together to contemporary challenges. In this paper, we build on Castel's concept of „creative audience "and the idea of creative change and audience's content reception based on the use of information and communication technologies.

Development of participative software apps and Web 2.0 tools has made engagement in specific online activities possible and blurred the line between production and consumption. What makes participatively different today is the fact that social media made participation more accessible to a large number of people. As Nina Simone asserts, the development of Web 2.0 technologies has transformed limited and not so frequent participatively into active engagement that is available to anyone at any time and any place.

The paper discusses various aspects of the implementation of information and communication technologies in libraries, focusing on audience involvement in the activities of these cultural institutions, primarily through the application of Web 2.0 technologies. Accordingly, our analysis proceeds in the direction of implementing various software and technologies in libraries. Participation of users in the work of libraries based on these technologies are discussed through specific examples such as: library website, library blog, library forum, podcast, implementation of wiki and RSS technology, etc. The paper also discusses significant issues concerning the quality, quantity, and impact of thusly generated content on the position and business of libraries in the information society.

In addition to discussing selected examples, the paper points to the basic features and capabilities of information and communication technologies that are important for library theory and practice. These technologies are easy to use and mostly free of charge, they quickly and efficiently connect an institution to a large number of users already located in an online environment (which is one of the key benefits), and they enable collaboration and networking with other institutions and individuals from around the world. Through the analysis of examples, we will see that technological tools and services are generally combined and used concurrently.

The Internet, Web and mobile technologies allow us, with some limitations, to communicate, collaborate, and participate in contemporary culture and society in an easy

way. It is the Internet as a medium that enabled the creation of a completely new space for social interaction. The paper will also show how social online networking software has a great potential to make library services more interactive, as they allow users to post their content, share knowledge, and build online communities.

REFERENCES

1. Beer, D. & Burrows, R. (2010). Consumption, Prosumption and Participatory Web Cultures: An Introduction. *Journal of Consumer Culture 10: 3*.
2. Castells, M. (2009). *Communication Power Oxford University Press*. Inc. New York, USA ISBN:0199567042 9780199567041
3. Cavanagh, F. M. (2014). Micro-blogging practices in Canadian public libraries: A national snapshot. *Journal of librarienship and Information science*, 1-13. Available at: https://mfcavanagh.files.wordpress. com/2010/03/microbloggingsurvey.pdf.
4. Kaplan, M. A. & Haennlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media*, Business Horizons 53*(1), pp. 59-68.
5. Liew, C. L. (2014). Participatory Cultural Heritage: A Tale of Two Institutions' Use of Social Media. *D-Lib Magazine*, *20*(3/4), Available at: http://www.dlib.org/dlib/march14/ liew/03liew.html.
6. Rutherford, L. L. (2008). *Building participative library services:the impact of social software use in libraries*. Library Hi Tech, 26(3), pp. 411–423.
7. Rutherford, L. L. (2008). *Implementing social software in public libraries*, Library Hi Tech, *26*(2), pp. 184-200.
8. Sadeh, T. (2007). *Time for a change: new approaches for a new generation of library users.* New Library World, *108*(7/8), pp. 307–316.
9. Simon, N. (2010). *The participatory museum.* Available at: http://www.participatorymuseum. org/read/
10. Stevens, M. (2007). *Technology Trends for a 2.0 World*, Library technlogy reports. Available at: https://journals.ala.org/ltr/article/view/4829/5793 .

Deploying Artificial Intelligence Imagery Analysis for Creative Work

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Keywords

Artificial intelligence, image analysis, machine learning, big data, creative work

I. Introduction

Due to today's tremendous increase in processing capacity, subsequent innovations, such as digitization, big data analytics, and artificial intelligence, transform business models and management approaches. Often, human capacity to make informed decisions about complex issues and to perform creative work is in the focus when relating the human brain to the 'machine brain'.

Creative work is a central element of knowledge-intensive businesses. As of today, conducting creative work benefits from big data analytics and machine learning. So far, the focus has been on tasks that take advantage of limited artificial intelligence and only require prior supervised learning on similar tasks.

