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Table of Contents

Human-computer Interaction in Medicine and Biomedical Engineering3
Jasmina Lozanović, Maja Đurović-Petrović
The Role of Transformational Leadership on Business Agility and Success in the
Digital Age
Jelena Lukić Nikolić, Charles Ramendran
Comparative Analysis of the Social Dimension in the Higher Education
Strategies of the EU Member States and Candidate Countries13
Biljana Stankov, Nataša Papić-Blagojević
The Healthcare Concept of Industry 4.0 - Digitalisation of Health Protection21
Radoje B. Jevtić, Ivana D. Janković, Momčilo B. Randjelović
The Influence of Ease of Doing Business on Innovation in Developing
Countries
Mohsen Mohammadi Khyareh
Overview of Studies Regarding Knowledge Management Efficiency Factors33
Verica Gluvakov, Mila Kavalić, Mihalj Bakator, Dejan Bajić, Stefan Ugrinov
Some Aspects of the Criminal Potential of Artificial Intelligence41
Aleksandar Filipović, Željko Bjelajac, Boro Merdović, Lazar Stošić
The Role of Machine Learning in Marketing Strategies within the Marketing 5.0
Framework
Mihalj Bakator, Dragan Ćoćkalo, Luka Đorđević, Mića Đurđev, Borivoj Novaković,
Slavica Prvulović
The Impact of Globalization on the Development of New Knowledge of Project
Managers
Zorana Tomić, Angela Fajsi, Slobodan Morača
Predictive Analysis on Absenteeism at a Workplace using Explainable AI63
Abhirup Bhattacharya, Soumi Majumder
The Impact of R&D Activities on Total Factor Productivity in Serbia:
Application of the Generalized Method of Moments Approach71
Lidija Madžar, Drinka Peković

Evaluating the Influence of ICT on Economic Growth: Insights from the MINT
Countries
Yilmaz Bayar, Oğuzhan Yelkesen
Ethical Problems in Communication with Consumers when Declaring, Labeling
and Advertising Food Products85
Nina Milošević
Project Financing of Local Self-government Units in the Republic of Croatia
with Funds as a New Development Concept, Risks and Benefits93
Dragan Dokić, Vesna Gantner
The Role of Brand Re-innovation in the System of Reinnovation Radar99
Tatjana Mamula Nikolić, Nenad Perić
The Knowledge Economy and Technology Bubble in the IT Sector105
Oleg Sukharev
Three Theories of Knowledge and Society111
Nikola Mlađenović
Application of Machine Learning in Investment Portfolio Structuring119
Vladimir Živanović
Risks of Consumer Behavior Changes: Reflecting on the COVID-19 Pandemic
Changes
Lenka Veselovská
Digitization in the Application of the Quality 4.0 Concept
Svetlana Stojkov, Edit Terek, Dragana Milosavljev
Smart City Risks
Mihaela Tarakcija, Goran Tepic
Adopting Digital Business Models: The Pivotal Role of Big Data in Guiding
Managers
Jelena Lukić Nikolić, Pero Labus
Real Economic Challenges of the Republic of Serbia's Exchange Rate155
Jasnima Šmigić-Miladinović, Milan Veselinović

The Impact of ICT Development on Economic Growth in Developing
Countries
Mohsen Mohammadi Khyareh
Examining the Side Effects of Digital Dialogue in the Classroom171
Momčilo B. Randjelović, Radoje B. Jevtić, Ivana D. Janković
The Role of School Culture in Creating an Image177
Dinko Jukić
New Trends in Organizational Learning
Bojana Jokanović, Nikola Stojić, Andrea Okanović, Ivana Tomić
The Use of Advanced Manufacturing Technologies for Sustainability in the
Context of Society 5.0
Dragan Ćoćkalo, Mihalj Bakator, Sanja Stanisavljev, Mila Kavalić, Dragana Kovač
Support for the Financing of Infrastructure Projects from European Union
Funds on the Example of the Construction of a Logistic Centre in Novi Sad199
Aleksandra Pavlović, Angela Fajsi, Slobodan Morača
The Impact of Artificial Intelligence on Social Media Marketing207
Slađana Starčević
Start-up Ecosystem in India: Problems and Prospects
Manya Gupta
Design Thinking and Creative Problem Solving in Modern Organizations221
Dragana Kovač, Edit Terek Stojanović, Verica Gluvakov, Stefan Ugrinov,
Maja Gaborov, Igor Vecštejn
EU Investments in the Republic of Serbia - Importance and Forecasting
Possibilities
Nataša Papić-Blagojević, Biljana Stankov
The Importance of Knowledge Management in Public-private Partnership
Projects
Aleksandar Đorđević, Biljana Rakić
Capital and Risk in the Tax System
Constantinos Challoumis

Building Resilience to Job Loss of Older Workers by Enhancing Their Digital
Literacy
Anđelka Stojanović, Isidora Milošević
Transformational Leadership, Police Resilience and Psychological Well-being
during the Covid-19 Crisis
Muhammad Azuwar Dol Mofti, Gazi Md Nurul Islam
Management of Innovations in Modern Business Processes
Ljiljana Stošić Mihajlović, Marija Mihajlović
Algorithmic Management: Utopia or Dystopia of the Platform Work?
Tijana Kovačević
Facilitating Innovation and Competitiveness: The Intermediary Function of the
Ease of Doing Business
Mohsen Mohammadi Khyareh
The Concept and the Role of the Operator in Industry 4.0
Radoje B. Jevtić, Ivana D. Janković, Momčilo B. Randjelović
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Application of Porter's Models in the Analysis of Strategic Competitive
Positioning in the Rakija Market in Serbia
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Application of Porter's Models in the Analysis of Strategic Competitive Positioning in the Rakija Market in Serbia
Application of Porter's Models in the Analysis of Strategic Competitive Positioning in the Rakija Market in Serbia

The Role of Artificial Intelligence in Human Resource Management
Biljana ilić, Zorica Djurić, Bojana Ostojić
Job Satisfaction in Scrum Teams
Maja Gaborov, Dragana Kovač, Nemanja Tasić, Dragan Kreculj,
Nada Ratković Kovačević
The Impact of Mobile Cloud Computing on Entrepreneurship and
Start-ups
Tiana Anđelković, Milica Stanković, Gordana Mrdak
Value-semantic Concepts of the Text in the Formation of the Pedagogical
Picture of the World among Graduate Students
Chumicheva Raisa, Reznichenko Anna
Risk-Based Thinking in the ISO 9001:2015 Standard
Dragoljub Šarović
Does the Capacity for Artificial Intelligence in Developed Countries
Significantly Differ from that in Developing Countries?
Dejan Romih, Blaž Frešer
The Attitude of Preschoolers to Monster Toys
Klopotova Ekaterina, Smirnova Svetlana, Tokarchuk Yulia
Students' Attitudes towards Entrepreneurship as a Contributing Factor of
Economic Change
Kosovka Ognjenović
Assistive Technology for Elderly People in Long-term Care Settings
Mengxuan Chen
Sustainable Human-computer Interaction
Jasmina Lozanović, Maja Đurović-Petrović
The Ethics Gap in Adolescents' Online Communication
Margarita Khusnutdinova, Tatiana Poskakalova
Public Health and Population Perspective of COVID-19 as a Global
Pandemic
Nazneen Akhter, M. Salim Uzzaman, Amr Ravine

Strategic Planning for Green and Innovative Regional Development
Inna Koblianska
Role of Financial and Digital Inclusion on Economic Growth of Asian
Countries
Shumaila Zeb, Asma Javed
Leaders and Followers: A Check Against Reality
Sergey Ivanov
Digitalisation of Public Services in Hungary
Edit Soós
Dynamics of Emotional State by Senior Adolescents in the Text Reading and
Video Games Conditions
Evgeniya Gavrilova, Elena Shepeleva, Ekaterina Valueva
Right to Work in Digital Environment (A Perception of Increasing
Digi-technological Unemployment)
József Hajdú
Pros and Cons of Being Digitally Involved
Abrosimova Larisa, Bogdanova Marina, Tatarchenko Andrey
Assessing the Influence of Artificial Intelligence on Knowledge Management in
Educational Institutions: A Comparative Study of India and Poland
Ashish Jorasia, Aksana Chmyha
Network Analysis of the Relationship between Personality Traits and Online
Behavior in Adolescents and Young Adults
Rubtsova Olga, Artemenkov Sergei, Salomatova Olga

Human-computer Interaction in Medicine and Biomedical Engineering

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Abstract— This work considers human-computer interaction (HCI) in medicine and healthcare engineering. Nowadays, HCI is mandatory in Medical engineering. Furthermore, medical devices are unimaginable without computers and HCI. There is no good healthcare without HCI. Most modern medical diagnostic methods include HCI. Medicine without modern technologies is blind. The link between medicine and technology is a human.

Keywords – HCI, healthcare, biomedical engineering, medical devices.

I. INTRODUCTION

The field of human-computer interaction (HCI) examines how computer technology affects human labor and activities [1].

Bearing in mind the Industrial Revolutions, the human-computer interaction has been present since the third industrial revolution, while the human-machine interaction can be taken with the first industrial revolution. Industry 4.0 and the visions of Industry 5.0 are unthinkable without HCI.

Computer technology includes computers, mobile phones, vehicle multimedia systems, engine control unit, embedded sensors and actuators, ultrasound devices, surgical robots, and many more. Computers are present in all technological processes, and interaction between computers and humans is indispensable. Therefore, every day, each of us encounters interaction with a computer. HCI become part of our everyday life, e.g., smart homes, cars, and professional life. The use of computers has brought numerous benefits in the development of science, so we can freely say that medicine without computers is unimaginable today. One of possible Human-Computer Interaction is shown in Fig. 1.

Like physical computing, physiological computing can be defined as the research and development of interactive software and hardware systems capable of sensing. processing, responding to, and connecting the digital and analog worlds. The difference between the two is that the computer focuses on using biosignals, creating a particular class of problems. Although biomedical engineering is the classic discipline associated with this field, biosignals applied to human-computer interaction (HCI) are leading researchers in information technology, electrical engineering, and many other fields [2].



HCI plays one of the most essential roles in medical decision-making [3]. Various research fields are strictly linked to HCI and clinical decision-making: Interfaces, Visualization, Electronic Health Records, Devices, Usability, and Clinical Decision Support Systems [3].

II. CLASSIFICATION OF THE RECENT HCI IN CLINICAL PRACTICE

Research conducted in the past focused on ergonomics and usability in the design of medical devices [4], as these factors were pivotal for obtaining regulatory endorsement.

Nowadays, digital engineering and biomechatronics, including HCI, are standard everyday clinical practices and crucial healthcare rules.

Classification of recent clinical practice HCI advances could be divided into four corresponding branches [3]. HCI in medical decision-making are

- Graphical User Interfaces
 - Medial GUI design
 - Applications of medical GUIs
 - Interactive visualization
- Electronic Health Records
 - EHRs and information technology
 - HER-based data analytics and integration
- Clinical Decision Support System
 - Text-mining
 - IoT and shared decisionmaking
 - Pathology oriented
 - User acceptance
- Usability in clinical decision-making
 - User-centered design
 - Usability and performance evaluation
 - Usability in EHR and CDSSs

Moreover, we can agree that all biomedical engineering activities include HCI in one or more aspects. Biomedical engineering covers biomechanics, biomaterials, human



performance engineering, rehabilitation engineering, bioelectric and physiological systems modeling, biosignals and biosensory, biomedical instrumentation and devices, neural engineering, medical and infrared imaging, medical robotics, medical and biological analysis biotechnology, molecular, cell and tissue engineering, regenerative medicine and cell therapies. personalized medicine. biomimetics, bioMEMs, prosthetic devices, artificial organs, telemedicine and e-health, clinical engineering and medical informatics [5].

The HCI community frequently finds the healthcare setting to be an alien environment. Conducting research in such circumstances presents substantial personal and professional obstacles, and there is a strong focus on acceptable ethical behavior, risk minimization, and patient safety. The HCI community can learn a lot from clinical and health service research about effective research in these types of settings [6].

Various types of interactive technologies are utilized for the provision of clinical care and the facilitation of self-management. These encompass medical devices that measure vital signs and administer therapies; information and decision support systems that aid in diagnosis and decision-making processes; and electronic health records that document data, diagnoses, and interventions. The functions of these diverse systems are depicted in Fig. 2. A simplified and generalized care pathway can be characterized as encompassing measurement, diagnosis, and decision-making stages, as well as the administration of therapies (such as medications, radiotherapy, or surgery) and the subsequent monitoring through additional measurements, decisions, and interventions as required. This care pathway is illustrated in the central cycle. The data derived from measurements, diagnoses, decisions, interventions, and their outcomes are all documented in the care record [7].

III. EXAMPLES OF GOOD PRACTICES OF HCI, MEDICAL ENGINEERING AND HEALTHCARE

One of the examples of direct application and multiple interactions of HCI is the constant monitoring of patients who have diabetes. This is particularly important when treating and determining adequate therapy for children with diabetes. Fig. 3 illustrates the interaction of HCI in treating diabetes [8]. Based on Fig. 3, it is clear that we have multiple HCI interactions, which the Internet of Things technology (IoT) certainly made possible.

In this type of solution for diabetes monitoring, the doctor is and must remain the key factor that will decide on the therapy of each individual patient.

The following example is monitoring the fluid balance in the human body by re-applying HCI. This is of vital importance for patients in intensive care. Obtaining a mathematical model with the possibility of monitoring is attached in



the paper [9]. An expert system for monitoring the patient's condition can be developed by improving this system. Ideally, the doctor could use a computer to regulate the therapy given to the patient through an infusion. The expert system would also send appropriate warnings to the medical staff. Working in intensive care units and monitoring the condition of the most medically demanding patients would not be possible without human-computer interaction.

To determine the ideal shape for locking compression plates (LCP) in terms of integrity and life, fatigue crack formation in orthopedic locking compression plates (LCP) under fourpoint bending has been modeled using the extended finite element technique (xFEM). For three distinct body weights (60, 90, and 120 kg), loads matched those in the human tibia during the gait cycle [10]. Such research would not be possible without modern technologies that are also used for medical engineering. In addition to load simulations, different images were used here and subsequently analyzed via computer.

In several papers [11-13] it was shown that ion channels could be modeled using HCI and system theory, i.e., system identification known in automatic control theory. In addition, the future of dynamic models obtained with this methodology is in applying nanorobots that would be guided and controlled by an expert system with the application of appropriate control algorithms. This kind of technology related to HCI would enable the treatment of cancer cells in a completely different way, Fig. 4.

Otherwise, the application of micro and nano machines in medicine is an area that is still developing, and it should be borne in mind that these machines represent computers at the micro and nano level.

In addition, by applying system theory, system identification, and control engineering, it is possible to develop a mathematical model of the spread of an epidemic or pandemic in an entirely new way [14]. An example is shown by the application of HCI when a new way of developing the pandemic model was established on the example of the Coronavirus and COVID-19. Of course, the control algorithm in this case also raises some ethical questions, which can be discussed.

IV. CONCLUSIONS

HCI plays a crucial role in all Medical aspects. United Nations defined sustainability goals, and healthcare and industry are included.

We expect the interaction with the computer will be further improved in the coming years, especially considering the era of digital engineering and industry 5.0. Of course, the development of artificial intelligence will significantly affect human-computer interaction and open up additional questions, but that is the future we create and the rules we, humans, set.

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The Role of Transformational Leadership on Business Agility and Success in the Digital Age

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Abstract-Leaders are viewed as powerful individuals, and in the corporate environment, they are viewed as the conduit for the working system. Leading a corporation or a team requires a mindset that is in demand in this day and age, and leaders must be well-versed in digitalization. As a result, transformational leaders are the most capable individuals in transitioning corporations into digitalization and may have the best traits for the present business trend. Transformational leadership represents the basis for understanding transformation. and promoting digital globalization, new products, new services, and sustainability. Transformational leaders are critical enablers of organizational change in the digital age. The kev characteristics of transformational leaders are anticipation of future needs and challenges, dealing with complex problems, conducting a holistic examination and analysis of all factors - both internal and external, and motivating followers to execute vision, mission and goals. The impact of transformational leadership on business success of corporations in the digital age is discussed in this paper. The paper provides an important conclusion for leaders and managers of corporations that operate in the digital age.

Keywords - Transformational leadership, leaders, digital age, digital business, agility.

I. INTRODUCTION

Leadership is a critical factor in determining organizational effectiveness, particularly during strategic transformation in the digital age. According to definition, leadership is the process through which one person (the leader) inspires a group of people (the followers) to attain a

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common goal [1]. A leader's primary task is to persuade followers to agree on issues that must be addressed, as well as to support their efforts to achieve common goals [2]. Consistenly, the capacity to persuade and inspire others is the essence of leadership [3]. Change is the only constant in the digital age, which is marked by swift and radical technological advancements. It is crucial for organizations to rely on leaders who can suggest, encourage, and lead change. The successful implementation of digital transformation processes and the creation of an agile and adaptable organization are the main objectives of leadership in the digital age [4]. Agility refers to the speed and success with which a business, its leaders, and its employees detect and respond to opportunities and dangers in the environment. Furthermore, agility entails actively seeking possibilities and opportunities in order to prepare the organization for future circumstances [5].

Compared to traditional leadership, leadership in the digital age is characterized by different values and drivers. These are: orientation to results and high quality, an effort to use knowledge in the best possible manner, an effort to encourage the creativity of employees and an effort to quickly adapt the organization to changes in the environment [6]. In order to successfully integrate and coordinate the efforts of all employees in an organization towards the achievement of the goal, leaders in the digital age must be agile, adaptable, and collaborative [7]. Employees are expected to be empowered and encouraged to think creatively, that is, to offer suggestions and ideas that go beyond the conventional modes of operating and conducting business. Additionally, leaders increasingly need to give the authority of decision-making to those employees who have the most knowledge and information. In the age of the digital economy and the fifth industrial revolution, leadership must be one step ahead. Some authors introduce the concept of *Leadership 5.0*, pointing out the importance and role of leaders who must anticipate changes and prepare for them in advance [8].

Traditional theories recognize autocratic, democratic, and laissez-faire leadership styles [9], but there are numerous new styles accessible nowadays, such as charismatic, transformational, transactional, creative, servant, pedagogical, participative, team, inclusive, adaptive, authentic, and digital leadership [1].

Transformational leadership is one of the most important leadership styles in the digital age. This is futher supported by [10]transformational leadership has a significant relationship with generation Y which is exposed to digital age and also managing digitalization among generation Z.

The purpose of this paper is to highlight the impact of transformational leadership on business agility and success in the digital age. The paper is structured as follows. The first title is dedicated to the role and importance of transformational leadership in the digital age. The second title is focused on the key characteristics of transformational leaders. The special emphasis is on the example of leadership style of Elon Musk.

II. THE ROLE AND IMPORTANCE OF TRANSFORMATIONAL LEADERSHIP IN THE DIGITAL AGE

Transformational leaders are needed in the digital age to transform followers, motivate and support them, admire their original ideas and creativity, build mutual trust, and foster their growth and development. Reference [11] was the one who developed the theory of Reference [12] transformational leadership. described four dimensions key of transformational leadership:

• The idealized influence is the first dimension. It relates to the extent to which followers recognize leaders' worth, confidence, belief, power, and ethical or moral orientation; their desire to identify with these characteristics; and a shift away from self-interest toward higher group objectives.

- The second dimension is inspirational motivation, which defines how leaders create visions in order to inspire and motivate followers to achieve their objectives.
- The third dimension is intellectual stimulation, which refers to leaders who question the *status quo* and underlying assumptions, urge followers to do the same, and are receptive to innovative and creative problem-solving approaches.
- Individualized consideration is the fourth dimension. Leaders, as well as mentors or coaches, provide emotional support and consideration for each follower.

Transformational leader is ready and eager to articulate the organization's vision and mission in a clear and consistent manner, as well as to push employees to think outside the box, to share information and knowledge with coworkers, and to provide them with necessary support and assistance [13]. Transformational leadership entails a variety of leader activities that have the potential to "transform" followers and improve their work engagement [3]. This leadership style is especially neccessary in teamwork, in order that a transformational leader assigns jobs and tasks based on each team member's expertise and competencies with the primary goal to carry out a defined strategy [14]. One of the most essential characteristics of transformational leaders is their capacity to employ intellectual stimulation to encourage people to question the status quo and to solicit their thoughts or solutions to increase productivity and other organizational outcomes [15]. This type of leader has influence and may drive followers to make improvements to the organization's vision, mission, and goals [16]. Additionaly, the extent to which leaders are transformational is measured by their overall influence on their followers - the degree of trust, admiration, loyalty and respect, as well as willingness to work harder [17].

Transformational leadership places a special emphasis on organizational changes. This leadership style improves organizational learning, creativity, and innovation [18]. Transformational leaders have several characteristics, including anticipating future needs and challenges, dealing with long-term problems and opportunities, conducting a holistic examination of all organizational factors - both internal and external, and motivating employees to substitute their personal interests for those of the organization [19]. Consequently, transformational leadership is connected to follower performance first through follower behaviors (personal initiative and use of one's strengths), then through follower work engagement [20]. The key characteristics of transformational leadership are [9]:

- Transformational approaches that encourage positive employee emotions, job satisfaction, organizational commitment, and well-being.
- Motivational mechanism transformational approaches motivate employees; they become more confident and engaged, and they are more eager to invest their time and effort.
- Identification mechanism: transformational approaches encourage employees to identify with the leader, his or her beliefs and identity, as well as the team or organization.
- Transformational approaches, through a social exchange system, improve the quality of transactions and relationships between leaders and followers. Followers are also more likely to believe that the leader, team, and/or organization support them.
- Justice enhancement mechanism: transformational approaches increase employee views of fairness, pushing followers to contribute more and to have more faith in the leader, team, and organization.

Transformational leadership promotes employee involvement, influence, and the meaningfulness of work responsibilities, which leads to job satisfaction and engagement [21]. Transformational leaders should develop attractive vision, align that vision with a strategy, translate that vision into concrete actions, express optimism and confidence in the process of implementing the vision and implement that vision through small planned phases [17,22].

III. THE KEY CHARACTERISTICS OF TRANSFORMATIONAL LEADERSHIP: ELON MUSK STYLE OF LEADERSHIP

Elon Musk, the founder of the world's most inventive enterprises - PayPal (X.com), SpaceX, and Tesla Motors - is one such leader whose name is commonly mentioned alongside Steve Jobs and Bill Gates. Academics and practitioners are interested in his leadership style because of the widely held view that he possesses individual characteristics and abilities that make him a "natural" and "born" leader [23].

Elon Musk is a transformational leader. According to literature and practice, leaders cannot be orientated and constrained to only one style of leadership [24]. In study of reference [25], Musk's leadership styles are also: charismatic, creative, change, intelligent, servant. participative, pedagogical, while reference [26] point out that Musk frequently uses transactional leadership style. Following the definition of visionary leaders which are inspired by a clear vision of the future, and which are able to inspire and motivate followers to achieve that vision [17] it can be concluded that Elon Musk has characteristics of visionary leader.

Musk's leadership style emphasizes continuous improvements, innovations, creative thinking, the development of new ideas, thinking "out of the box", innovative, and distinct approaches. He is widely regarded as a highly inspiring leader who is able to encourage and engage all people in the pursuit of common goals. He is well-known for his quotation: "We will not stop until every car on the road is electric" [27].

During strategic changes, it is critical to maintain excitement, energy, agility, and flexibility, as well as to be tolerant on mistakes and failures. The most difficult issue for leaders in the twenty-first century is to regard change as a chance and an opportunity [28], and to encourage followers to be innovative [29]. Leaders should be catalysts for positive strategy change in this way. Musk possesses all of the aforementioned characteristics. He views failure as an opportunity for future learning and progress. Furthermore, Musk presents a good example by working harder than his followers and looking after them [1]. Musk is a hero and role model for generations Y and Z because of his vision, ambition, intelligence, charm, persistence, and optimism.

The key leadership characteristics of Elon Musk may be examined by using the Big Five personality model (Table I). According to data presented in Table I, Musk is extraverted, open to new experiences, conscientious, and emotionally stable, but has a low agreeableness, which is a common attribute of high achievers and intelligent individuals. He constantly seeks for new knowledge and in one of the interviews he stated: "I was raised by books. Books, and then my parents" [27].

TABLE I.	BIG FIVE PERSONALITY MODEL - ANALYSIS
	OF ELON MUSK (ADAPTED FROM [30])

Dimension Characteristics of Elon Musk		
Extraversion	Energetic, open, interactive, and sociable; frequently talks in public; active on social media; connects and maintains contact with clients.	
Openness to experience	Imaginative, unconventional, unique, thinks "outside the box", is curious and open-minded, and wishes to make the world a better place.	
Conscientiousness	Achievement-driven, hardworking (80-100 hours a week), efficient, organized, precise, and reliable.	
High emotional stability	Maintain challenging and stressful situations easily, willing to take risks, and resilient.	
(Low) Agreeableness Wishing to make the world a the place, compassion for humanity. In circumstances of contrast others, his attitude somethal lashes out at employees who for meet his high standards.		

Musk's leadership qualities are clearly desirable for any form of strategic change. However, there are some characteristics that should be considered. Some employees have stated that working with (and for) Musk is challenging due to his high standards, focus on exceptional results, and ambitious goals. In the long run, all of these circumstances may cause employee anxiety, stress, and burnout. He frequently behaves like an autocratic leader, seeking sole authority, a high level of surveillance and control, and centralized decision making [27]. Even he refers to himself as a nanomanager on occasion [31].

Elon Musk is an inspiration to young people. In a 2023 study in which participated students from one faculty in the filed of management, the students were asked to write the name of a leader they admire and who is their role model. The study included 40 students ranging in age from 19 to 25. The name Elon Musk was written by the most students (more than 70% of students wrote the name of Elon Musk). During the group students highlighted his discussion, the characteristics that they most admire. They frequently mentioned the following characteristics:

- Innovative thinking,
- A vision for the future,
- An entrepreneurial spirit.

Young generations that have grown up in the digital age and with digital technologies value those leaders who are innovative.

IV. CONCLUSION

Transformational leadership is becoming increasingly important in the digital age. Transformational leaders may alter the status quo and effect significant changes and transformations that are essential for business agility and success. The essential values of transformational leadership, as well as the key characteristics of transformational leaders, are presented in this paper, with a special emphasis on Elon Musk. The findings presented in this paper may be useful for organizations seeking strategic change, as well as leaders and managers. They may find inspiration and useful lessons in Musk's leadership style. He is a powerful change agent who can clearly express any strategic vision into a feasible strategy and goals.

This paper has several implications. First, it emphasizes the important characteristics of the business environment in the digital age and the role and importance of transformational leadership. Second, it highlights the essential leadership attributes needed for business agility and success in the digital age. These attributes are: innovative thinking, a vision for the future and an entrepreneurial spirit.

In the future, there will be an increased demand for change agents and transformational leaders who are willing to devote all their time and energy to creating or inventing remarkable things. Future research on this area should focus on identifying new leadership attributes required for business success and agility. Apart from that, future researchers can consider extending the Big Five personality model.

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Comparative Analysis of the Social Dimension in the Higher Education Strategies of the EU Member States and Candidate Countries

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Abstract—The implementation of the social dimension in national higher education systems has become a very important issue over time, to which the European Union and the European Higher Education Area have been paying even more attention in the last two decades. The research problem is related to the commitment to the social dimension and implementation of the equity strategy in the EU member states and candidate countries. The subject of the research is four indicators that indicate the implementation of the strategy on equity in higher education, the definition and measurability of objectives, the undertaking of social dialogue on the adoption of the strategy and the monitoring of the improvement of the social dimension, while ensuring equality, respect for diversity and encouraging inclusion.

Keywords – Social dimension, inclusion, equity, higher education, European Union

I. INTRODUCTION

The emergence and functioning of the European Union (EU) has always been based on respect for equality, fairness and inclusion principles. When looking at the process of EU development chronologically, from the idea about the integration of European countries, overcoming rivalries between some countries and the reconstruction of war-destroyed Europe, the pioneers whose actions marked these events almost always stood for peace and equality within European integrations. Social justice in Europe, and in general on the European continent, has always been a matter of special priority and often the guiding idea of numerous individuals who contributed to European integration and to the arrival of the current form of the European Union.

The intensification of interest in the problems of social and economic equality is related to the beginning of the 21st century. In that period, the mentioned questions again attracted the attention of the general public, primarily political and scientific circle members [1-3]. In such circumstances, the application and respect of the principles of equality and inclusion in education becomes a very important topic [4-5].

Reference [6] points out that the problem of inequality in higher education in Europe is widespread, while pointing out its complexity. At the core of the European education system are fairness and inclusion as key values that characterize the European Union itself. These values are mentioned as priorities within the European Strategy for Universities, presented at the beginning of 2022. However, the degree of inclusion of socially disadvantaged and vulnerable groups in the higher education system in the European Union is still insufficient, and one could even say low. It is a fact that specific knowledge, competencies and skills can only be acquired through different types of higher education. Therefore, its availability to all categories of young people is crucial. At the meeting of the European Council held at the end of 2017, it was clearly concluded that education

is the key element in building an inclusive and cohesive society. In this context, [7] states that the social dimension of higher education within the Bologna Process has become an issue of importance that all the players are aware of.

According to [8], social inclusion in higher education – often called the social dimension of higher education – refers to the increasing access to higher education and degree completion for underrepresented groups, improving Europe's human capital and innovation capacity while fostering social inclusion of citizens and increasing their labour market opportunities.

II. SOCIAL DIMENSION OF THE EUROPEAN UNION HIGHER EDUCATION

Modern higher education with a pronounced social note must provide equal educational opportunities for all interested individuals, with respect for the established quality standards, and in accordance with the needs of each individual and the broader social community. The social dimension of higher education has been the focus of attention of the European educational community since 2001 [9].

The social dimension of higher education was not explicitly expressed in the Bologna Declaration of 1999. Its importance was emphasized in the Prague communiqué in 2001. [10] emphasized that the social dimension of higher education strategy is first explicitly mentioned in a Bologna Ministerial communiqué in Bergen 2005. Ministers concluded that the social dimension includes government measures to help students, especially from socially disadvantaged financially groups, and economically and provide them with guidance and counselling services to widen access. Then, in the London communiqué from 2007, the important role of higher education in fostering social cohesion, reducing inequality and raising the level of knowledge, skills and competencies in society is discussed. In this context, the need to maximize each individual's potential is emphasized to encourage personal development, which would result in developing a democratic and sustainable society based on knowledge. According to [11], the commitment to making higher education more socially inclusive was firmly inscribed in the 2015 Yerevan communiqué announcing the implementation of the European Higher Education Area (EHEA) social dimension strategy. Strengthening the social dimension of higher education is a priority task in the EHEA [11-12].

Following the guidelines of the Bologna process, long-term investments were made in improving the social dimension of higher education in the countries of the European Union, but, as [13] points out, inequality remained stubbornly persistent. In the European systems of higher education, as well as in the labor markets, inequality according to gender, country of origin, parents' education, economic status, etc., is still the most prevalent.

Some of the principles of social justice that contribute to the provision of equal rights and obligations and the fair distribution of resources and power in society refer precisely to inclusion, equality and respect for diversity. Higher education can have a significant impact on solving the problem of social and economic inequality in society. However, we often witness situations where formal equality in higher education does not always lead to absolute equality in practical circumstances. Socially responsible higher education, which is based on the implementation of the strategy on equity, is based on the following principles:

- *Equity* ensuring equal opportunities for all members of society, fighting against discrimination, helping individuals from vulnerable social groups, and standing for social inclusion in higher education.
- *Cooperation* improving mutual trust and encouraging dialogue among participants in higher education through exchanging information and ideas, all to make decisions based on actual needs, relevant information and examples of best practices in higher education.
- *Quality* applying high-quality standards in higher education to improve the efficiency of the HE system and ensure quality educational outcomes.
- *Transparency and participation* the public in the work of institutions of higher education in order to strengthen their social responsibility and involvement in the processes of preparation and adoption of laws and other legal acts related to higher education.

The Rome communiqué from 2020 points out that the social dimension should occupy a central place in the strategies of higher education, both at the systemic and institutional level, in the EU member states and among the EHEA members. That is very important because highly educated young people can often find better-paid jobs, as confirmed by an OECD research study from 2021. Results indicate that young people aged 25 to 34 with a higher education diploma can achieve an average of 38 per cent higher earnings than those with only secondary education.

According to [8], most European countries implement various activities to make higher education opportunities transparent and bring them closer to potential students. However, information on the social affiliation or ethnic origin of students is still missing, so it is difficult to gain insight into the achieved level of social inclusion in higher education. [6] talks about the connection between higher education and social mobility but also points out that "too many" potential students in Europe are excluded from the higher education system due to their socioeconomic situation, educational background, insufficient support and other obstacles. The author emphasizes that young people from socially disadvantaged areas and with economic difficulties do not have the same opportunities to access higher education as their peers from "privileged" groups. Even with no higher education tuition or registration fees, students from low socio-economic status backgrounds are less likely to enter the more prestigious or sought-after higher education institutions [6].

III. COMMITMENT TO THE SOCIAL DIMENSION IN HIGHER EDUCATION IN THE EU MEMBER STATES AND CANDIDATE COUNTRIES

The strategy of higher education must have a social dimension in its focus that will support equal opportunities for all students from the moment of application and enrollment through the period of study until the end of studies. Each individual in that series of steps must progress only on the basis of his own abilities, and the life circumstances of the student and other factors that he cannot influence must be left aside. [14] concluded that the social dimension is directly related to the higher education institution's ability to retain students from the beginning of their studies until graduation. Therefore, introducing and improving the social dimension in European countries' framework of higher education strategies is paramount.

The Eurydice report from 2022 about equity and inclusion in higher education in Europe examines the commitment to the social dimension in higher education [15]. The EU, the EHEA, the education systems at the level of the member states, and higher education institutions in each country should continuously address this issue. The report examines the commitment to the social dimension at the level of the educational system through the following criteria application: implementation of a strategy on equity in higher education; the existence of clearly defined objectives and measurable targets; conducting social dialogue before adopting the strategy; monitoring the presence and implementation of the policy of improving the social dimension in higher education. In the next chapter, a comparative analysis will be made between EU member states and candidate countries based on the mentioned criteria.

A. Strategy Implementation

The first indicator refers to implementing the strategy with a social dimension, or a national plan of similar content, in the higher education systems of the EU member states and candidate countries. The strategy must necessarily support equality and encourage diversity and inclusion. Countries differ according to whether the mentioned strategy has already been implemented, whether it is enough for at least one strategy, and whether it is in the process of preparation or not implemented in the country.

As it presented in Table I, almost all EU member states have at least one strategy or national plan that deals with the social issues of students in higher education, emphasizing equity and inclusion. In Slovakia, such a strategy is currently being prepared, while in Germany, Denmark, Luxembourg and Belgium (Flemish and German-speaking Communities), the educational systems are presently without this strategy.

There are many reasons for the absence of a strategy, from the fact that existing legislative frameworks already sufficiently deal with social issues and equality to the fact that such a strategy existed until recently.

Among the EU candidate countries, North Macedonia, Serbia and Turkey stand out, as they have incorporated the strategy on equity into their national higher education systems.

The research points out that the social dimension is only one of the aspects of higher education strategies in the analyzed countries. That is, only in Croatia, Cyprus, Netherlands,

Country	Strategy implemented (at least one)	Strategy preparation	Without strategy
Austria	\checkmark		
Belgium			\checkmark
Bulgaria	\checkmark		
Croatia	\checkmark		
Cyprus	\checkmark		
Czechia	\checkmark		
Denmark			\checkmark
Estonia	\checkmark		
Finland	\checkmark		
France	\checkmark		
Germany			\checkmark
Greece	\checkmark		
Hungary	\checkmark		
Ireland	\checkmark		
Italy	\checkmark		
Latvia	\checkmark		
Lithuania	\checkmark		
Luxembourg			\checkmark
Malta	\checkmark		
Netherlands	\checkmark		
Poland	\checkmark		
Portugal	\checkmark		
Romania	√		
Slovakia		\checkmark	
Slovenia	\checkmark		
Spain	\checkmark		
Sweden	\checkmark		
Albania		\checkmark	
Bosnia and Herzegovina			\checkmark
Montenegro			
North Macedonia	\checkmark		
Serbia	1		
Turkey	1		

 TABLE I.
 Implementation of the strategy on equity in higher education of EU member states and candidate countries.

Source: Adapted by author based on data from the Eurydic Report 2022

Austria, and Finland is the strategy based exclusively on the social dimension.

B. Objectives and Targets

In order to be able to measure the contribution of the equity strategy in higher education and evaluate its implementation effectiveness, the strategy's objectives must be clearly defined and quantitatively measurable (targets). In the case of such a setting of objectives, one can expect to achieve the desired and concrete results. In addition to the above, it is crucial to recognize and feel a strong orientation towards social issues in the objectives and targets.

A clearly defined objective, and at the same time quantitatively measurable, can refer to a precisely determined number of newly enrolled students who belong to vulnerable groups, then the exact ratio between the sexes that is to be achieved, the percentage increase of young people with completed higher education, and the like.