However, technology develops quickly. Numerous AI projects suggest a continuous broadening of AI-supported creative domains. Recently, IBM's Watson created a movie trailer for the horror film Morgan [1]. Google's Deep Dream AI surprised audiences with its imaginative superimpositions of eyeballs, cats, birds, and iguanas onto everyday images [2]. Both instantiations of AI rely on advances in the field of machine learning and allow machines to mimic the functioning of the human brain.

Artificial Intelligence Imagery Analysis (AIIA), another instantiation of AI in the field of machine learning, entails innovative approaches to investigate large amounts of imagery data, such as thumbnails. As thumbnails picture scenes with objects that possess characteristics [3], they can serve as micro-level recommendation entities

In this study, we study how AIIA can assist decomposing thumbnails provided in the context of online video consumption in order to foster the consumption of online videos due to appropriately designed thumbnails.

To this end, we use AIIA to analyze the imagery features of thumbnails presented to promote online videos. Our data source consists of about 400,000 YouTube thumbnail images. We find that thumbnails are an important trigger for consuming videos.

II. Approach

To analyze how different thumbnails, affect the consumption of online videos, we conduct an observational, cross-sectional study. We collected the thumbnails of about 400,000 videos uploaded to YouTube between 2005 and 2015. To 'quantify' the visual content of the thumbnails, we employed AIIA [4]. We used Microsoft Cognitive Services APIs for detecting imagery concepts, faces, and emotions in faces within the thumbnail pictures [5, 6]. Furthermore, we processed all thumbnails with Tesseract, an open-source character recognition engine, to investigate any text in the thumbnails.

Having 'quantified' the visual content of the thumbnails, we conducted multiple linear regression analyses to analyze how different imagery features affect the consumption, here views, of the respective videos.

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III. Findings

We derive the following findings.

- A pictured concept that is shown only once within the dataset / exclusively for a certain video, decreases the video consumption.
- A unique color scheme within a thumbnail – respective to all color schemes in the dataset – increases the video consumption. Apparently, a unique color scheme provides a novel information cue, which drives attention and behavior [7].
- Imagery and text characters in thumbnails lower the consumption of online videos. In contrast, several faces 'loaded with emotion' increase it.
- Emotions in thumbnails promote the video consumption. The effect is especially strong for negative emotions – supporting the 'bad is good' hypothesis [8] that negative emotions better capture attention and are more conducive for getting attention.
- Higher image resolution lowers the video consumption.
- In order to grab the viewers' attention and trigger video consumption, images in thumbnails should be vague, rather than visually complex to trigger [9].

IV. Conclusion

From our study, we conclude that deploying AIIA affects how humans conduct creative work, here how they customize and target thumbnails to audience preferences. Deploying AIIA enlightens the thumbnail 'black box' and uncovers thumbnails as an integral gatekeeper to online video consumption. It helps commoditizing the 'indexing' of complex content such as large video assortments. It provides for reducing users' search costs and leads to machines taking over work formerly conducted by humans – either individual authors or the crowd. Furthermore, based on AIIA, machines can algorithmically align thumbnails to content and as well as target user preferences – at near-zero marginal costs and, if necessary, in real-time. Hence, deploying AIIA may replace humans in the domains of customizing and targeting thumbnails to audience preferences.

References

1. Smith, J. (2016). IBM Research Takes Watson to Hollywood with the First "Cognitive Movie Trailer". Available at: www.ibm.com/blogs/think/2016/08/cognitive-movie-trailer.
2. Hern, A. (2015). Yes, androids do dream of electric sheep. Available at: www.theguardian.com/technology/2015/jun/18/google-image-recognition-neural-network-androids-dream-electric-sheep.
3. Henderson, J. & Hollingworth, A. (1999). High-level scene perception. *Annual Review of Psychology*, *50*(1), pp. 243-271.
4. Cremer, S. & Ma, A. (2017). Predicting E-Commerce Sales of Hedonic Information Goods via Artificial Intelligence Imagery Analysis of Thumbnails, In *Proceedings of the International Conference on Electronic Commerce*.
5. Chen, D., Ren, S., Wei, Y., Cao, X. & Sun, J. (2014). Joint Cascade Face Detection and Alignment. In *Proceedings of the European Conference on Computer Vision*.
6. Yu, Z. & Zhang, C. (2015). Image based static facial expression recognition with multiple deep network learning. In *Proceedings of the International Conference on Multimodal Interaction*.
7. Gleasure, R. (2014). Using distractor images in web design to increase content familiarity: a NeuroIS perspective. In *Proceedings of the International Conference on Information Systems*.
8. Baumeister, R., Bratslavsky, E., Finkenauer, C. & Vohs, K. (2001). Bad is stronger than good. *Review of General Psychology*, *5*(4), pp. 323-370.
9. Deng, L. & Poole, M. (2010). Affect in web interfaces: a study of the impacts of web page visual complexity and order. *MIS Quarterly*, *34*(4), pp. 711-730.