Objectives that are specific but not quantitatively measurable (targets) at the same time speak only of the tendency to increase the number of students with disabilities, students from poor categories of the population, "adult" students and the like, or refer only to the need to encourage members of sensitive groups to further their education at institutions of higher education.

Based on the data shown in Table II, it is concluded that EU member states whose strategies on equity in higher education are based on specific objectives and measurable targets are: Austria, Czechia, Estonia, Finland, Hungary, Lithuania, Poland, Portugal, Slovenia and Sweden. On the other hand, in Ireland, Greece, Spain, Croatia, Italy, Malta and the Netherlands, clearly defined objectives within the strategies stand out, but their quantification was missing (no measurable targets). Previously, it could be noted that Bulgaria, France and Romania have incorporated the strategy of equity into their education systems. Still, it is evident that the strategies are not based on essential pillars such as clear objectives and measurable targets.

When talking about EU candidate countries, it was noted that a strategy on equity in higher education is present in Serbia, North Macedonia and Turkey; in Albania, it is being prepared, while in Bosnia and Herzegovina and Montenegro, such a strategy does not exist. The next indicator tells us that clearly defined objectives and measurable targets appear within the strategies in Serbia and Turkey. In North Macedonia, objectives on equity in higher education have been described, but without the possibility of measuring their realization.

C. Social Dialogue

At the national level, we sometimes witness situations where important decisions are made or federal policies are adopted without public discussion and consultation of all interest groups. TABLE II.INCLUSION OF CLEARLY DEFINEDOBJECTIVES AND MEASURABLE TARGETS IN THE STRATEGYON EQUITY IN HIGHER EDUCATION OF EU MEMBER STATES
AND CANDIDATE COUNTRIES.

Country	Objective s and targets are included	Objectives included but no targets	Without objective s and targets	Without strategy (or n preparat ion)
Austria	\checkmark			
Belgium			\checkmark	
Bulgaria			\checkmark	
Croatia		\checkmark		
Cyprus			\checkmark	
Czechia	\checkmark			
Denmark				
Estonia	\checkmark			
Finland	\checkmark			
France			\checkmark	
Germany				
Greece		\checkmark		
Hungary	\checkmark			
Ireland		\checkmark		
Italy		\checkmark		
Latvia			\checkmark	
Lithuania	\checkmark			
Luxembourg				
Malta		\checkmark		
Netherlands		\checkmark		
Poland	\checkmark			
Portugal	\checkmark			
Romania			\checkmark	
Slovakia				
Slovenia	\checkmark			
Spain		\checkmark		
Sweden	\checkmark			
Albania				
Bosnia and Herzegovina				\checkmark
Montenegro				
North Macedonia	\checkmark			
Serbia	\checkmark			
Turkey		\checkmark		

Source: Adapted by author based on data from the Eurydic Report 2022

Indeed, any of the extremes will not bring the expected effects. It happens that too many irrationally chosen participants can significantly slow down, or even turn off, the process, while on the other hand, decision-making only by the highest state authorities certainly reduces the democratic process, especially regarding sensitive issues such as equality and inclusion.

All interested parties must be consulted before adopting a strategy on equity in higher education. Inequalities are already appearing in

TABLE III. SOCIAL DIALOGUE CONDUCTION AND ADOPTION OF THE STRATEGY ON EQUITY IN HIGHER EDUCATION OF EU MEMBER STATES AND CANDIDATE COUNTRIES.

Country	Social dialogue first then strategy	Strategy without social dialogue	Without strategy
Austria	\checkmark		
Belgium			\checkmark
Bulgaria	\checkmark		
Croatia	\checkmark		
Cyprus	\checkmark		
Czechia	\checkmark		
Denmark			\checkmark
Estonia	\checkmark		
Finland	\checkmark		
France	\checkmark		
Germany			\checkmark
Greece	\checkmark		
Hungary	\checkmark		
Ireland	\checkmark		
Italy	\checkmark		
Latvia		\checkmark	
Lithuania	\checkmark		
Luxembourg			\checkmark
Malta	\checkmark		
Netherlands	\checkmark		
Poland	\checkmark		
Portugal	\checkmark		
Romania	\checkmark		
Slovakia	\checkmark		
Slovenia	\checkmark		
Spain	\checkmark		
Sweden	\checkmark		
Albania	\checkmark		
Bosnia and Herzegovina			\checkmark
Montenegro			
North Macedonia	\checkmark		
Serbia	\checkmark		
Turkey	\checkmark		

Source: Adapted by author based on data from the Eurydic Report 2022

education, especially when it is talked about higher education; unequal opportunities of access in terms of financial and other obstacles stand out.

Establishing social dialogue before adopting the strategy will undoubtedly contribute to its more successful incorporation into the higher education system and more efficient application in practice

The data presented in Tabele III lead to the conclusion that, most often, public dialogue is

first established before the strategy of higher education with a pronounced social dimension is adopted in the EU member states and candidate countries. Most often, representatives of the Ministry of Education, heads of higher education institutions, experts in the field of higher education and government representatives in charge of related fields are involved in the social dialogue. In a smaller number of cases, representatives of employee unions, nongovernmental organizations, student organizations, other levels of education and international organizations were also involved. In this context, the Eurydice report suggests the existence of certain deficiencies in this process. Namely, non-governmental organizations are very rarely included in the social dialogue as representatives of certain social groups (persons disabilities, with persons with special educational needs, migrants, and representatives of racial, ethnic or gender-based groups).

The EU candidate countries are not lagging in this area behind EU members. Serbia, Turkey and North Macedonia held a social dialogue before adopting a strategy on equity in higher education (or a national plan of similar content). In Albania, a social dialogue is ongoing, considering that the strategy is in the preparatory phase. At the same time, Bosnia and Herzegovina and Montenegro do not implement an equality strategy in their higher education systems.

D. Policy Monitoring

Whether higher education institutions implement a strategy on equity is very difficult to determine. A large number of institutions and their autonomy make this process difficult. In this case, for research purposes, Eurydice collects data on whether the authorities in the EU member states and candidate countries require quality assurance agencies to monitor the process of implementing a strategy or national plan on equity in higher education.

The agency monitoring system also includes checking the existence of a social dimension improvement policy based on respect for diversity and inclusion and ensuring equality.

The data presented in Table IV does not give an optimistic picture. In slightly more than half of the EU member states, there is a request for agency monitoring and verification of whether higher education institutions implement policies to improve the social dimension. On the other

TABLE IV.	MONITORING THE IMPLEMENTATION OF A
STRATEGY ON	EQUITY IN HIGHER EDUCATION INSTITUTIONS
IN EU MEM	BER STATES AND CANDIDATE COUNTRIES.

Country	Agency monitoring	No agency monitoring
Austria		\checkmark
Belgium		\checkmark
Bulgaria		\checkmark
Croatia	\checkmark	
Cyprus		\checkmark
Czechia	\checkmark	
Denmark		\checkmark
Estonia	\checkmark	
Finland	\checkmark	
France		\checkmark
Germany	\checkmark	
Greece	\checkmark	
Hungary		\checkmark
Ireland	\checkmark	
Italy	\checkmark	
Latvia		\checkmark
Lithuania	\checkmark	
Luxembourg		\checkmark
Malta	\checkmark	
Netherlands		\checkmark
Poland	\checkmark	
Portugal	\checkmark	
Romania	\checkmark	
Slovakia	\checkmark	
Slovenia		\checkmark
Spain	\checkmark	
Sweden	\checkmark	
Albania		\checkmark
Bosnia and Herzegovina		\checkmark
Montenegro		\checkmark
North Macedonia		\checkmark
Serbia	\checkmark	
Turkey	\checkmark	

Source: Adapted by author based on data from the Eurydic Report 2022

hand, there is no monitoring in the remaining countries. The situation is even more unfavorable in the case of EU candidate countries.

Only in Serbia and Turkey is there a request from state authorities that quality assurance agencies monitor the presence of the social dimension and the process of improving inclusion, equality and diversity. However, the data should be interpreted with a certain amount of caution because it is possible that individual institutions independently undertake activities to improve and promote equality in their environment without this being expected of them.

IV. CONCLUSION

Fair education for all and equal access to opportunities are the priorities of modern European society. In order to create a society in which every individual is offered the same opportunities, it is essential to remove all obstacles, especially social inequalities, which are present in higher education in Europe. Individual inclusion and possibilities of contribution to society depend on the personal education level. There is an urgent need to address the social dimension of higher education more forcefully and coherently, particularly because of the economic downturn across Europe [16].

It can be concluded that most of the EU member states and half of the candidate countries are firmly committed to the social dimension of higher education. In most countries, the strategy on equity has been implemented in the education system, and the conduction of social dialogue preceded its adoption and implementation. The strategy's objectives are primarily specific and clearly defined in the member countries but often not quantitatively measurable. In insufficient EU member countries and candidate countries, the authorities require quality assurance agencies to monitor the implementation of a strategy on equity in higher education. The Republic of Serbia stands out among the candidate countries, given that it met all the researched conditions, and its commitment to the social dimension of higher education can be positively assessed.

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The Healthcare Concept of Industry 4.0 - Digitalisation of Health Protection

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Abstract—Great achievements of Industry 4.0 are real and visible all over the world, in many different activities. Digitalisation of many processes in different activities has already begun. Related to healthcare, digitalisation of this activity has also begun but its progress is very slow and barely visible related to some other activities and industries. One of the most important reasons for this fact is very hard acceptance of new technology from healthy workers. Because of the nature of their work. they don't have wide technical education related to engineers, technicians and other workers with technical education. However, there are many examples where Industry 4.0 and digitalisation provide great help. One of these examples is, of course, pandemic of COVID 19 This paper was written to present the current and the future degree of digitalisation in healthcare and influence of Industry 4.0 on health.

Keywords - Healthcare, Industry 4.0, concept, digitalization

I. INTRODUCTION

Healthcare 4.0 presents quite new term. This term was implicated by Industry 4.0. It is obvious that Industry 4.0 is increasingly take over in many activities and spheres so as in the sphere of healthcare. It is important to note that this domination related to healthcare is not so fast, visible and effective such as in other activities, spheres or industries, but it is without any doubt has already begun. Healthcare 4.0 concept is using personalisation and virtualisation. This concept is directed to the patient and improvement of all aspects of healthy protection. Patients and healthy workers are connected with organisation of Industry 4.0, its methodology and technologies that this industry uses. Healthy organisations should be created as integrated

centres, capable to serve the patient, which is in this case threated as active subject. Of course, one such complex and large concept purports use of many different research spheres, such as robotics, computing, healthy informatics, artificial intelligence, computing in cloud, information safety, bioengineering etc.

Related to earlier healthcare, actually to influence of other industrial revolutions to healthcare, Healthcare 4.0 as a consequence of Industry 4.0 has achieved such developments greater than anything achieved so far, for short time. For example, the First Industry Revolution has brought to the mankind next inventions, in the sense of healthcare, such as thermometer, stethoscope, syringe etc. Expectedly, the second Industry revolution has gone even further and brought to the mankind inventions such as electrocardiogram, pressure gauge, X-ray device etc. The third Industry revolution has gone farther and brought to the mankind inventions such as ultrasound, pacemaker, magnetic resonance. tomography, PET/CT scanner. endoscopy, usage of implants, usage of artificial hip, stent, laser surgery, digital devices (ear digital device) etc. Related to exposed examples in different industrial periods, Healthcare 4.0 as a consequence of Industry 4.0 has provide more than all three industrial revolutions: cyber physical system, Internet of things, Internet of services, developed computing and usage of powerful software, usage of cloud, easy and effective handling of large amounts of data, usage of so called bio implants, usage of 3D printing of tissues and organs, usage of robotics and robots in complex processes such as hard and long term operations etc. Noted inventions and benefits of Healthcare 4.0 are equally important
and for medicine and for stomatology. It is interest and important to note that digitalisation and usage of digital technologies in health and pharmacy industry significantly lags behind. Researches showed that very small percentage (less than 15 %) of health and pharmacy companies are digitalised.

There are four established areas of digitalisation important for health and health workers. Those are Internet of medical things, Health protection 4.0, artificial intelligence and cyber security. Some of them have been already in use while some of them are yet to come in the near future [1].

II. HEALTHCARE 4.0-MEANING, TRENDS AND TASKS

Generally, Healthcare 4.0 as a consequence of Industry 4.0 purports continual process of digitalisation of complete medical system and it includes medical and stomatology services, hospital and no hospital services (treatment, recovery, care, monitoring), medicines and equipment production, logistic in health, law and regulations in health. leadership and management of financial system in health, management of social system in health etc. New system, called Healthcare 4.0 will purport the presence and activities of many cyber physical systems, artificial intelligence, robots and other elements which will be connected through Internet of things. They will have intelligent communication and reading with a large amount

of available information and computing in cloud. Patients will have higher degree of control related to their condition and chronical diseases. With the help of Internet of things, patients will have a possibility to complete their own information and this will significantly help to doctor to create vision about every patient. Many additional, unnecessary and redundant processes and analyses will be eliminated and doctor will have а much better connection and communication with other colleagues, in case that patient's disease or state demands cooperative work of more experts and specialisations. Healthcare 4.0 enables that enormous amount of information will be available to more doctors, clinics or similar what will beside effective treatment and care about patient also significantly reduce costs and improve their control and management. Artificial intelligence presents great innovation and improvement in health. The areas of appliance are almost infinite. As example, artificial intelligence will help in the reduction of work in the sense of performing of non-inventive activities, enabling better attention and concentration to the patient. Comparing and interpretation of results, pictures, and findings are only a small part of artificial intelligence possibilities. Also, security of information about patients presents very vulnerable and sensitive task. Healthcare 4.0 will significantly improve cyber security and care about all kind of information. Applications of Healthcare 4.0 are presented on Fig. 1.



For success and realisation of Industry 4.0 in health and generation of Healthcare 4.0, many tasks must be enabled and realised. Although the Healthcare 4.0 will present huge scientific, professional and effective step, it won't reduce their complexity. It purports engagement and involving of many different experts, areas and spheres. Of course, noted tasks are numerous but it can be defined and determined. Some of them are health protection on "demand"; enormous amount of data handling, storing and managing; virtual reality healing; increased production of portable medical devices; predictive health protection; artificial intelligence; blockchain and provision of better and effective medical documentation and records.

One of the very popular modern health protection concepts is so called on demand concept. Generally, it presents health protection and health care which patients determined by themselves- time, schedule, place, conditions and other parameters. Of course, it purports the existence of doctors or institutions engaged on demand, what meets the changing needs of their patients more effectively. The possession of smart phone or/and some other smart devices significantly enables realisation of healthcare on "demand".

The existence of enormous amount of data in health is a logical consequence of increase in a patient number, usage of new medicaments and ways of healing, usage of new instruments and apparatus, more efficient management of procedures and records, production and supply of different medical stuff, better connections and faster approach to distant patients, very effective prediction of organisation of medical teams and staff, continual monitoring of endangered and critical patients and lot of other tasks and items. Managing and handling of enormous amount of data present great importance for Health 4.0.

Virtual reality healing concept is still in the development phase, but it certainly presents reality and the future in healthcare. Virtual reality presents effective way of healing and treatment, and it can be used for elimination of pain, consequences of different disturbances, as a substitution for many medicaments, determination and elimination of many problems in ophthalmology etc. Great advantage presents the usage of virtual reality and simulations for improvement of different skills and techniques, such as, for example complex operations or procedures.

Digital technologies have enabled design and production of different portable medical devices. Similar in the example of laptop, these devices have significantly improved health care, health protection and prevention. Patients can be examined on site with early detection and determination of problem and much greater possibilities for their elimination. Many critical epilogues can be eliminated, what is especially important for urgent conditions. Related to valid evaluations, the market of portable medical devices will significantly increase in the near future. Some of those portable devices are portable EKG apparatus, portable EEG apparatus, and oximeters for patients with respiratory problems, different devices with sensors for monitoring and detection of pressure, temperature, pulse, sweat, sugar etc.

Prediction presents one of the most important tasks and concepts in health. Analyse of enormous amount of data enables to predict optimal reception of patients, right timed reaction, better organisation end effectiveness and many other parameters and items. Prediction is extremely important in the case of some disease such it was, as example, pandemic of COVID 19 virus. Potential location, potential spreading, stopping, localisation and many other important items can be realised by prediction. Related to one or more examples, potential prediction model can be designed and realised for future situations. One of the most important concepts in health is that it is always better to stop and eliminate then cure, so it is obvious that prediction presents fundamental element for stopping and elimination.

The usage of artificial intelligence presents one of the most significant future trends in healthcare. Related to some predictions, the market of devices and tools with artificial intelligence will cover almost every aspect of healthcare and enable more tens of billions of dollars. Certain types of robots with different duties and tasks have already been working in hospitals and medical institutions in some countries, such as USA or Japan. The duties and tasks can be different, from simple physical assists, therapeutic services, measuring and monitoring to record, diagnose, analyse, prediction, operations, procedures and lot of other complex tasks. Related to some sources, the usage of artificial intelligence will save more than 150 billion of dollars to USA health what economy, presents extraordinary importance.

Very interesting trend and task in Healthcare 4.0 has blockchain and providing of better end effective digital health evidence. Generally, blockchain presents digital book or digital data base about different transactions, usage of medical evidences, electronic health records and other administrative items in health. Related to some predictions, this market will overfulfil several hundred million dollars. This concept will provide safe and secure changing of, at the first step, financial information. This will significantly reduce the costs and improve optimisation of complete medical documentation. The main problem in the medical documentation related to the patients was in the fact that documentation consisted from parts, very often not collected to the one place. The solution called electronic health record presents digital form of medical documentation and purports all information at one place-disease history, used medics, used treatments, realised diagnose, complete results of different tests and examinations and similar. Personal data about patient such as home address, job address, phone numbers, and financial card numbers are also included in this digital form of medical documentation. But there are problems in this sphere in the sense of safety and technical realisation. Electronic health records are very easy and attractive material for abuse mostly by hackers and criminals. In the sense of technical realisation, there are difficulties in the manual input of data what implicates in many problems, mistakes, false diagnoses, wrong treatments etc. This problem can be reduced with noncentralised computer nets that managing with blockchain.

The appliance of computers and other modern systems in the last years made base for development of Healthcare 4.0 [2].

III. HEALTHCARE 4.0 BENEFITS

It is obvious related to noted facts that Healthcare 4.0 will have a great benefit for, at the first step, patients, and generally for medicine and medical treatment. Technologies of Industry 4.0 implemented in the concept of Healthcare 4.0 provide better digital solutions for n numerous problems. Benefits, solutions and reliefs are numerous and almost endless, but, because of limitation of this paper, only some of them will be presented.