Answer for Innovative Entrepreneurial Reasoning Lies within Quantum Physics?

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Keywords

Entrepreneurship, quantum theory, entrepreneurial reasoning, quantum reasoning, cognitive black box.

SUMMARY

There is a decent number of articles explaining the entrepreneurial thinking and reasoning process. That process has been described as an adaptable process, as a nonlinear process or even as a strategic one [3,5,6]. However, we are quite away not just from a theory, but even the understanding of the entrepreneurial reasoning process. In this paper, I argue that the answer lies in quantum physics and that quantum theory could help us toward the developing of a comprehensive theory of entrepreneurial reasoning.

Quantum physics or quantum mechanics is known as a strange world of the subatomic particles. However, new theories give us some clearer picture of this quantum world [2]. Until recently, there was a hard line between Newtonian and quantum mechanics [10]. Quantum physics finds its place in the management literature, as well [1, 9]. Most important, some authors argue [4] that quantum physics may be the optimal method of reasoning and processing information.

The Schrödinger cat is widely used as an example of the complexity of the quantum world [8]. That black box where a cat could be simultaneously dead and alive is a fine example of quantum reasoning, as I see it. A cognitive black box capable of creative and complex reasoning, not just of the successful entrepreneurs, but the successful leaders and critical thinkers, as well. A creative thinker will build the ideas. Further, he will make a complex connection among them, in order to get a clear bigger picture. He is capable to find the right information in a correct place in the black box, in similarity to the wave-particle duality in quantum physics. It is a sense where to search and how to recognize the required information. An entrepreneur-thinker will recognize any quality of one information in many aspects and different relations with others, in similarity to the superposition in the quantum world. Moreover, he understands fully the effect of a changing fact, idea or information on the other connections in his reasoning system, in similarity to the entanglement in the quantum theory. That thinker is an ingredient of that subjective inner world. With the disturbance he makes and the probabilities he senses and without his interference that inner world would not exist, in similarity to the measuring in the quantum physics.

The cognitive black box components are quantum gravity fields of the box. The main ideas are the central points of those quantum gravity fields. Those leading ideas are the forces, which affect the space-time in the curvatures Einstein would not recognize. The cognitive box is an open system. Present time, current connections and their present complexity are important, but the openness also assumes the bond with the past and the future. However, the time is not similar to the time we are sensing in our world, some combination of ideas could be of use only when an entrepreneur-thinker sense that the time is right. It is important not to hold some universal truths. That is a path to the closed system, which leads to the entropy and death of the idea. Therefore the old logic thinking is not welcomed in

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quantum reasoning. Religious thinking is an example of the old logic. If a deity is declared in some holly book, old logic will lead to believing. The quantum logic would use the known facts in the present time, unencumbered with the old reasoning. The outcome of the present knowledge, their complex linkages, and the quantum logic should be the probability of the existence of that deity. Quantum reasoning asks for quantum logic. Quantum logic is resulting from the complex connections in the black box and the possibility of the potential outcomes. It is important to recognize all necessary elements that build that quantum reasoning system and to understand the linkages. Quantum logic is forcing the thinking process toward the big picture, where all blanks or dark matters are not hidden anymore. An innovation is made, the possibility of success is high and the risk of the failure is the lowest.

Bill Gates' wife Melinda explains the reasoning process of her husband as chaos [7]. He thrives on complexity. The ways Bill can see all the ideas together other people cannot see. "I wouldn't wanna be in that brain" conclude Melinda Gates and I couldn't agree more, because there is a sharp difference between the brain of entrepreneurs and non-entrepreneurs, as well as between that quantum world we can sense and our world we can see.

REFERENCES

1. Adžić, S. (2004). *Lider in marketing. [Lider u marketingu]*. Economics Institute, Belgrade.
2. Ball, P. (2018). *Beyond Weird: Why Everything You Thought You Knew about Quantum Physics Is Different*. University of Chicago Press, Chicago.
3. Dhliwayo, S. & Vuuren, J. J. V. (2007). The strategic entrepreneurial thinking imperative. *Acta Commercii*, *7*(1), pp. 123–134.
4. Fuchs, C. A. (2002). Quantum Mechanics as Quantum Information (and only a little more). *ArXiv:Quant-Ph/0205039*. Retrieved from http://arxiv.org/abs/quant-ph/0205039
5. Groves, K., Vance, C. & Choi, D. (2011). Examining Entrepreneurial Cognition: An Occupational Analysis of Balanced Linear and Nonlinear Thinking and Entrepreneurship Success. *Journal of Small Business Management*, *49*(3), pp. 438–466.
6. Haynie, J. M., Shepherd, D., Mosakowski, E. & Earley, P. C. (2010). A situated metacognitive model of the entrepreneurial mindset. *Journal of Business Venturing*, *25*(2), pp. 217–229.
7. Inside Bill's Brain: Decoding Bill Gates. (2019). Retrieved from https://www.netflix.com/rs/title/80184771
8. Schrödinger, E. (1935). Die gegenwärtige Situation in der Quantenmechanik. *Naturwissenschaften*, *23*(48), pp. 807–812.
9. Wheatley, M. J. (2006). *Leadership and the New Science: Discovering Order in a Chaotic World* (3rd edition). Berrett-Koehler Publishers, San Francisco.
10. Yurov, A. V., & Yurov, V. A. (2019). The day the universes interacted: Quantum cosmology without a wave function. *The European Physical Journal C*, *79*(9), p. 771.

Entrepreneurship and Economic Growth: the Mediation Role of Access to Finance

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Keywords

Citizens access to finance, entrepreneurship, economic growth, mediation effect

SUMMARY

A growing body of research revealed positive effects of entrepreneurship on a variety of economic indicators including investment and foreign direct investment [1-3], productivity[4,5], the borrowing cost for governments and firms [6], income and wealth equality [7], human capital development [8], exports [9], per capita GDP and economic growth [10,11]. Prior empirical studies have been addressing the relationship between entrepreneurship and economic growth [12,13]. However, some of contributions have been addressing the nature and extent of the relationship between finance and Economic growth.

The main reason why finance matters is that financial development and intermediation has been shown empirically to be a key driver of economic growth and development. Finance (financial intermediation) motivates savers to save by offering them a range of instruments to fit their financial needs, channels savings to investors and in the process broadens investment opportunities, increases investment, ameliorates risk sharing, increases growth of the real sector, enables individuals and business entities to smooth income and consumption profiles over time, and there is some evidence that through this process it not only leads to economic development but it may play a positive role in reducing poverty and income inequality.

Despite of its essential role in the progress of efficiency and equality in a society, 2.7 billion people (70% of the adult population) in emerging markets still have no access to basic financial services, and a great part of the them come from countries with predominantly Muslim population. With growing interest in developing a financial system, it would be worthwhile to explore what is the contribution of finance in entrepreneurship-growth nexus. Access to finance is growing at a fast pace in all over the globe as the demand for financial products and services.