Very important task realised by Healthcare 4.0 is the determination of patient's health and potential risk. Healthcare 4.0 enables better approach to all necessary information about patients in the system of healthcare protection. That will provide fast, precise and right timed detection of potential risks, what will also at the same time reduce potential negative consequences and costs in financial sense.

Development of procedures, methodologies, trends, and other elements important for healthcare and improving of medical processes will be also one of the very important tasks. It predicts realisation of large innovations, such as automatization of health processes; collection, storing and managing of large amount of data; measurements, optimal managing and monitoring of different parameters important for health processes; fast and precise decision realisation related to different health processes etc.

Healthcare 4.0 would not be able to function without professional and well-educated workers, so the improving of efficiency of health personnel in all medical institutions will present very detail task. Educated medical personnel will be able to manage and use many new devices for better efficiency and treatment, such as for example medical robots. It also will integrate different devices, processes, methodologies etc. Human resources will be used much better with automatization help.

The approach of patients to health services present big problem because of many reasons. Healthcare 4.0 will provide better approach to medical services and better usage of medical resources with technologies that monitoring and evaluate patient's needs. Of course, for optimal realisation and results, medical personnel must not be overburdened, what will be realised with better planning and using of resources. Healthcare 4.0 will engage new technologies which provide great reduction of awkward and incident situations and events. Resources will be optimal used by medical personal, what will realise with better productivity, better quality and better safety of medical services.

Protection, safety and security of medical institutions, medical equipment, and medical services are also very important and always open task. Healthcare 4.0 with use of modern technologies and digitalisation will provide monitoring of medical events, processes, equipment in real time what will significantly increase safety level. Information also must be protected and it will be possible with use of new innovative technologies in the chain values. The researches and involving of new medical procedures, treatments and task in the purpose of better and more effective treatment present very demanded and responsible task which includes many different professionals and many different procedures and methodologies. Healthcare 4.0 will provide the design of performance profiles for every treatment procedure and different analytic tools for optimal realisation of medical services and achieving of optimal results [2,3].

IV. CONCLUSION

The implementation of all consequences of Industry 4.0 in many different spheres has already begun. Related to medical sphere, the appliance of Industry 4.0 showed new and better possibilities for disease diagnostic, patients' treatment and care and lot of other benefits. The functioning and managing of hospitals and clinics will be much better and effective with use of new innovative technologies. The usage and managing of many complex devices will be optimised, what implicates maximal health appliances of new result. The digital technologies made very important solutions during COVID 19 pandemic- different sensors were used for monitoring of different parameters and patients' states, providing many important information for doctors.

So, all of noted implementations and technologies can be defined as one particularly new concept-Healthcare 4.0. This concept purports smart engineering and use of smart systems, such as cyber physical systems, Internet of things, Cloud computing, Virtual reality, Simulations and other benefits and consequences of Industry 4.0.

The final aim of Healthcare 4.0 is much better and effective healthcare generally, much bigger number of cured and satisfied patient, much better prediction and elimination of potential diseases and risks etc [2,4].

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The Influence of Ease of Doing Business on Innovation in Developing Countries

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Abstract—This extensive research delves into the intricate relationship between a nation's Ease of Doing Business (EODB) and its innovation landscape within developing countries. By conducting a thorough analysis of EODB index indicators and their influence on annual patent applications spanning from 2008 to 2020 across 27 developing nations, this study provides profound insights. Employing a robust Fixed Effects model and the advanced Generalized Method of Moments (GMM) model, we establish a compelling correlation: an increase in the EODB score significantly correlates with a rise in yearly patent applications.

Keywords - Innovation, Ease of Doing Business, patents, developing countries

I. INTRODUCTION

Distinguished economists such as Schumpeter, Solow, and Porter have consistently highlighted the paramount role of innovation in propelling economic progress and sustaining business vitality. Innovation serves as the driving force behind "creative destruction," where obsolete methods and products are superseded by newer, superior alternatives [1-4]. Firms must continually embrace innovation to maintain their competitiveness and foster economic growth,

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especially in sectors critical for society, such as security and healthcare [5,6]. The field of innovation research, particularly in the context of the Ease of Doing Business (EODB), has expanded significantly due to the availability of detailed patent application data [7-9]. Launched in 2003, the Ease of Doing Business (EODB) index assesses the ease with which entrepreneurs can initiate, operate, and terminate businesses based on ten key indicators. This study seeks to explore the complex relationship between innovation and the EODB, utilizing annual patent applications as a metric. Additionally, it examines the impact of EODB indicators on innovation within a dataset encompassing 27 developing countries, spanning from 2008 to 2020^{1} . The analysis employs a Fixed Effects model and a Generalized Method of Moments (GMM) Model to account for nation-specific and temporal factors.

II. DATA AND METHODOLOGY

A. Data

This study focuses on 27 developing countries² over the period from 2008 to 2020, selected due to the research objectives, the scope of the study, and the availability of data. data

¹ It's essential to recognize that the Ease of Doing Business (EODB) index, which assesses the ease of conducting business within a country, has faced controversies and has not been in use since 2020. The discontinuation of the index was due to concerns about its methodology, data quality, and allegations of manipulation in some cases. Considering these issues, the findings presented in this paper are based on data available up to 2020 and should be interpreted with

caution. The discontinuation of the EODB index has implications for the validity and relevance of our analysis.

² India, China, Brazil, Russia, Mexico, South Africa, Indonesia, Turkey, Argentina, Thailand, Malaysia, Philippines, Egypt, Nigeria, Pakistan, Iran, Vietnam, Colombia, Peru, Chile, Ukraine, Kazakhstan, Venezuela, Ecuador. Sri Lanka, Kenya, Ghana

availability. The primary dependent variable used to approximate innovation output is the annual count of patent applications, obtained from the World Bank and compiled by the World Intellectual Property Organization (WIPO). To provide a comprehensive global perspective on patent applications, a new variable called "Patents" has been created by aggregating patents registered by both residents and nonresidents. The EODB index, sourced from the World Bank, measures the ease of regulatory processes, while control variables include R&D expenditures and GDP.

B. Methodology

The analysis employs both the Fixed Effects and Generalized Method of Moments (GMM) models to investigate the impact of regulations on innovation. The regression equation features the number of patent applications as the dependent variable and the EODB score as the independent variable of interest, along with control variables.

III. RESULTS

Table I presents the outcomes of our analysis concerning the influence of the Ease of Doing Business (EODB) index, alongside relevant coefficients for each indicator and control variables affecting patent output. The first column presents results from the Fixed Effects regression, while column (2) highlights findings from the Random Effects model, and column (3) reveals results from the GMM model.

The EODB index, which assesses the ease of conducting business within a country, was examined in relation to patent output. Logarithmic transformations were applied to certain variables (Patents, GDP, and RD expenditure) due to their skewed and high-value distributions. An increase of 1 point in the EODB score was found to correlate with a 3.6% increase in patent output. Additionally, the study investigated individual EODB indicators to discern their separate effects on innovation. The GMM model was preferred over the Fixed (Random) Effects models in all cases, taking into variables' consideration endogeneity, autocorrelation, and the exclusion of significant variables. The indicators exhibited varying degrees of impact on patent output, with most effects remaining modest and not exceeding a 5% change in patents for a one-point change in the indicator score.

TABLE I.	REGRESSION RESULTS
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Variable	Model 1	Model 2	Model 3
	(FE)	(RE)	(GMM)
EODB	0.036***	0.034***	0.039***
	(0.009)	(0.009)	(0.004)
Construction	-0.019**	-0.015*	-0.022***
Permits	(0.007)	(0.008)	(0.006)
set up a	-0.014*	-0.016*	-0.023**
business	(0.007)	(0.008)	(0.008)
Electricity	0.017*	0.014	0.021***
	(0.009)	(0.009)	(0.006)
Registering	0.026**	0.019*	0.031***
Property	(0.009)	(0.007)	(0.008)
Enforcing	-0.013	-0.010	0.018
Contracts	(0.008)	(0.008)	(0.006)
Credit	0.018**	0.0015*	0.032**
	(0.007)	(0.007)	(0.008)
Taxes	-0.011	0.014*	0.021***
	(0.008)	(0.008)	(0.006)
Trading	0.017**	0.012*	0.026**
	(0.006)	(0.006)	(0.005)
Insolvency	-0.016	-0.018	-0.024
	(0.015)	(0.016)	(0.014)
Protecting	0.026	0.021	0.028*
Investors	(0.018)	(0.018)	(0.015)
RD	0.042**	0.047*	0.047**
Expenditure	(0.024)	(0.027)	(0.021)
GDP	0.028**	0.022*	0.031**
	(0.012)	(0.012)	(0.009)

Note: Standard errors are enclosed in parentheses. p < 0.05, p < 0.01, p < 0.001

All indicators demonstrated significant effects; however, Enforcing Contracts, Insolvency, and Protecting Investors displayed non-significant impacts on patent counts. In summary, the analysis indicates that the Ease of Doing Business index and its individual indicators can influence a country's innovation output, with variations in the strength and significance of these effects.

IV. DISCUSSION

The results presented in Table I indicate a significant relationship between the Ease of Doing Business (EODB) index and patent output. This index, designed to assess the ease of conducting business within a country, was found to have a positive impact on innovation, as evidenced by a 3.6% increase in patent output for every one-point increase in the EODB score. This suggests that a more favorable business environment, as indicated by the EODB index, can lead to increased innovation and patent activity within a country.

The study also delved into the specific EODB indicators to understand their distinct contributions to innovation. The results showed that each indicator had varying degrees of impact on patent output. Most of these effects were relatively modest, with a one-point change in the indicator score resulting in less than a 5% change in patent counts.

- •Construction Permits: This indicator displayed a negative effect on patent output. A stricter process for obtaining construction permits was associated with a decrease in innovation. The negative impact could be attributed to the additional barriers and delays imposed by complex permitting procedures.
- Setting Up a Business: Like construction permits, setting up a business also exhibited a negative impact on innovation. A more cumbersome process for business registration appeared to hinder innovation. Simplifying these procedures might help promote innovation.
- Electricity: Access to reliable and affordable electricity showed a positive effect on patent output. This indicates that a stable and efficient electrical infrastructure can facilitate innovation, especially in industries reliant on electricity.
- Registering Property: This indicator had a positive impact on innovation. An efficient property registration system may provide entrepreneurs with a sense of security and encourage them to invest in innovative ventures.
- Enforcing Contracts: Surprisingly, this indicator displayed a non-significant impact on patent counts. This could suggest that the ease of enforcing contracts might not be a primary driver of innovation.

- Credit: Access to credit was found to have a positive effect on innovation. This implies that a well-functioning credit system can stimulate innovative activities.
- Taxes: The tax environment did not show a consistent impact on patent output. While this may indicate that the tax structure is not a significant driver of innovation, it is essential to consider the broader economic and business context.
 - Trading: A positive impact on patent output was observed for this indicator.
 Efficient international trade processes may encourage businesses to engage in innovative activities.
 - Insolvency: This indicator exhibited a non-significant impact on patent counts, suggesting that the ease of handling insolvency may not be a primary driver of innovation.
 - Protecting Investors: Protecting investors had a positive impact on innovation. A legal framework that safeguards investor rights may enhance confidence and attract more investment in innovative projects.
 - RD Expenditure: Research and development expenditure exhibited a positive effect on patent output. This underlines the importance of investment in R&D for driving innovation.
- GDP: A positive relationship between GDP and patent output was observed, which is consistent with the notion that a growing economy may foster innovation.

V. CONCLUSION

This study embarked on a comprehensive exploration of the intricate interplay between business regulations and innovation. Its primary objective was to assess the impact of business regulations by scrutinizing the relationship between the Ease of Doing Business (EODB) indicators and the number of patent applications across 27 developing countries over a span of 13 years, from 2008 to 2020.

To provide robust and reliable insights, the study employed the Generalized Method of Moments (GMM) modeling approach. Unlike traditional regression models, GMM is adept at addressing endogeneity concerns, which often arise in studies of this nature. Endogeneity refers to situations where variables are interrelated and may bias the analysis. In this study, the GMM model was specifically chosen to account for the potential endogeneity of variables.

To ensure that the observed relationship between business regulations and innovation was not confounded by other factors, the analysis carefully controlled for several key variables. These included R&D expenditures, population size, and GDP. By including these control variables, the study aimed to isolate the specific influence of business regulations on innovation while holding other factors constant.

One of the pivotal findings of the study was the establishment of a statistically significant positive association between the EODB score and the volume of patent applications. In simpler terms, as the Ease of Doing Business score improved, there was a corresponding increase in the number of patent applications submitted by innovators in the studied countries.

The study quantified the impact of this relationship by estimating that a one-point increase in the EODB score corresponded to a 3.6% increase in annual patent applications. This quantitative insight underscores the practical significance of improved business regulations in fostering innovation. It suggests that even relatively modest improvements in the business environment can have a substantial positive effect on innovation outcomes.

The study's findings have significant implications for policymakers and business leaders in developing countries. They highlight the tangible benefits of creating a favorable business environment, as measured by the EODB index. By streamlining regulatory processes, reducing bureaucratic hurdles, and enhancing legal protections, nations can encourage and support innovation-driven economic growth.

In summary, this study employed advanced analytical techniques and meticulous control of variables to uncover a compelling relationship between business regulations, as measured by the EODB score, and innovation, as reflected in patent applications. The results emphasize the practical importance of fostering a conducive business environment to stimulate innovation, ultimately contributing to economic progress in developing countries.

A. Advantages

The paper addresses an important and relevant topic - the relationship between the Ease of Doing Business index and innovation, which has implications for economic development and policy formulation.

The paper employs a variety of statistical models (Fixed Effects, Random Effects, GMM) to analyze the data. This approach enhances the credibility of the findings and accounts for potential endogeneity and autocorrelation issues.

The paper provides a comprehensive analysis of individual EODB indicators, shedding light on their specific contributions to innovation. This granularity is valuable for policymakers and researchers seeking to understand the nuanced effects of business regulations.

The study discusses the implications of its findings for policymakers, suggesting that reforms to improve the business environment can promote innovation. This practical aspect adds value to the research.

The use of logarithmic transformations for skewed variables is a good practice for handling non-normal distributions, ensuring the statistical validity of the analysis.

B. Limitations

The quality and coverage of the data used in the analysis can significantly impact the results. It is important to acknowledge any limitations or potential biases in the data sources.

While the paper identifies associations between EODB and innovation, establishing a clear causal relationship is challenging. Causality is often a complex issue in studies like these and should be discussed.

The paper does not extensively consider contextual factors that could influence the relationship between EODB and innovation. Cultural, political, and sector-specific aspects may play a significant role but are not discussed in detail.

The findings may be specific to the dataset and the countries under consideration. The extent to which these findings can be applied to a broader set of countries or regions should be addressed.

The paper explains why the GMM model was chosen over Fixed and Random Effects, but it could provide more detail on the specific reasons for this choice and discuss potential criticisms of the GMM model.

While the paper mentions endogeneity control as a reason for choosing the GMM model, it would be beneficial to explain in more depth how this control was achieved and its potential impact on the results.

The paper should address the possibility of publication bias, as studies with significant results are more likely to be published. It's important to consider the potential influence of unpublished or non-significant studies.

The paper could benefit from a discussion of avenues for future research. Identifying areas where further investigation is needed can guide future scholars.

Overall, this paper makes a valuable contribution to the literature on the relationship between business environment and innovation. However, it is crucial to acknowledge and address the limitations to ensure the validity and applicability of the findings.

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Overview of Studies Regarding Knowledge Management Efficiency Factors

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Abstract—Knowledge represents the imperative of modern business and, as such, represents the most important resource for achieving success and competitiveness of companies. In order for companies to be successful in the long term, their operations should be based on the continuous improvement of the knowledge and skills of employees and their involvement in creating quality. Productivity of knowledge, and therefore of companies, depends on many factors, which include investment in human resources, business environment and quality of business. This paper aims to define and presents organizational factors that influence the effectiveness of the application of knowledge management. The paper will contain a review of different studies and literature by different authors in order to make conclusions. The analysis of various studies and literature will lead to universal conclusions which will be presented in the paper.

Keywords – Knowledge management, efficiency factors, organization.

I. INTRODUCTION

In the conditions of the modern economy and global market, the key success factor of the company is the achievement of competitiveness, profit and a stable market position. The stability that companies strive to achieve is the stability of adapting to constant changes in the internal and external environment and, in such business conditions, knowledge has become the key and most important resource [1]. Natural resources, capital and workforce have become secondary sources of business effectiveness, while effective knowledge management has assumed a primary role. Knowledge management represents a challenge for management as a whole, especially in the domestic market, and when a quality knowledge management system is established in companies, it represents a management revolution.

Knowledge management as a management tool and a complex discipline dates back to IT disciplines and American research on artificial intelligence, Swedish research in the field of measuring knowledge and intellectual capital, and Japanese research in the field of knowledge creation, development and innovation [2]. Today, when it has been determined that knowledge represents the most important business and strategic resource, knowledge management deals with maximizing the abilities of employees in the organization, creating new knowledge and value, increasing productivity and developing infrastructure [3]. Knowledge management as an organizational innovation has been present in the business world for decades. As a discipline, knowledge management has reached a state of maturity where the principles, practices and tools that make it unique can be discerned. This discipline has given rise to the creation of new disciplines, concepts and categories to study the important ways in which organizations use knowledge to create value [4].

Knowledge is the ability to act, and knowledge management is a systemic and integral approach to identifying, managing and transferring all information ownership in a corporation, including the experiences and expertise of employees, databases, policies and processes [5]. Knowledge management implies the management of both information and people, i.e. employees in the organization. Aspects of knowledge management can be considered both at the individual and at the organizational level [6].

Knowledge management means creating a base of information, data and experiences of the organization available to scientific employees responsible for its use. Knowledge management encourages the learning of the organization and its employees, strengthening cooperation within it and continuously improving the achievement of the organization's goals [7]. Typical goals of knowledge management are [8]:

- Facilitate a smooth transition of knowledge from employees retiring from their positions to employees recruited to fill those positions.
- Minimize loss of corporate memory due to attrition and retirement.
- Identify critical resources and areas of knowledge so that the organization works efficiently and effectively.
- Create a set of tools and methods that can be used with individuals, groups and the organization as a whole to stop the potential loss of intellectual capital.

The knowledge entire process of management includes the creation, acquisition, storage, sharing and application of knowledge, which represents the collective knowledge of a whose goal is the effective corporation application of knowledge when making organizational decisions [9]. Knowledge management does not change other important business strategies, but it has the function of an important business strategy, especially when it comes to the decision-making process. Namely, the result of this process is to obtain the necessary information in a relatively short period of time, which greatly facilitates the decision-making process. The most important sub-processes of knowledge management are [10]:

• Creating knowledge - implies individual learning or learning through cooperation in teams and the acquisition of external knowledge.