Analyzing the previous studies, we can notice that the results are mixed. Most of the studies used direct relationships to confirm the impact of entrepreneurship on economic growth. Some of them have proved the significant impact of entrepreneurship on economic growth [14,15], while some studies have shown insignificant impact of entrepreneurship on economic growth in a direct relationship [16]. The insignificant direct relationship of the variables and the importance of entrepreneurship, finance and economic growth relation push us to think about the indirect and moderating relationship, which is the main goal of the current study. In addition, while prior research focused primarily to determine if there is a relationship between any pair of these three variables. As a result, the purpose of this research is to examine the mediating role of finance in the relationship between economic growth and entrepreneurship

in a sample of 67 GEM countries. We developed a model where banking finance as a proxy for Access to finance mediates the relationship between the total early stage entrepreneurship (TEA) as a proxy for entrepreneurship and economic growth. Correlation, Baron and Kenny approach (causal steps approach) and PROCESS Macro (normal test theory) developed by Hayes were used to find out the direct and indirect effects of access to finance between entrepreneurship and economic growth. The bootstrap mediation results indicated that finance was a significant predictor of entrepreneurship and entrepreneurship was a significant predictor of economic growth. These findings support the mediation hypothesis. In addition, findings showed that there is a positive relation between entrepreneurship and economic growth and a positive relation between finance and economic growth in selected GEM countries. Furthermore, the findings of this study indicate that the total association between entrepreneurship and economic growth is not only direct, but also that entrepreneurship contributes to levels of economic growth through the increased levels of finance. As a result, countries with higher levels of access to finance tended to experience entrepreneurship at higher levels, which in turn contributed to the emergence of increased levels of economic growth. The results indicated that the direct effect of entrepreneurship on the economic growth remained significant when controlling for finance, thus suggesting partial mediation. In other words, finance only mediates part of the effect of entrepreneurship on economic growth.

REFERENCES

1. Habib, M. & Zurawicki, L. (2002). Entrepreneurshp and foreign direct investment. *Journal of international business studies, 33*(2), pp. 291-307.
2. Mauro, P. (1995). Entrepreneurshp and growth. *The quarterly journal of economics*, pp. 681-712.
3. Tanzi, V., & Davoodi, H. (1998). Entrepreneurshp, public investment, and growth. *The Welfare State, Public Investment, and Growth*, pp. 41-60, Springer Japan.
4. Lambsdorff, J. G. (2003). How entrepreneurshp affects productivity. *Kyklos*, *56*(4), pp. 457-474
5. Rivera-Batiz, F. L. (2002). Democracy, governance, and economic growth: theory and evidence. *Review of Development Economics, 6*(2), pp. 225-247.
6. Ciocchini, F., Durbin, E. & Ng, D. T. (2003). Does entrepreneurshp increase emerging market bond spreads? *Journal of Economics and Business, 55*(5), pp. 503-528.
7. Jong-Sung, Y. & Khagram, S. (2005). A comparative study of inequality and entrepreneurshp. *American Sociological Review, 70*(1), pp. 136-157.
8. Rose-Ackerman, S. (2008). Entrepreneurshp. *Readings in public choice and constitutional political economy*, pp. 551-566.
9. Zelekha, Y. & Sharabi, E. (2012). Entrepreneurshp, institutions and trade. *Economics of Governance, 13*(2), pp. 169-192.
10. Kaufmann, D. & Kraay, A. (2003). Governance and Growth: Causality which way? Evidence for the World, in brief. Manuscript. World Bank publication.
11. Kaufmann, D. Kraay, A. & Mastruzzi, M. (2009). Governance matters VIII: aggregate and individual governance indicators, 1996-2008. World Bank policy research working paper, (4978).
12. Broadman, H. G. & Recanatini, F. (2001). Seeds of entrepreneurshp–Do market institutions matter? *MOST: Economic Policy in Transitional Economies, 11*(4), pp. 359-392.
13. Aidt, T. S. (2009). Entrepreneurshp, institutions, and economic development. *Oxford Review of Economic Policy, 25*(2), pp. 271-291.
14. Baumol, W. J. (1990). Entrepreneurship: Productive, unproductive, and destructive. *Journal of Business Venturing, 11*(1), pp. 3-22.
15. Kreft, S. F., & Sobel, R. S. (2005). Public policy, entrepreneurship, and economic freedom. *Cato J., 25*, p. 595.
16. Hartog, C., Van Stel, A. J., & Storey, D. J. (2010). Institutions and entrepreneurship: The role of the rule of law. EIM Scales paper H, 201003.