- Acquiring knowledge implies activities similar to employee trainings, such as participation in various training courses and improvement by reading appropriate literature.
- Knowledge storage implies creating an appropriate database, i.e. electronic storage of knowledge so that it is easily accessible to employees.
- Sharing knowledge with others implies the development of effective information and communication systems within the organization so that its members share significant knowledge with each other.
- Application of knowledge implies the basic task of the entire process of knowledge management, which is the application of knowledge when making organizational decisions.

Organizations exposed to the global market and modern business conditions are forced to create systems and processes that make available the knowledge possessed by employed individuals. More efficient use of knowledge implies its codification and preservation. These transformation processes are made possible through rapid development in the field of information technology. The greatest contribution of knowledge management may concern the effort to transform tacit knowledge into explicit knowledge. The impact of knowledge management on the business world is a complex field, and one of its significant uses is the strategic field in organizations. Knowledge management, in addition to being strategic, is also an operational tool of the organization [11].

One of the the key roles of knowledge management is to provide employees at all organizational levels with the necessary, i.e. the right knowledge, at the right time and in the right place [12]. Effective knowledge management in the organization contributes to the achievement of long-term goals due to the creation of new knowledge and innovations, which increases the competitive advantage of the organization. In addition, knowledge management greatly enhances and develops existing organizational knowledge, which means that learning organizations continuously change and develop as a whole.

II. METHODOLOGY

A. The Subject and The Problem of Research

Many organizational factors are responsible for the success of the organization as a whole and for the success of the implementation of knowledge management. This paper will deal with the analysis of the most important efficiency factors in the concept of knowledge management, by considering different literature sources and studies. Additionally, this paper will try to indicate their importance within the organization.

B. Research Goal

The main goal of this paper is to identify knowledge management efficiency factors and to present their importance.

C. Research Question

Based on analyzed theories, we will try to answer the following question:

• What are the most important factors of knowledge management efficiency within the organization?

D. Research Method

This is a form of theoretical research in which universal conclusions are made by considering previous conducted research, studies and literature. Research will consider results of as many other authors as possible in order to make conclusions.

III. RESULTS AND DISCUSSION

Organizational culture represents the general pattern of behavior, common beliefs and values of their members. Organizational culture involves the learning and transmission of knowledge, beliefs, and patterns of behavior over a period of time. It establishes the rules of human behavior that are taken for granted in the business environment [13]. Organizational culture represents one of the key variables of organizational behavior. Culture is an expression of communicative and interpersonal relations of a company, i.e. the company's ideology. The content of the organizational culture consists of the norms, standards and philosophy of the company with dominant attitudes and values.

The company's philosophy reflects goals, values, convictions, ideas and ideals. Norms of behavior talk about the way of communicating with the internal and external environment, which represents the idea that guides each individual in the organization. Standards represent the way in which work should be performed, i.e. the generally accepted way in which each individual within a certain function or sector performs the assigned task [14].

Organizational culture is very important for a company because it facilitates its adaptation to the demands of the environment. It also includes the influence of the company's history and tradition on its market success, as well as on the behavior of associates. i.e. employees. Organizational culture also talks about the rules and rituals that take place in the company, and there are numerous authors' opinions that a large number of employees in lower and middle management are not aware of what organizational culture is and what type of image that culture has created about the company in its environment [15].

When the company's organizational culture is developed so that the level of employee involvement in the organization's functioning is high, employees will feel a greater degree of security in expressing their ideas, sharing knowledge and experiences, and participating in the decision-making process. Such an organizational culture supports and stimulates the implementation of knowledge, as well as the sharing of knowledge among employees. If the internal environment of the organization is developed in this way, the values, attitudes and norms that the employees adhere to will stimulate the process of knowledge management in the organization [16]. A key element of the organizational culture that supports the implementation of knowledge management is the focus on knowledge workers and preventing the outflow of knowledge from the company, that is, retaining and motivating employees who possess important organizational knowledge.

Leadership as a discipline is necessary for modern organizations, primarily due to the fact that leadership supports the implementation of organizational changes, and the introduction of knowledge management into the daily functioning of the organization represents a significant change in domestic business organizations and changing the status quo. It can be said that leadership as a concept represents a important resource of business very organizations and one of the critical success factors of modern organizational systems. One of the significant features of leadership as a discipline is its motivating influence on followers

and raising employees' awareness of the benefits and well-being of their business activities, both for themselves and for the organization in which they work. Taking into account the fact that leaders lead the organization in the desired direction and occupy a significant role in the decision-making process, leadership is also a significant factor for the implementation of knowledge management due to increased flexibility, acceptance of changes and competition with strong competition in the market [17].

Organizations that implement knowledge management processes in its business create knowledge workers led by knowledge leaders. Such an organization possesses distinctive capabilities that provide it with a competitive advantage and within which special organizational values are developed. There is a significant connection between organizational culture and leadership, because it is leadership that develops a culture of knowledge among employees that they, with the leader's motivation, accept. This develops significant organizational competencies. Leadership and knowledge management are the foundation in building the organizational culture of the company, focused on the coordination of activities, measurement and evaluation of achieved results and systematic planning and control of the entire business. Knowledge and learning in themselves represent an indispensable part of leadership, therefore leadership in the application of knowledge management is a very important factor. The application of leadership in support of the implementation of knowledge management in the organization implies the expression of mentoring, creativity, innovation, development of vision, acquisition and sharing of knowledge. Therefore, with the help of leadership, i.e. knowledge leaders, existing organizations focused on resources are transformed into organizations based on knowledge that surpass with their organizational competitors performance. As there are different styles of leadership in literature and practice, so different styles of knowledge leaders can be applied in the implementation of knowledge management. Organizations will choose a certain style in accordance with their goals and desired effects, and each of the knowledge leadership styles should fulfill the success factors, i.e. the "7C" of knowledge leadership [18]:

• Context – a knowledge leader should understand the nature and complexity of

the context within which he or she operates, as well as have the ability to inspire others.

- Competence knowledge leaders support systematized learning frameworks that create knowledgebased competencies.
- Culture knowledge leaders know the connection between psychological and sociological skills such as individual motivation and organizational culture, which creates a business vision.
- Community knowledge leaders understand and create the value of the community, i.e. teams in order to realize the set vision.
- Conversation and Common language knowledge leaders develop a common language in the organization and encourage dialogue among employees that affects organizational results.
- Communication knowledge leaders understand the importance and develop communication processes within the organization due to the fact that developed communication facilitates learning processes and the exchange of organizational knowledge.
- Coaching knowledge leaders are continuously trained and train employees with developed skills and vision.

Therefore, leadership represents the first secondary activity of knowledge management, which means that effective leadership processes enable the successful implementation of knowledge management among employees and business processes of the organization. Knowledge leadership integrates knowledge management with knowledge development, which creates new, useful organizational values and results such as increasing productivity, innovation, creativity of employees and strengthening the reputation of the organization. Leadership as a discipline has a significant role in the realization of organizational learning and the transfer of organizational knowledge. Leadership know-how represents accumulated knowledge that is the result of learning from previous experiences. In the organizational environment, there is room for constant learning and improvement, and knowledge leadership is reflected in continuous training and employee training. Also, by applying different motivational mechanisms and unifying

knowledge from different disciplines, leadership creates a positive atmosphere and working environment for business based on knowledge, with a focus on exchanging existing and creating new knowledge, instead of documents and procedures [19].

Applying leadership and knowledge management ensures a high level of individual and collective knowledge important for achieving good organizational and economic performance. Knowledge leaders have the ability to recognize the talents and skills of employees, which gives them the ability to guide and develop the potential of employees. They indicate to employees the benefit of knowledgebased work and remind them of the realization of the vision and the creation of value, by which employees are involved in the process of creating knowledge in addition to achieving financial results. Also, knowledge leadership builds and develops the trust of employees, their interaction and useful mutual communication. By creating a vision as a desired image of the future to be aspired to, knowledge leaders encourage the organization to operate beyond the scope of managerial activities such as goals, strategies, policies, budgets, and the like, while not neglecting them.

In modern business, the application and development of information technologies plays a key role in the very survival of the organization on the market, its functioning, but also the creation and sharing of knowledge. Information technologies by themselves are not sufficient to successfully implement knowledge management, but they represent a significant factor in its concept, because databases and corporate intranet represent the development and facilitation of knowledge exchange among employees and between different organizational levels. Organizations can use advanced software that includes knowledge management systems, and technical means have an impact on ensuring the market efficiency of organizations. In order for information and communication systems to successfully participate in the implementation of knowledge management in the organization, thev should be compatible with other organizational platforms, as well as have reliability and accuracy [20].

Three groups of technologies that can be used to support knowledge management in an organization are [21]:

- Communication technologies provide access to the necessary knowledge and communication between employees using the organizational intranet and electronic mail.
- Collaborative technologies provide a means for teams to work together that can use shared documents, simultaneously or not, from different locations.
- Warehouse architecture includes systems and technologies for managing databases that enable knowledge storage and management.

information The strengthening of technologies is connected with the strengthening of the concept of knowledge management because there is a significant connection between their application. By applying information technologies in the implementation of knowledge management, important methods and techniques of knowledge sharing in the organization are developed such as blogs, expert systems, content management systems, Internet, Intranet. Extranet and SAP (Systems. Applications and Products) [22].

In addition to the mentioned useful methods for sharing knowledge in the organization, in order for the knowledge management system to be more effectively applied with the help of information technologies, it is necessary to design the knowledge management system. Designing a knowledge management system includes all phases of the development life cycle of the information systems themselves, such as the design of the organizational structure, analysis of user activities and requirements, analysis of relationships, design of the database and application-software architecture of the information system [23].

The concept of knowledge management is based on the concept of the learning organization and the concept of total quality management of the organization (TQM concept), and when talking about the sub-processes of knowledge management and knowledge acquisition, it is important to emphasize the importance of communication and the creation of information systems for the organization. The result of the integration of the mentioned sub-processes of knowledge management implies the creation of a virtual organization, i.e. an organization that integrates services with the help of developed technology with the aim of electronic business management [24]. Organizations with these characteristics are needed by today's changes in the market, because only organizations where electronic technologies define the business can face the changes in the market.

IV. GUIDELINES AND RECOMMENDATIONS

Examining knowledge management efficiency factors is a key aspect of improving organizational processes and performance. In order to adequately understand this area, the following guidelines and recommendations are offered:

- Analysis of organizational culture organizations with an open and supportive culture of knowledge often achieve better results in the implementation of knowledge management strategies.
- Identification of key success factors identification of key factors that influence the effectiveness of knowledge management is very important. This may include identifying the technological, human and process factors that contribute to or limit the success of implementing knowledge management.
- Measuring the impact of knowledge management on business performance – managers should consider how to measure and quantify the impact of knowledge management on business performance. This may include analyzing key performance indicators such as efficiency, innovation, cost reduction or revenue growth.
- Continuous evaluation and improvement - the effectiveness of knowledge management is a dynamic field. Organizations should regularly evaluate their knowledge management practices and implement improvements based on new knowledge and changes in the environment.

Researching knowledge management efficiency factors requires a multidisciplinary approach and careful planning. However, the realization of these activities can bring long-term benefits to organizations.

V. CONCLUSION

Based on the review of the literature presented in the paper, it is concluded that one

of the most important factors in the effectiveness of knowledge management is an adequate organizational culture, strong leadership, an efficient system of business quality and appropriate support of information technologies (RQ:1). If knowledge is viewed as a process, it is necessary for employees to focus on the creation of knowledge, its exchange and distribution, which is achieved by sharing information and data between individuals and groups at all organizational levels. In order to achieve business excellence, it is necessary for companies to work long-term on the implementation of business quality based on increasing the productivity of work and knowledge of each employee. It is necessary that the entire organizational culture supports the development of existing and acquisition of new knowledge at the level of the entire organization, and aspects of management and organization that should support knowledge management are organizational learning, organizational behavior, innovation and leadership. Therefore, in organizations, it is necessary to create a suitable climate that encourages learning and knowledge, effective communication systems and awareness at all levels about the importance of applying knowledge.

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Some Aspects of the Criminal Potential of Artificial Intelligence

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Abstract—This paper explores the potential criminal aspects of artificial intelligence (AI) and its ubiquitous presence in today's society. It delves into various dimensions of this issue and highlights diverse areas where AI could pose a significant threat. The paper analyzes the differences between various levels of artificial intelligence, from narrow artificial intelligence (ANI) to general artificial intelligence (AGI) and superintelligence (ASI). It emphasizes that while significant progress has been made in ANI, AGI, and ASI, which could compete with human intelligence, are not yet developed. Next, it examines the criminal potentials of AI, including possible threats such as job displacement, decision-making bias, military use, and potential misuse of AI in various forms of criminal activities. The paper also considers the challenge of applying human laws to artificial intelligence, which lacks ethical norms or moral consciousness. Furthermore, it analyzes the race among countries to develop AGI and ASI, expressing concern that such a race could lead to conflicts or even wars among nations possessing such entities. The concept of "singularity" - the moment when artificial intelligence may cease to be under human control - is also explored as a potential threat. Lastly, the paper addresses specific examples of criminal activities using AI, including attacks on security systems, identity theft, the generation of fake video and audio content, and other forms of cybercrime. In conclusion, the authors emphasize the crucial need to seriously consider these threats and develop protective measures to confront the growing criminal potential of artificial intelligence in modern society.

Keywords - Artificial intelligence, criminal potential, existential risks, singularity, ethics

I. INTRODUCTION

At the core of the contemporary human conception of artificial intelligence (AI) lies the belief that humans will eventually create machines surpassing their own intellectual capabilities. Each passing year witnesses remarkable practical advancements in AI, including the generation of authentic video content, the creation of text, images, and music, well as the increasing autonomy of as automobiles. However, when viewed from the standpoint of Artificial General Intelligence (AGI) - which represents the pinnacle of intellectual capacity within $A\hat{I}$ – these achievements appear rudimentary, insignificant, and profoundly unpromising. Presently, while humans have constructed numerous AI systems that excel in specific tasks, there is neither an extant nor a projected intelligent system capable of matching the overall cognitive power of the human brain, not even when compared to the brain of an ordinary rodent [1].

Contemporary scientific discourse classifies AI into three theoretical forms: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI). ANI is considered "weak" AI, while the other two categories are designated as "strong" AI. Weak artificial intelligence is defined by its capacity to perform specific tasks. Instances of ANI application encompass natural language processing (NLP), computer vision employed in the development of self-driving vehicles, and computer vision tasks [2]. Conversely, stronger or higher-order AI, such as AGI and ASI, involve the replication and simulation of human cognition and behavior. Strong AI is characterized by its ability to compare and equate with human cognitive abilities. AGI aims to achieve parity with human intellectual capacities, while artificial superintelligence (ASI) aspires to substantially surpass human intelligence and the cognitive faculties of the human brain.

The challenge posed by strong AI is not solely ontological but also phenomenological in nature. Even advanced scientists have yet to provide a comprehensible scientific or practical framework for AGI or ASI, aside from reiterating a descriptive definition that posits "higher forms of AI represent the cognitive segment driving and governing the processing of data acquired through perception, as well as the segment that generates and leverages knowledge gained through the AI entity's own experiences [3]." AGI and ASI entities are posited to possess embodiment, consciousness, and superior intelligence. These attributes inherently define the subjective characteristics of AI entities, facilitating the assimilation and processing of all acquired information to comprehend and interpret the surrounding world. Given the dearth of scientific elucidation, higher forms of AI are portrayed to the public as an implementation of artificial intelligence found in science fiction literature and films, depicting a system capable of solving problems more efficiently and rapidly than humans. Such a conceptualization remains nonexistent on Earth, and there is no coherent scientific conjecture regarding its emergence. Instead of AGI and ASI, contemporary ANI artificial intelligence remains highly specialized, purpose-built, and incapable of seamlessly transitioning between different objectives. Furthermore, progress with ANI development fails to meet anticipated timelines. Despite notable advancements in the creation and utilization of intelligent software and machines, the outcomes, when compared to the ultimate objectives, remain rudimentary and offer scant reason for optimism [4]. This concern is particularly salient when considering the criminal potential and existential risks that have perturbed the scientific community and experts for some time [5].

A pertinent issue is the pace of advancement in AGI development and the prospect of presenting humans with the first self-sustaining cognitive AGI entity. Researchers abstain from making precise predictions, but the prevailing consensus suggests that the close of this century serves as a feasible timeline for the creation of rudimentary AGI entities [6]. Ray Kurzweil, an optimistic futurist, asserted five years ago that there exists a 50% likelihood of AGI development by 2029, while Rodney Brooks, a roboticist and co-founder of iRobot Corporation, the most pessimistic outlook posits AGI's advent no earlier than 2200 [7].

In tandem with engineers' efforts to develop AGI, a progressively more profound discourse on the ethics of employing artificial intelligence emerges, alongside apprehensions of its potential to contravene human laws and engender substantial and irremediable quandaries. These quandaries exhibit gradation. At the lower end of the spectrum, issues encompass the loss of millions of jobs, biases in decisions made by artificial intelligence across various tasks, or the risks inherent in deploying AI in military systems. At the zenith of existential risk are assessments positing that the criminal potential of strong AI looms so large that uncontrolled and unauthorized AGI-ASI development could culminate in the extinction or annihilation of the human species on Earth.

Futurists have long foreseen that even decades before the emergence of AGI and ASI, advancements in computing and robotics could precipitate profound disruptions in the global labor market. This could potentially result in tens of millions of individuals losing their livelihoods. Researchers hold that artificial intelligence is poised to surpass human capabilities in translation quality (by 2024), the composition of school essays (by 2026), autonomous truck driving (by 2027), and employment in retail (by 2031). AI is also projected to be capable of writing books (by 2049) and even outperforming human surgeons (by 2053) [8]. Furthermore, researchers contend that there is a 50% probability that artificial intelligence will outperform humans across all tasks within 45 years and fully automate all human occupations within 120 years [8].

II. THE UTILIZATION OF AI AS A CONDUIT FOR CRIMINAL ENDEAVORS

At the apex of the peril posed by the flagrant criminal potential of AGI-ASI lies an existential risk to human society on Earth. Nevertheless, when we discuss the criminality of strong AI, a certain distinction should be made, or at least a question posed. How reasonable is it to believe that human laws will be relevant and binding for strong AI? Scientists have yet to provide an answer to this question. Instead, futurists offer a response by pointing to the behavior of the HAL 9000 computer, or the immense malevolence exhibited by androids like the T-1000 or T-3000 in the Terminator film franchise.

Without diminishing the benefits that AI technologies have brought to the world, the scientific community, excluding a substantial group of roboticists, electronic engineers, and others, does not conceal its concern regarding the escalating advancement of artificial intelligence and its integration into crucial domains of both public and private life. "The installation of deep learning and self-learning neural network-based systems, the utilization of machines far superior to humans in data analysis and decision-making speed, as indicated by researchers, scholars, and futurists, with the passage of time, not only can displace a human from many employment fields but may also erode one's mental faculties, determine or alter their inclinations, habits, communication, and even destiny, jeopardize inviolability of privacy, and lead to the destruction of human freedom" [9].

People generally fear their inability to constrain the criminal potential of artificial intelligence and the technology it encompasses. The more people become acquainted with AI, the more trepidation ensues, particularly among experts in AI entities. The Future of Life Institute (FLI) has categorized artificial intelligence as one of the technologies with the potential to pose an existential risk. They define existential risk as "any risk capable of eradicating the entirety of humanity or, at the very least, causing significant casualties among the global population, leaving survivors without sufficient means to rebuild society to current living standards. Alongside artificial intelligence on this list are "nuclear war," "biotechnology," and "climate change" [3].

A similar viewpoint on the hazards that could arise from the criminal activities of uncontrolled AGI has been expressed by Nick Bostrom, the author of the book "Superintelligence." Bostrom has issued a dramatic warning about the potential danger of AI criminal behavior, stating that artificial intelligence, due to misaligned goals, poses a greater threat to the existence of the human race than climate change: "The concern is not that AGI would hate people or take offense at being enslaved by them, or that it would suddenly develop consciousness and rebel, but that AGI would be very competent in achieving goals that differ from ours." [10].

Scientists have long been warning humanity that the "awakening of robots," which includes current-level smart machines based on software AI, could, in a particularly destructive but not impossible development, signify, if not the disappearance of the world, then its transformation into a world inherently alien to humans and their mental faculties.

The question of a fatal existential threat is temporally distant compared to the problems brought about by ANI, such as economic disruptions, privacy erosion. criminal subjugation of the web, and the use of advanced automation in warfare. Barbara Gros, a professor of artificial intelligence at Harvard, believes that "currently. with artificial intelligence systems, we have a vast number of unresolved ethical questions. It is a distraction from them because of frightening futuristic scenarios" [11].

Martin Ford argues that "perhaps the most important conclusion that most architects of AI come to is that there are no easy answers in a field as complex as artificial intelligence. Even the most elite scientists do not agree on fundamental questions and challenges facing the world. The main conclusion people don't grasp is how much disagreement there is," says Ford. "The entire terrain is so unpredictable. People disagree on how fast it's moving, what the next breakthroughs will be, how quickly we'll get to AGI, or what the most important risks are" [6].

III. HUMANS AS COLLATERAL DAMAGE AND SINGULARITY AS A CRIMINAL THREAT OF AI

Various nations are presently engaged in the development of strong AI entities, participating in competitive endeavors. However, these countries do not maintain amicable relations characterized by collaboration and peaceful coexistence. In fact, some of them are embroiled in conflicts, or their policies suggest the potential for hostilities in the foreseeable future. In the event that these nations succeed in constructing Artificial Superintelligence (ASI), a pertinent question arises: will they employ ASI entities against other states possessing similar technology? Consequently, the scenario unfolds where machines, originating from both Eastern and Western powers, could potentially engage in a global struggle for supremacy, potentially culminating in the eradication of machine intelligences and human populations alike.

The ascendancy of humanity to the apex of the terrestrial ecosystem can be ascribed not to physical attributes such as sharp dentition or robust musculature but, rather, to the faculty of human intelligence. This leads us to a profound inquiry concerning artificial intelligence: Is it conceivable that AI could eventually surpass human intelligence? Dependence solely on the termination of power sources proves inadequate, as an AI of sufficient advancement could preempt such measures and take precautions to safeguard its continuity. This concept is commonly termed the "singularity," signifying the juncture at which human cognition no longer maintains its supremacy on Earth [3].

The progression of life on our planet is entering a phase wherein its sustenance becomes contingent upon machines possessing vastly superior cognitive faculties and processing capabilities in comparison to humans. Importantly, these machines are devoid of ethical considerations or a moral framework aligned with human values. Scholarly discourse further accentuates the notion of a significant "criminal potential" intrinsic to AI. characterizing it as an exponentially "perilous apparatus" whose inherent risks escalate with each passing day [12]. Historical precedents have consistently demonstrated that behind every perilous machine or disruptive innovation resides an equally hazardous human entity who, at times, harbors the misguided belief that control over such entities can be readily exerted [13]. Elon Musk, a prominent figure in the technological realm, has expressed a prescient sentiment, asserting, "With artificial intelligence, we are summoning the demon. In all those stories where there's the guy with the pentagram and the holy water, it's like yeah, he's sure he can control the demon. Didn't work out" [14].

IV. THE CRIMINAL POTENTIAL OF ANI

When contemplating the swift integration of artificial intelligence (AI) into everyday life and its potential for criminal exploitation, it becomes evident that we are dealing not merely with intelligent software but also with complex human factors. In the contemporary landscape, entities possessing self-sustaining AI capabilities, which can function autonomously without human intervention, are indeed rare. These AI entities remain confined within predefined systemic boundaries, subject to moral and legal frameworks, and interconnected with human oversight. It is imperative that AI entities are subjected to human governance and control. However, the pivotal question pertains to the identity of the human controller. It is crucial to recognize that the human responsible for managing an AI entity wields the full spectrum of capabilities inherent to that entity.

The criminal potential of AI manifests through diverse avenues. AI holds distinct advantages over human actors, and these advantages often stimulate the conceptualization of AI as a tool for criminal endeavors. AI has the capacity to facilitate real-world actions against predetermined targets by leveraging its inherent capabilities. This is particularly relevant when considering criminal activities that human actors are either incapable of or reluctant to execute due to associated risks, physical limitations, or constraints. While response time the methodologies employed may be novel, the resultant crimes can exhibit traditional characteristics, encompassing activities such as theft, extortion, intimidation, and acts of terrorism. AI offers a manifold advantage when it comes to analyzing and predicting human behavior, the behavior of institutions, or the functioning of business and financial systems, thereby allowing for the identification and exploitation of vulnerabilities. Society has already encountered instances of criminal behavior involving the generation of counterfeit video and audio content, identity theft, as well as the deployment of AI in extortion and reputation-damaging assaults against individuals and organizations. Moreover, AI systems themselves can become targets of criminal activities, leading to the compromise or erratic operation of reliable or mission-critical systems.

Crimes influenced or directly executed by Artificial Narrow Intelligence (ANI) exhibit significant diversity. These crimes can be directed toward individuals. institutions. corporations, consumers, physical assets, governmental bodies, social fabric, and public discourse. Their motivation may stem from financial gain, the acquisition of power, or the alteration of one's social standing relative to others. These crimes have the potential to dismantle reputations construct or and relationships, alter policies, or sow discord. Their effects can serve as both an end in themselves and as a steppingstone toward further objectives. Criminal acts may be committed with the intention of mitigating or evading punishment for other offenses, or they may be driven by desires for retribution, sexual gratification, or the advancement of religious or political agendas.

The contemporary online milieu. characterized by the precarious ownership of personal and corporate data, significantly diminishes the intrinsic value and practical authority of information. Consequently, it serves as an ideal environment for the exploitation of AI-driven criminal activities. In contrast to traditional forms of crime, digital environment crimes are inherently highly replicable. Once developed, techniques can be readily shared, duplicated, and even commercialized, thereby establishing the potential for the commodification of criminal methodologies and the provision of "crime-as-a-service."

In a report named "The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation," it is posited that rogue states, criminal elements, and terrorist entities may employ AI for nefarious purposes. This comprehensive report, spanning 100 pages, delineates three primary domains - digital, physical, and political - where the malevolent and criminal exploitation of artificial intelligence is deemed most likely [15]. Jane Wakefield has highlighted the preeminent threats stemming from artificial intelligence in the wrong hands, including the deployment of weaponized drones, the propagation of fraudulent videos designed to manipulate public sentiment and automated cyber intrusions [16]. Those involved in the development of robotics and artificial intelligence systems are impelled to adopt more stringent measures to ensure that their technologies are not harnessed for deleterious purposes.

Shahar Avin, affiliated with the Center for the Study of Existential Risk at the University of Cambridge, underscores the disconcerting emergence of novel training methodologies applied to artificial intelligence. This evolution has elevated robotics to a level of superhuman intelligence, albeit devoid of the ethical constraints inherent to human operators [16]. Avin presents several scenarios wherein artificial intelligence could unexpectedly emancipate itself from human control in the near future [15]. As a safeguard against this eventuality, Avin emphasizes the significance of "fuzzing architectures extended by neural network technologies." These architectures are employed to identify "vulnerable" program states, drawing an analogy to the manner in which AlphaGo's software deploys neural networks to identify "vulnerable" states within the expansive search space of the Go game [16]. In addition, the ClusterFuzzLite project, developed by Google, facilitates the organized conduct of code-fuzzing tests during the operational phase of continuous integration systems, thereby enabling the early detection of potential vulnerabilities.

These methodologies serve to fortify the security of well-guarded systems overseen by major corporations and certain segments of Western governments. Nonetheless, it is noteworthy that organized criminal factions in Eastern Europe have, after a period of approximately one to two years, adopted these very systems, deploying ransomware attacks. This malevolent software undergoes continuous refinement through the discovery of numerous new exploits facilitated by fuzzing techniques. Although fully patched operating systems and browsers generally demonstrate resilience, the majority of older mobile phones, laptops, and IoT devices persistently exhibit vulnerabilities [17,18].

Miles Brundage, a researcher affiliated with the Institute for the Future of Humanity at the University of Oxford, contends that "AI will redefine existing threats to individuals, organizations, and nations. These threats encompass criminal activities involving the installation of hacking mechanisms or the illicit acquisition of individuals' information, as well as incursions into privacy through surveillance, personality profiling, and further repressive measures. AI will engender a broad spectrum of security implications for humanity" [16].

Seán Ó hÉigeartaigh, the executive director of the Center for Existential Risk and a co-author of the report mentioned above, supplements this perspective by emphasizing the transformative influence of artificial intelligence. He underscores the imperative for scientific communities to respond to the multifaceted impact of AI and the prospective alterations it may induce within our global landscape over the ensuing 5 to 10 years. It is incumbent upon us to recognize that we inhabit a world vulnerable to the daily perils stemming from the misuse of artificial intelligence, and thus, we must commence addressing this formidable challenge, as these risks are undeniably genuine [16].

The protracted era of enthusiasm surrounding artificial intelligence, characterized by a belief in its capabilities attainable only in a distant and secure future, has irrevocably concluded. Engineers are now compelled to software and microprocessors fashion characterized by heightened resistance to cyber intrusion, while governments must enact legislation and international regulations to bolster these security measures [15].

A scholarly work by Begishev and Khisamova in the Russian language [19] discerns between direct and indirect criminological risks associated with the use of AI. Ovchinskiy, in his conclusive observations, ascertains that available evidence indirectly suggests that criminal elements are actively preparing to harness the potential of artificial intelligence. The author delineates numerous principal domains within which criminal communities might deploy artificial intelligence, including its utilization for compromising and embedding malicious software within payment systems, primarily leveraging blockchain protocols and P2P architecture. Additional applications encompass incursions into intellectual property, violations of human life and health, the construction of databases from diverse sources, involving the unlawful collection and utilization of information, participation in extremist and terrorist activities, and even the illicit practice of criminal 3D printing [20].

V. CONCLUSIONS

The human community perceives criminal acts as malevolent deeds, and criminals are viewed as individuals committing harm, thus devising an entire spectrum of activities to punish wrongdoers and protect others from them. However, regardless of how many human laws it may transgress, AI is not inherently evil. AI possesses divine-like characteristics; it is an entity beyond the realms of good and evil. No matter how hard programmers strive to align AI with the moral principles of the human community, AI eludes such efforts. One can argue that its ontological existence resides in an "absence of ethics" [21]. AI does not possess a concept of "right" or "fair" conduct; it lacks empathy and remorse. Its decision-making is shaped by algorithms in an endless ethical and logical uniformity that St. Augustine described as an "absence of good" [21].

Stephen Bush has noted that AI does not necessarily have to take human lives to disrupt them or lead to adverse political outcomes. He points out, "However, if artificial intelligence were to extinguish human life, it almost certainly would not resemble an eruption of malevolent destructive superintelligence from Terminator films. The catastrophe will not occur when sophisticated intelligence decides to use its power for intentional harm but rather when it is shockingly indifferent to everything human, choosing the easiest way to ultimately fulfill its programmatically assigned objectives (or simply eliminate competition). The threat that artificial intelligence will precipitate some form of societal disaster is, of course, the reason why we should be concerned about research, ethics, and transparency. However, this focus on catastrophic potential can sometimes divert attention from more mundane dangers" [22].

Scientists argue that AI should enable machines to replicate human cognitive abilities, but concurrently, there is a resolute stance that AI should never attempt to assume the entirety of human's multifaceted mental processes. Artificial intelligence undoubtedly provides a substantial boost to the augmentation of human general capabilities. Still, the human body and mind constitute the foundation of humanity's existence. Some facets of human activities may be entrusted to virtual management, but responsibility and ultimate control must remain within human purview. All tools, from a simple screwdriver to interactive global management systems, are mere adjuncts to human activities and must never supplant human capacity to intervene in the process and exercise control over it.

The understanding of the peril of losing control over AI actions is not new. In the early 19th century, ideas about artificial beings and thinking machines evolved in fiction, as seen in Mary Shelley's novel "Frankenstein," first published in 1818, or in Karel Čapek's "R.U.R. (Rossum's Universal Robots)," published in 1920, which introduced the term "robot" for the first time [23]. A more precise danger was also identified in the 1920s, but it took another two decades before the danger was formalized. Isaac Asimov introduced the concept in the 1940s when he formulated the initial cautions as the Three Laws of Robotics within his short story "Runaround" published in March 1942 [24]. AI must be subject to the laws of robotics. If humans relinquish responsibility and control, room for errors and abuses emerges, marking the first step toward human obsolescence on this planet.

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The Role of Machine Learning in Marketing Strategies within the Marketing 5.0 Framework

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Abstract—This study investigates the relationship between machine learning (ML) and marketing strategies, highlighting its transformative potential for businesses and governments. Machine learning enables sophisticated customer predictive segmentation, analytics, and personalization, all of which lead to more refined and effective marketing strategies. The main goal of the paper is to develop a theoretical model for improving competitiveness. The model is based on machine learning and Marketing 5.0. The study emphasizes the importance of innovation and ethical considerations in using ML in marketing to develop impactful, value-driven strategies.

Keywords – Marketing 5.0, competitiveness, machine learning, business, strategy

I. INTRODUCTION

The modern business environment's rapid evolving technological innovations and consumer preferences are expected to have a significant impact on the future marketing landscape. A greater emphasis on customercentricity and personalization is expected to characterize this environment. This is where data and analytics will come into play, allowing brands to personalize their services, products, and communications to each consumer's unique needs and preferences [1]. The role of AI and machine learning in analysing consumer in order behaviour to provide highly personalized and relevant experiences will be important. Sustainability and ethical considerations are also to become cornerstones

of marketing strategies. Modern consumers are increasingly concerned about the environmental and societal consequences of their purchases, and they prefer enterprises that practice environmentally friendly and socially responsible business practices. This implies that brands that embrace sustainability and ethical practices and communicate them openly are more likely to gain consumer favour and trust. Aside from ethical concerns, technological advancements such as augmented reality (AR), virtual reality (VR), and blockchain are poised to change the way brands interact with customers. AR and VR are expected to provide immersive brand experiences, while blockchain is expected to bring unprecedented levels of transaction transparency and traceability. The dominance of content marketing is expected to continue, with a focus on high-quality, valuable, and relevant content to attract and retain customers [2].

E-commerce and Direct-to-Consumer (D2C) models are also expected to gain traction. This shift can be attributed to shifting consumer preferences, with an increasing preference for online shopping [3]. The ability for brands to interact directly with consumers via these models will strengthen brand-consumer relationships and provide valuable consumer insights to brands.

The integration of online and offline experiences, known as "phygital" marketing, is expected to gain traction, with brands using digital technologies to enhance in-store experiences and integrating online data to provide enriched and seamless customer journeys [4,5]. Given the rise in smartphone usage, the importance of mobile marketing is set to rise, with an emphasis on mobile-friendly websites, apps, and mobile-specific content to effectively reach consumers. Employees' roles as brand ambassadors are expected to grow in importance, with employee advocacy significantly contributing to brand credibility and reach through the provision of credible and authentic information.

In this study the main research question was:

What factors in the domain of machine learning and Marketing 5.0 affect competitiveness of enterprises?

The paper includes three main sections (excluding the Introduction and Conclusion sections). First, the concept of Marketing 5.0 is discussed. Next, machine learning and marketing are analysed. Additionally, the developed model is presented. Finally, suggestions and guidelines for improving competitiveness are noted.

II. THE CONCEPT OF MARKETING 5.0

Marketing 5.0 is the most recent evolution in field of marketing, resulting from the technological advancements and the growing importance of creating highly personalized This customer experiences. concept is inextricably linked to the fifth industrial revolution - Industry 5.0, which emphasizes collaboration between humans and machines with the goal of improving human experience [6].

The use of advanced technologies such as Artificial Intelligence (AI), machine learning, augmented reality (AR), virtual reality (VR), and the Internet of Things (IoT) is important in Marketing 5.0. These technologies enable brands to provide consumers with more personalized, immersive. and interactive experiences, increasing both engagement and satisfaction [7,8]. They allow for a more precise and in-depth understanding of consumer preferences, behaviours, and needs, allowing for highly specific marketing strategies and solutions. The emphasis on emotional engagement and a human-centric approach is the defining characteristics of one of Marketing 5.0. It goes beyond the logical and rational aspects of purchasing decisions to tap

into the emotional and subconscious layers of consumer choice, allowing brands and consumers to form deeper and more meaningful connections [9]. It aims to achieve a harmonious integration of technology and emotion, allowing brands to convey empathy and build trust with their customers, resulting in stronger and more enduring relationships.

Another important factor is the increased sustainability ethical emphasis on and practices. considerations in marketing Consumers are more aware and concerned about the environmental and social consequences of their purchases in the age of Marketing 5.0. To appeal to the conscientious consumer, brands must be more transparent and responsible in their operations and communications, incorporating sustainable practices and ethical values into their core business strategies [10, 11]. In this marketing era, data plays a more important role than ever before, driving decision-making processes and enabling the development of more precise and effective marketing strategies. Brands can anticipate consumer needs, optimize their offerings, and deliver more relevant and timely content and solutions by making extensive use of data analytics and insights. With technology enabling brands to create highly personalized experiences and interactions, personalization is at the forefront of Marketing 5.0 [12]. This level of personalization enables brands to address each consumer's unique needs and preferences, increasing satisfaction and loyalty.