Dimension of Leadership in the Concept of "Smart" Cities in Serbia

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Keywords

Smart city, medium-sized city, challenges of leadership cooperative leadership, participation of citizens

SUMMARY

"Smart" city is a relatively new concept in today's academic literature, and also a wide one [1] in Serbia, it was first used in 2013. when the author was defending the subject of the doctoral thesis. Today, it is still a new and unimaginable concept in a poor, centralized and highly corruptive state [2]. The context of Serbian society is an unimaginable environment for the development of "smart" cities. But that isn't true. There are many different ways of developing a smart city – from neoliberal, corporative to citizen oriented.

If we put aside the Huawei's pilot project in Niš, as a potentially first smart city in Serbia, because it is a corporative and neoliberal way of developing "smart" city, (and willing to say, it is a premature state directive), there are many more logical and fruitful ways for a city to get on a path to "smart".

In the Strategy of Spatial Development of the Republic of Serbia, "medium-sized" cities are best candidates for "smart" cities because they do not have problems like agglomerations (waste disposal, crowded traffic, etc.) and they have much better quality of life.

In academic and non-academic literature there are mentioned six different dimensions of smart cities – people, environment, mobility and transport, quality of life, economy and leadership. The author takes, as most eligible, Rudolph Giffinger method of examining "smart" cities because it is quantitative and qualitative at the same time [3], and it's highly comparable with official national statistics of Serbia, which enabled the ranking of medium-sized cities (in Serbia).

Leadership in Serbia is facing many problems, on the local level especially – from political use of resources to neglecting citizen's "right to the city".

In the analysis of potentially "smart" cities in Serbia, orienting the analysis on medium-sized cities, and using data from statistics as well as from case studies, author respectably insists that the most important dimension for developing "smart" cities in Serbia is the dimension of leadership that has to be cooperative and not centralistic (as it is today) and has to include a wide specter of citizen participation. It is that social component is often neglected in the research of "smart" cities and the use of qualitative research is indicating that it is the most crucial component that could trigger the development of medium-sized cities in Serbia, as potentially "smart" cities.

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REFERENCES

1. Albino, V., Umberto B. & Dangelico, R.M. (2013). Smart Cities: Definitions, Dimensions,

and Performance. In *Proceedings IFKAD*, pp. 1723-1738.

2. Fiscal council, [Fiskalni savet]. http://www.fiskalnisavet.rs/doc/istrazivacki-radovi/FS-Radni-dokument-2019-01.pdf
3. Giffinger, R. (2007). Smart cities: Ranking of European medium-sized cities. Final report. Centre of Regional Science, Vienna University of Technology.
4. Kitchin, R. The Promise and Perils of Smart Cities. https://www.scl.org/articles/3385-the-promise-and-perils-of-smart-cities
5. Kummitha, R. K. R. & Crutzen, N. (2017). How do we understand smart cities? An evolutionary perspective. *Cities, 67*, pp. 43–52.
6. Lefevr, A. (1980), Theory of space, [Teorija prostora]. *Treći program Radio Beograda, 45(II),* pp. 557-651.
7. Petrović, M. & Toković, M. (2016). Neo-endogenous development and ecological paradox: case study of six cities in Serbia, [Neoendogeni razvoj gradova i ekološki paradoks: studija slučaja šest gradova u Srbiji]. *Sociologija (special ed.)*, *LVIII*, pp. 181 – 209.
8. Ralev, R. (2019). Huawei to launch smart city pilot project in Serbia's Nis. https://seenews.com/news/ huawei-to-launch-smart-city-pilot-project-in-serb ias-nis-652301
9. Stojkov, B. (2006). City status, decentralization and polycentricity of Serbia, [Status grada, decentralizacija i policentričnost Srbije]. In *Damjanović, D., & Milenković, D. (ed.), U susret novom statusu gradova u Srbiji - realnost i potrebe*. PALGO centar, Belgrade.
10. Ministry of Environment and Spatial Planning, Republic Agency for Spatial Planning. (2009). Spatial Development Strategy of the Republic of Serbia, [Strategija prostornog razvoja Republike Srbije 2009-2013-2020].
11. Todorović, M. (2013). Challenges of "smart" cities' development in Serbia [Izazovi razvoja "pametnih" gradova u Srbiji]. http://webserver.rcub.bg.ac.rs/publicFileDownload?idSednicaMaterijal=17141

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