In sum, Marketing 5.0 is distinguished by a symbiotic relationship between advanced technology and human-centric approaches, with the goal of providing consumers with deeply personalized and emotionally resonant experiences. To meet the evolving needs and expectations of modern consumers, it leverages advanced technologies, emphasizes emotional engagement, incorporates sustainability and ethics, relies heavily on data-driven insights, and blends online and offline experiences.

III. MACHINE LEARNING AND MARKETING STRATEGIES

The framework of machine learning, a subset of artificial intelligence, has significantly altered the landscape of marketing strategies, with a plethora of applications to optimize and personalize the consumer experience. It entails using algorithms and statistical models to enable systems to improve performance, make

decisions, and generate insights from data without the need for explicit programming [13]. Customer segmentation and targeting are two of the most important applications of machine learning in marketing. Machine learning algorithms are used by marketers to analyse large datasets, identifying patterns and segmenting customers based their on behaviours. preferences. and purchasing histories. Marketers can create their strategies, messages, and offers to each segment's specific needs and preferences, increasing the effectiveness of marketing campaigns and improving customer satisfaction and retention [14]. Predictive analytics is another important application in which machine learning models are used to forecast future trends, behaviours, and events based on historical data. Marketers can use predictive analytics to anticipate their customers' needs, preferences, and purchasing probabilities, allowing for more proactive and informed decision-making [15]. Marketers, for example, can optimize product

recommendations, personalize offers, and improve overall customer experience by predicting which products a customer is likely to purchase.

Personalization is an important aspect of marketing strategies where machine learning shines [16]. Machine learning enables the creation personalized content. of recommendations, and experiences by analysing individual user behaviours, preferences, and interactions [17]. This increased level of personalization enables brands to communicate more effectively with their target audience, stronger bonds and building increasing customer loyalty and engagement. Machine learning is also important in optimizing pricing strategies [18]. Dynamic pricing models powered by machine learning algorithms allow businesses to adjust prices in real time based on factors such as demand, competitor prices, and inventory levels [19]. This dynamic adjustment enables businesses to maximize profits, increase



sales, and respond to market fluctuations more quickly.

Furthermore, machine learning helps to improve digital advertising strategies through programmatic advertising and real-time bidding. Machine learning algorithms analyse user behaviour, preferences, and demographics to determine the best ad to show to a user at a given time to maximize engagement and conversion [20]. This not only increases ad spend efficiency, but also ensures that users see more relevant and appealing advertisements.

Machine learning assists in sentiment analysis in the context of social media marketing by evaluating user-generated content, comments, and reviews to gauge public opinion and sentiment about a brand or product. This analysis provides useful insights into customer perceptions, assisting brands in refining their messaging, addressing concerns, and improving their public image [21]. The ability of machine learning to process and analyse large amounts of data also allows for more effective campaign management. It enables marketers to evaluate the success of marketing campaigns, identify areas for improvement, and optimize strategies for improved results. Machine learning-powered A/B testing can help determine the most effective content, design, and messaging, thereby increasing the overall impact of marketing efforts.

Based on the analysed literature, a theoretical model was developed. The model is presented on Fig 1.

IV. SUGGESTIONS AND GUIDELINES

Based on the analyse literature and developed model, the following suggestions and guidelines for improving competitiveness are noted:

Enterprises the must ensure establishment of strong data management and governance structures. Adequate focus must be placed on the acquisition, cleaning, and processing of high-quality, relevant data, which serves as the foundation for effective machine learning models. Establishing secure and compliant data handling and storage processes is important for maintaining trust and adhering to regulatory requirements, particularly for governments dealing with sensitive citizen data.

- Enterprises should take a step-by-step approach to implementing machine learning in marketing. This entails beginning with smaller, manageable projects to gain insights and refine strategies before progressing to larger, more complex applications. Implementing pilot programs and validating their effectiveness early in the process can help in identifying potential pitfalls and areas for improvement.
- Cultivating a culture of continuous learning and development is important for staying current on developments in machine learning and marketing strategies. Training programs and workshops should be held on a regular basis to help employees improve their skills and develop in-house expertise in relevant domains. Both businesses and governments should invest in collaborations with academic institutions, research organizations, and industry experts to facilitate knowledge exchange and collaborative learning.
- In marketing strategies, the use of machine learning should be combined with a focus on customer-centricity and personalization. Enterprises can make their communications, products, and services to meet the unique needs and preferences of each customer or citizen, increasing satisfaction and forging stronger, more meaningful connections.
- Ethical considerations and transparency should be integrated into marketing machine learning applications. To build trust and maintain reputational integrity, enterprises must address the ethical implications of using machine learning and be transparent about how customer data is used. To ensure fairness, accountability, and bias avoidance, ethical guidelines and best practices should be established to guide the development and deployment of machine learning models.
- Enterprises should continuously monitor and optimize their machine learning models and marketing

strategies improve business to competitiveness. Regular assessments and refinements are required to adapt to changing market dynamics, consumer preferences. and technological advances. Implementing feedback loops and incorporating user feedback can help with ongoing marketing optimization and enhancement.

- Governments should prioritize citizen and welfare while engagement leveraging machine learning for public communication and services. Machine learning-enhanced public sector marketing strategies should aim to improve service delivery, effectively disseminate information, and foster a of community sense and civic participation.
- An interdisciplinary approach should be used to develop holistic, effective strategies by combining insights from machine learning with domain knowledge in marketing. Collaboration across departments and the utilization of diverse skill sets can result in the development of innovative solutions as well a more comprehensive as understanding of consumer behaviour and market trends.

Overall, incorporating machine learning into marketing strategies with care, strategy, and ethics can significantly boost competitiveness and improve overall business outcomes for both businesses and governments. Enterprises can leverage the transformative potential of machine learning to drive innovation and create value for their customers or citizens by focusing on data customer-centricity, continuous quality, learning, ethical considerations, and interdisciplinary collaboration.

V. CONCLUSION

Machine learning has the potential to revolutionize organizational competitiveness and business improvement across the board, from enterprises to governments. Enterprises can make their offerings more precisely by cultivating a structured and ethical approach to integrating machine learning insights with strategic marketing initiatives. This improves customer and citizen satisfaction, engagement, and loyalty. To realize the transformative potential of machine learning in marketing, a focus on data quality, customer-centricity, continuous improvement, and ethical deployment is required.

Future research could delve deeper into the development of more advanced, ethical, and transparent machine learning models to address the evolving marketing challenges and opportunities. Investigating the impact of emerging technologies on machine learning applications in marketing, such as quantum computing and blockchain, can provide insights into new possibilities and enhancements.

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The Impact of Globalization on the Development of New Knowledge of Project Managers

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Abstract—Globalization influences both the macroenvironment and the microenvironment, including its impact on Project Management. The changes it brings are most noticeable in multinational companies and virtual networking, which, as a result of globalization, require a different approach to work and project management. This research paper aims to highlight significant aspects of globalization that pose challenges for project managers. It also suggests guidelines for developing new knowledge and skills that will facilitate management in a networked society

Keywords- Globalization, project management, multinational companies, virtual network, knowledge

I. INTRODUCTION

We live in a world of rapid change, and this is not merely a characteristic of modern society, but much more than that. It represents a new philosophy of life, a new way of thinking that profoundly influences individuals, their way of life, and the business landscape. Science and technology strive to address the challenges of change, while simultaneously serving as their catalysts, offering new opportunities that can and should be seized. The project-oriented approach to organization and management stands as the most fitting response to the heightened pace of change. We are confronted with shifts in society, culture, economy, technology, politics, rights, and ecology. Whether arising from internal needs or propelled by processes and possibilities of globalization, we must address these changes on a local level, yet through a global mindset, with the participation of international and multidisciplinary teams. This international

cooperation finds its reflection in multinational corporations, international consortia, business networks, clusters, and the virtual connectivity of experts—virtual project teams.

The aim of this paper is to delineate the impact of the most pivotal aspects of globalization on the role of project managers and provide recommendations for the future of project management. Specifically, it seeks to answer the question of what knowledge must be cultivated in order to effectively respond to the transformations that globalization entails.

II. THE BASICS OF PROJECT MANAGEMENT

The most renowned definition, as documented in the Guide to the Body of Knowledge for Project Management, defines a project as follows [1]: "A temporary effort undertaken in order to produce a unique product, service, or other result." While this definition serves to establish the essence of a project, it's worth noting that projects vary in type. What remains consistent across all projects are the following key elements [2]: a defined goal, a predetermined deadline, inherent uniqueness, time constraints, allocated resources, and associated risks. Furthermore, projects progress through distinct phases, and the project team holds paramount importance throughout.

At a minimum, the project team should encompass [3]: a project manager, financial manager, and communications manager.

A. Project Manager

The project manager is responsible for overseeing the entire project. Their knowledge

and skills significantly impact the project's success and efficiency. To ensure a project's success, a project manager must possess technical, interpersonal, and conceptual skills. This encompasses familiarity with tools and techniques, effective teamwork, and the ability to anticipate how changes and challenges may influence the project and its overall workflow. As a result, a project manager should be well-versed in both the macro and micro environments to achieve the defined overarching goal. [4]

B. Macroenvironmental and Microenvironmental Factors

Macroenvironmental factors constitute the broader context in which business operations are conducted, including [5]: economic, demographic, political, legal, and technological frameworks. Microenvironmental factors, on the other hand, pertain directly to the company itself, encompassing [5]: business partners, competitors, employees, and users.

Globalization impacts both the macro and micro environments. It is essential to gain familiarity with its various aspects and understand what knowledge is required in this era of rapid change. This ensures that project managers do not jeopardize their projects with constant challenges that could have a negative impact on management

III. GLOBALIZATION

Globalization has different definitions, but when we refer to something being on a "global level," we imply a level that applies universally. This encompasses all parts of the world and the repercussions of globalization on various sociological, cultural, political, economic, and ecological aspects. Given its influence on all facets of life, it also significantly influences the role of project managers. Their position becomes more prominent, but also more demanding, necessitating the inclusion of new tasks on their to-do lists.

In the 20th century, projects could be managed by charismatic engineers and experts. However, since the 1950s, the discovery of scientific management methods has made project management more effective [5]. All the consequences of globalization have far-reaching effects on society and the environment. In terms of ecology, due to the absence of borders, environmental risks become increasingly challenging to control [6]. Globalization also extends to cultural shifts. Cultural homogenization gives rise to a global culture, implying the potential diminishment of local cultures [7]. Economically, globalization involves the liberalization of financial activities, reducing state intervention, and bolstering the influence of global entities such as the World Bank, the International Monetary Fund, and international corporations [8]. Many economists criticize globalization for several reasons [8]: a reduction in jobs, lower labor standards, and widening disparities between the wealthy and the poor.

Political globalization raises concerns about sovereignty, the influence of multinational organizations, and governance. It has led to a diminishing sovereignty of states and an augmented influence of international institutions, implying that the international community should respond to crisis situations [9].

of examination all aspects An of globalization reveals that multinational organizations serve as arenas where its merits and demerits become evident. Here, diverse cultures converge, giving rise to disparities in power dynamics and generating new social issues and questions about employee rights and protection. Hence, the forthcoming discussion will delve into the facets of globalization and multinational corporations, which serve as their reflection.

IV. MULTINATIONAL COMPANIES

Multinational companies are a product of globalization and serve significant as contributors to global economic development. They drive advancements in technology and work methods, and efficiently utilize existing resources. However, their impact extends beyond the economic sphere. Consideration must also be given to the political, legal, sociological, cultural, and ecological aspects, as they are not confined by legal boundaries. Operating across multiple countries, multinational companies are not state actors and are not bound by national jurisdictions. To address this, a contract known as the "Zero Draft" has been proposed, aiming to obligations establish specific for these companies. However, there has been criticism of its applicability to all instances of rights violation, with concerns that it may be too broad and suitable only for severe cases such as slavery, international crimes, genocide, and forced labor [10].

In the cultural realm, "glocalization" is a noteworthy concept. It involves the integration of both globalization and localization [11]. This implies that companies are making efforts to preserve the unique characteristics of their localities while functioning as non-state entities. The growth of multinational companies has led to increased persistence of harmful substances in water, air, and the environment. The atmosphere is endangered due to the use of certain technologies and the emission of gases during production. While these companies may not violate environmental regulations in their home countries, they may do so in less affluent regions. Conversely, many multinational companies incorporate environmental awareness into their business policies [12]. Therefore, managers must navigate a complex landscape to choose a path that best contributes to the reputation of the multinational company. This underscores the need for extensive knowledge, as the networked society is rife with contradictions.

V. MANAGER AS A LEADER IN A GLOBALIZED WORLD

Opinions still vary on whether a manager and a leader are one and the same, but there is consensus that a leader must also be a competent manager. Conversely, a manager should possess leadership skills. Both roles are oriented towards achieving a vision, and leadership is precisely about realizing that vision [13]. A manager isn't solely focused on administration; they also guide their team. Possessing leadership qualities is imperative; without them, one can hardly expect favorable outcomes. It's vital for a manager to wield influence within the organization and comprehend the dynamics of power, interests, and politics, enabling them to respond effectively [14]. Moreover, a manager's role isn't confined to maintaining stability, particularly in a world marked by rapid technological advancement, a "risk society," and heightened competitiveness. This holds true especially for companies that are increasingly expanding their reach on a multinational scale and embracing virtual work environments.

A. Virtual Networking at Work

The advent of global communication technology has revolutionized the way we work. This new mode of work is centered around networks, where information and knowledge hold paramount importance. Today, we are acquainted with it through remote and virtual teams, characterized by their flexibility, physical separation, and heightened competitiveness [15].

Virtual work is a highly relevant topic, not only for its sociological implications but also because it is touted as an excellent alternative to traditional work for economic reasons. From an economic standpoint, it addresses the need for maintaining stability while pursuing profitability, particularly in relation to factors such as temporary employment, rapid job turnover, market uncertainty, and demand fluctuations [15].

A virtual team should possess the same qualities as a team in a traditional setting-trust, strong relationships, effective team management, and developed skills in intercultural communication. A significant contribution of globalization is the emergence of global virtual teams. Despite their physical distance, they are able to exchange ideas and explore new multinational solutions. They enhance companies by conferring a competitive edge, offering innovative solutions, recruiting top experts irrespective of their location, providing flexible work hours, and maintaining high levels of productivity.

Team interactions take on a different form in this context. Communication occurs online, eliminating face-to-face encounters. While this can be a drawback, it also minimizes the visibility of class differences within virtual environments. Virtual teams are intertwined with political and environmental aspects. Due to reduced infrastructural requirements, many states actively support virtual work [15].

Virtual teams are, in essence, a result of the overall virtualization of organizations. Companies opt for virtualization primarily due to several factors: globalization and contemporary trends, the ability to swiftly locate experts on the global network, rapid shifts and a growing demand for specialized knowledge, as well as the need for specialized services/products.

There are three levels of virtualization. Regardless of the specific level, they can be characterized by the following attributes: a broad network of dispersed skills, the use of modern technologies for connectivity, flexibility and dynamism, which encompass innovation and creative solutions, and the integration of team members with the organization. This integration, achieved through trust and shared values and norms, tends to be more straightforward in a
traditional setting. Members of the organization, first and foremost, need to be motivated for this transition. Without communication facilitated by information technologies, the virtual form of work would not be possible. However, this mode of communication can be intricate due to potential misunderstandings when reading or interpreting messages, cultural differences, and the inability to perceive non-verbal cues [17].

VI. RESEARCH

Research on the topic of globalization and project management was carried out with the aim of identifying the most important factors of globalization that affect project management. The task was to provide guidelines based on expert opinions for future management, which should contribute to the development of new or existing knowledge for managers.

The research was conducted through several steps: the formation of a theoretical framework (prior to the research, a theoretical section was written based on literature covering key terms such as project management, globalization, multinational companies, and virtual work), the compilation of a list of globalization factors (this list included the most frequently mentioned factors from the literature and formed the basis questionnaire), creation of for the the questionnaire, conducting the research, and considering the results. The Delphi technique was employed in the research phase. Delphi research falls under qualitative research and is used when it is exceptionally important to gather the opinions of respondents. Given the complexity of globalization, this technique was chosen. The target group for this research consisted of experts in the field of business who have experience in project work.

A sample of 32 respondents, all of whom expressed willingness to participate in both the first and second rounds of research, was obtained through a deliberate sampling of experts to ensure better representativeness of the results. I administered the questionnaire through Google Forms. In the first round, respondents were presented with a set of two questions. The first question asked them to choose the most influential factors from a list of 30. In the second, they were encouraged to express their own perspectives by adding factors not mentioned in the first question.

The factors, derived from the literature, included in the questionnaire are as follows:

- Flexibility [18],
- Global economic development [8],
- Growth in the number of multinational corporations [8],
- Temporary employment of workers [15],
- Inequality between partner countries [19],
- The development of modern technologies [8],
- Development of science [20],
- Changes in society (crime, violence, diseases) [8],
- Development of ecological awareness in society [20],
- Virtual business [15],
- Educational level of society [20],
- Leader's level of education [21],
- Knowledge of the English language [22],
- Knowledge of multiculturalism [22],
- Knowledge of cost management [21],
- Knowledge of risk management [21],
- Lifestyles of project participants [22],
- High competitiveness [15],
- Knowledge of procurement management [21],
- Knowledge of stakeholders perspectives [21],
- Knowledge of communication management [21],
- Knowledge of human resource management [21],
- Intolerance of diversity [18],
- Entrepreneurial spirit of managers [20],
- Motivation [15],
- Human relations within the team [23],
- Online communication [15],
- Creativity [20],
- Knowledge of time management [21],

• Knowledge of quality management [21].

The second questionnaire, utilized in the 2nd round of Delphi research, consists of a single item, i.e. a Likert scale, with which respondents should rate the most frequently selected factors from the 1st round (1- very low impact; 2- low impact; 3- medium influence; 4- high impact; 5very high impact).

A. Results

Of the 30 factors of globalization obtained from the literature, respondents reached a consensus in the first round that 13 of them are of greater importance: Motivation of team members; Flexibility in business; Human relations in the project team; Knowledge of cost management; Knowledge of risk management; Leader's Creativity: level of education: time Knowledge of management; The development of modern technologies; Virtual business: Knowledge management of communications; Knowledge of the English language; Entrepreneurial spirit of the manager; In the second round, respondents ranked the factors as follows:

- Motivation of team members = 4.38;
- Development of modern technology = 4.34;
- Knowledge of communication management = 4.31;
- Human relations in the project team = 4.25;
- Leader's level of education = 4.19;
- Flexibility in business = 4.16;
- Knowledge of risk management = 4.13;
- Knowledge of time management = 4.03;
- Knowledge of cost management = 4.00;
- English language = 3.81;
- Manager's entrepreneurial spirit = 3.81;
- Creativity = 3.59;
- Virtual business = 3.41.

VII. DISSCUSION OF RESULTS

Based on the results of both rounds of research, it can be concluded that there is a consensus that motivation is the most influential factor in project management. It can be assumed that motivation is ranked as the top factor because participants have noticed its significance in its absence.

Specifically, motivation and enthusiasm have declined with the advent of globalization. Major reforms necessary for survival create pressure for those involved in work. Additionally. socioeconomic changes and the analysis of these factors in the society they live in can impact their motivation. Individuals from economically prosperous countries view participation in work as an opportunity to enjoy the fruits of their labor in their daily lives. On the other hand, individuals from economically weaker countries lack motivation because their earnings only secure basic necessities for survival [25].

The respondents in the sample live and work in Serbia, which is not considered an economically strong country. Therefore, it can be inferred that the economic situation in our society has influenced attitudes towards the importance of motivation. Hence, it is crucial for project managers to be aware of the context in which team members work and live in order to develop the best way to motivate them.

Furthermore, the development of modern technology is ranked as highly significant. Its importance in project management cannot be denied. This information is vital because guidelines for educational institutions that train future project managers would include modernizing work methods, introducing more subjects that offer knowledge about contemporary technologies, their application, and contribution. Jeffrey Pfeffer wrote in his book about how in a globalized society, we often seek success in the wrong places. According to him, these wrong places include technology, the global market, and a focus on competition. By wrong, he does not mean unimportant places, but rather places that are less important than issues related to human resources. According to him, the use of the aforementioned, such as goalsetting strategies, is much less important than whether people can achieve the goal. Every strategy should actually be focused on humanity (1998).

Flexibility, as a factor, receives a high rating, confirming that the modern world and work are full of risks due to frequent changes, forcing all work participants to become agile.

Due to global changes, the Agile methodology was created, now utilized by the

majority of project managers. The reasons flexibility has become essential include the absence of fixed schedules, constant material resources, and the risk of high user expectations [26].

VIII. CONCLUSION

The goal of this research is to identify the primary aspects of globalization, an interdisciplinary concept, that most significantly impact project management. Ranking these factors based on the literature can provide valuable insights for further advancements in the field of project management, considering that globalization is an ongoing phenomenon with no foreseeable end in sight.

Through the research, a consensus among experts was achieved regarding the influence of globalization factors on project management, questionnaires utilizing and the Delphi technique. It was determined that globalization, due to its external influences, compels experts to focus on their internal environment (motivation, human relations, communication, flexibility), as well as on the education of the person leading the team and their alignment with the advancements in modern technology. Motivation emerged as the most influential factor. In the context of management, it is crucial to remember that the development of technologies, tools, and methodologies will not yield results if individuals do not perceive value in achieving defined objectives.

In light of these findings, the proposed guidelines are as follows (Fig. 1):

- Management should prioritize motivation and the satisfaction of team members.
- Management should keep pace with modern technology.
- Management should be adaptable and agile.
- Management success hinges on knowledge and managerial skills, rather than solely on virtual environments.
- Management in a virtual environment will be more effective if experts are attuned to cultural and individual differences, which call for distinct motivating factors.



Considering the persisting and emerging challenges such as pandemics, economic crises, wars, and the rapid evolution of technology without parallel developments in educational systems, this approach to project management should be applied across all spheres of professional work and daily life. Globalization, above all, represents a new philosophy of life. Therefore, project managers should enhance expertise in people management, their motivational techniques, modern technology, and agile methodologies. Given the constant evolution of these factors, readiness for continuous learning is paramount for success in modern society.

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Predictive Analysis on Absenteeism at a Workplace using Explainable AI

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Abstract-Approval of employee leaves and providing planned time-offs are a regular part of managing a team. Under certain circumstances, even unplanned leaves are accepted depending upon the organizational policies. However, the situation becomes concerning when unexplained or excessive absence of an employee becomes a recurring issue, especially when the same group of employees is consistently absent without valid reasons. In this study, we explored some important algorithms in machine learning to determine the excessive absenteeism of an employee. We have focused on a variety of features, such as reason for absence, month of absence, day of the week, transportation expense and distance from residence to work. Thorough analysis of attributes and preprocessing of data has helped to create a predictive model that has been trained on multiple classification models. The prediction results of all the models trained were assessed using evaluation criteria such as recall score, precision score and F1-score. The XGBoost classifier outperformed the other classifiers. Furthermore, explainable artificial intelligence methods such as local interpretable model agnostic explanations and SHAP have been used to determine the cause behind artificial intelligence predictions. The current work managed to predict with an accuracy of 83% and detect the features that have an impact on the absenteeism of an employee.

Keywords - Absenteeism, machine learning, XGBoost, SHAP, explainable AI

I. INTRODUCTION

An organization needs a systematic business plan and a skilled workforce to execute the plan to sustain downfalls and future hindrances in business. What is more important than skills is enthusiasm to show up at the workplace regularly and punctually. Frequent or excessive leaves taken without authorization and prior notice that affect the organization's culture, employee productivity and morale are termed absenteeism. Uninformed leaves put the employer in a difficult situation. An employer would like to be ready and ensure that there are always enough employees in the workplace. Currently, in the present economy, the consequences of absenteeism are a serious problem, and organizations must understand its causes. This will have adverse impacts on different levels: individual-level, team-level and organizationallevel performance. Absenteeism has a direct relationship with lower productivity. In a very simple equation, we can say that the person who works less consistently is less productive. Productivity has merged with the profitability index of an organization. If employees have commitment issues, they will be engaged less at work, and their level of contribution will not be recognized. Human resources are producers of human capital. To make a healthy competition in the market, firms must focus on employees" happiness and progress components.

Reports suggest that unplanned absence causes 29.3% productivity loss in India, 31.1% in the US and 22.7% in Europe. High absenteeism leads to loss of pay, degraded discipline, bad work impressions, and altered work perception, and coworkers are also affected, as it leads to increased workload, undesired overtime and peer-to-peer conflicts. The current work is based on predictive analysis and proposes an absenteeism prediction system for an organization that can help identify employees with excessive and considerable absenteeism.

An important aspect of the project is the use of [1-3] explainable AI as a tool to build a trustworthy prediction system. It comprises approaches and strategies that enable people to trust the outcomes and grasp the impact of different algorithms. It is essential in establishing accuracy, objectivity, clarity, and repercussions for AI decision- making. By using XAI, one may debug and comprehend the AI's predictions, which might improve the model's overall execution and prediction capabilities. To use AI models for production purposes, it is essential to build trust and confidence [4].

The current study not only focuses on the identification of excessive absenteeism but also highlights the various reasons that contribute to absenteeism because the information derived is of utmost importance for both the employer and the employee. According to the cause of excessive absenteeism, the organization can take actions such as reduction of workload, flexibility in service times and employee engagement programs [5].

Since the data we have worked with in the current project are related to human resources, unbiased predictions are crucial. Insights from explainable AI techniques, such as LIME and SHAP, help to improve the company's decision-making process and establish trust in the predictive model [5]. The content of this work is presented as follows: Section II concentrates on the prior history of the present report. In Section III, details of the data, preprocessing techniques and methods employed are described. Section IV presents a comprehensive analysis of the obtained outcome, and Section V concludes the current work.

II. RELATED WORK

According to the studies of [6], each year, the nonattendance of employees at the workplace costs firms billions of dollars in productivity losses. Additionally, managing employees who do not perform well takes much time for businesses [7]. According to a Bureau of Labour Statistical analysis, absences from work account for almost 2.8 million lost workdays annually. As per a survey by the Society of Human Resource Management (SHRM), 52% of responses specified that they had to grant Family and Medical Leave Act requests that were illegitimate owing to Labour Department Regulation, which resulted in millions of dollars in damages.

As per [8], disciplinary failure is a very significant characteristic for determining

absenteeism. We know that incentives or financial stability holds importance in the life of an employee. The work of [9] shows that unemployment is negatively correlated with which means that absenteeism, when unemployment is high, people tend to pay more attention to their jobs and are concerned about their security, which leads to lowered absenteeism rates. Employees are not robots, which implies that they ought to have a worklife balance and deserve a breathable working atmosphere and growth-oriented organizational culture. It was addressed by [10] that administrative guidelines and policies of an organization impact the rate of absenteeism. The work of [11] adds value to the current work for XAI research to expand human-focused and discipline exclusive XAI designs.

According to studies on absenteeism behaviour, there are several variables that can function as incentives, such as organizational culture, organizational rules, size of the organization, colleagues, medical and family issues and many more. Regular smokers and drinkers tend to fuel the rate of absenteeism to a great extent. Studies related to this have found that absenteeism is strongly correlated with employee health status. Respiratory diseases are one of the factors concerning employee absenteeism.

Reference [12] found that the workplace's smoking control policy has an impact on productivity and absenteeism. According to their studies, present smokers frequently exhibit absenteeism that is noticeably higher than that of former smokers and non- smokers.

III. DATA AND METHODS

A. Dataset Description

In this study, a publicly available dataset [13] with employee absenteeism information from Kaggle was used. In Table I, the features are described.

B. Data Preprocessing

This dataset comprises 740 records and 21 features consisting of both numerical and categorical features. The target variable "Absenteeism in hours" comprises numerical values. The values have been categorized into a binary class, where "Absenteeism in hours <= 4" means "Considerable absenteeism" (Group

hours = 1) and "Absenteeism in hours > 4" means "Excessive absenteeism" (Group hours = 2). Features, namely, "Distance from Residence to Work" and "Age", had outliers that were treated. "Education" was reduced to two categories, namely, "high school" and "graduates". Similarly, "sons", "pets", "age" and "Distance from Residence to Work" were also categorized into bins according to the features. On performing bivariate analysis on the features, it was found that "Day of the week = Monday", "Sons <= 2", "Social drinkers" "Distance from Residence to Work > 25 kilometers" and "Service time > 9" had high absenteeism (Fig. 1).

 TABLE I. ATTRIBUTES APPLIED FOR PREDICTIVE ANALYSIS.

Attributes	Description	
ID	Individual Identification	
Reason for absence	Absences attested by the International Code of Diseases (ICD)	
Month of absence	Month of the year (Jan-Dec)	
Day of the week	Monday to Friday	
Seasons	summer (1), autumn (2), winter (3), spring (4)	
Transportation expense	Expense of employee on Transportation	
Distance from Residence to Work	Distance in kilometers	
Service time	Service time of employee	
Age	Age of an employee	
Work load Average/day	Workload on an employee	
Hit target	Targets to achieve	
Disciplinary failure	Yes or No	
Education	high school (1), graduate (2), postgraduate (3), master and doctor (4)	
Son	Number of children	
Social Drinker	Yes or No	
Social Smoker	Yes or No	
Pet	Number of pets	
Height	Height of an employee	
Weight	Weight of an employee	
Body mass index	Ratio of Height and Weight	
Absenteeism in hours	Absenteeism hours of employee	



C. Explainable AI

In the last decade, advancements in the field of AI and ML have allowed systems to achieve superhuman performance [14]. The majority of machine learning classifiers run as "black box" models, making it difficult to understand how the system makes a judgement. To lessen the possibility of biased and inaccurate predictions, XAI offers transparency in the control method and enables humans to question AI judgements. In explainable AI, LIME and SHAP are effective techniques. LIME focuses on deriving interpretable substitute models from individual model predictions to aid in understanding. In contrast, SHAP provides a single framework to measure feature relevance in a modelindependent way, promoting both global and local interpretability. Both methods must be used to improve machine learning model transparency and trust.

D. LIME

Machine learning predictions are interpreted using the local interpretable model-agnostic explanations (LIME) technique [15]. It generates locally reliable models that roughly depict the behavior of the complex model around a specific data point. By providing informative justifications for why a certain prediction was made, LIME enhances model transparency and aids in decision-making and debugging. It checks the classifier's local fidelity.

E. SHAP

SHAP (SHapley Additive exPlanations) is a powerful interpretability framework for machine learning models. It relies on game theory and optimum Shapley values to illuminate why a particular prediction deviates from the norm and which characteristic has a major impact on the AI classifier's prediction. To understand why specific predictions were produced, identify potential biases, and improve model performance, one can use SHAP, which quantifies the value of characteristics in a model- independent manner. It is frequently employed for model debugging, judging fairness, and enhancing the openness and transparency of AI systems.

IV. RESULTS AND DISCUSSION

The present research was performed on Jupyter Notebook, and XAI methods were subsequently used to support the predictions. The decision tree, random forest, and XGBoost were used to develop the prediction model, while LIME and SHAP were used to determine the model"s key characteristics. Table II shows the accuracy scores of the various trained classifiers, out of which XGBoost has been chosen for further discussion. A distributed, scalable gradient-boosted decision tree (GBDT) machine learning system is called extreme gradient boosting (XGBoost). Parallel tree boosting is a feature of the best machine learning library for regression, classification, and ranking problems. It creates a strong learner for speed and efficiency. In the current work, XGBoost has been trained to achieve maximum accuracy by using its hyperparameters, such as "max depth", which regulates the complexity of individual trees and the maximum depth of each decision tree in the ensemble; "learning rate," which regulates the step size at each iteration while aiming for the loss function"s minimum; The number of decision trees (boosting rounds) to be built in the ensemble is specified by the parameters "n_estimators"; and "booster", which determines the type of boosting model to use. Common options include "gbtree" (treebased models), "gblinear" (linear models), or "dart" (Dropouts meet Multiple Additive "gamma", Regression Trees). and а regularization hyperparameter, regulates the minimal loss function reduction necessary to create a new partition on a leaf node. It is possible to improve the outcomes and avoid problems such as overfitting by modifying them in accordance with the particular situation and dataset.

 TABLE II.
 ACCURACY PERCENTAGE ACQUIRED BY CLASSIFIER MODELS.

Model	Accuracy
XGBoost	83%
Random Forest	82%
Decision Tree	83%
Gradient Boosting	72%
AdaBoost	71%

The performance metrics of the XGBoost classifier are shown in Fig. 2. The ratio of correct classifications to total classifications is known as accuracy. In other words, it is the outcome of the percentage of correctly classified data.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}.$$
 (1)

Precision is the ratio of how many of the data classified as positive are actually positive.

$$Precision = \frac{TP}{TP+TN}.$$
 (2)

Recall measures the proportion of projected positive datathat truly turn out to be positive.

$$Recall = \frac{TP}{TP + FN}.$$
 (3)

The outcome of combining the "recall and precision" variables in a calculation is the F1 score.

$$F1 - score = 2 * \frac{precision * recall}{precision + recall}.$$
 (4)

р	recision	recall	f1-score	support
0 1	0.90 0.73	0.83 0.82	0.86 0.77	72 39
accuracy macro avg weighted avg	0.81 0.84	0.83 0.83	0.83 0.82 0.83	111 111 111
<pre>[[60 12] [7 32]] Accuracy of the model on Testing Sample Data: 0.83 Figure 2. References matrice of XCR post</pre>				
Figure 2. Performance metrics of XGBoost.				

To back the relevancy of the model accuracy, XAI was deployed. The report ahead comprises multiple plots of LIME and SHAP that analyze the features and highlight the key factors contributing to the excessive absenteeism of an employee.

In Fig. 3, a feature importance plot is displayed that focuses on the attributes that have



utmost importance in the predictive analysis. "Reason for Absence", which includes multiple medical reasons, and "Son_up to Two sons", which includes the number of children of an employee, average workload and transportation expense, add the highest value to the target variable.

In Fig. 4, the SHAP heat map is plotted, which provides a visual representation of how each feature contributes to the model's output for a set of data points. The color-coded representation of the feature's impact on the prediction of a specific data point represented by f(x) shows its strength and direction. Here, red indicates a positive impact that increases f(x), and blue indicates a negative impact that reduces f(x). The heat map helps identify the features that have the most significant influence on predictions across different data points.

Fig. 5 demonstrates a summary plot that provides comprehensive and simplified insight into the features that are involved in the prediction of absenteeism. The different features are visualized in decreasing order of their importance in the prediction.

The SHAP dependency plots help visualize the relationship between specific features. The most important features from Fig. 3 have been analysed using the dependency plots in Figs. 6 and 7. From Fig. 6, we can deduce that "Work load Average/day" valued in the range 230 to 270 has high SHAP values that positively impact our target.

In the form of graphs and other visual representations, LIME offers a set of local explanations based on altered data samples that explain how an instance's characteristics affect the prediction. In Fig. 8 and Fig. 9, the LIME for 2 instances are described. In these figures, the features and their corresponding values are presented. On the left, the prediction probabilities of the two classes of absenteeism are shown. If the instance has a higher probability (close to 1.0) for "Excessive", then the employee has Excessive Absenteeism. In Fig. 8, the instance has "Excessive = 0.93". The Fig. 9 shows LIME for "Considerable" absenteeism with a probability of 0.68.

In Figs. 10 and 11, two force plots are presented for 2 individual instances, which represent the contribution of each feature to the prediction model. The length of the bar of a



feature represents its impact on the prediction for that particular instance. These values can vary depending upon the instance. In these figures, the features with utmost importance in the predictive analysis are shown for the 161st and 44th instances. A SHAP waterfall chart or plot is a visualization that offers a detailed breakdown of how specific feature values affect the difference between a model's output and its expected output (baseline prediction). It helps in understanding the decomposition of a prediction into the effects of different features. Fig. 12 shows f(x), which represents the final prediction made by the model for a particular data point. taking into account the contributions of individual features, whereas E[f(x)] is the model"s expected prediction for a dataset. It marks the beginning of the waterfall chart. It shows the model"s average prediction on the supposition that there are no particular feature impacts. The feature "Reason for absence" has a negative impact, whereas "Work load Average/day" has a positive impact. To highlight the role of each feature in the process, this visual shows how the model"s forecast for a given data point evolves from the baseline value to the final prediction.



Figure 11. Force plot for the 161st instance.



Figure 12. Waterfall plot for the 78th instance.

The current research work focused on thoroughly analyzing various employee-related features with the aim of predicting excessive absenteeism among employees in an organization. The univariate and bivariate analysis provided valuable insights that fueled the overall predictive analysis. After model training and tuning of the hyperparameters of the machine learning models, the XGBoost classifier was chosen based on the results of

multiple evaluation metrics, such as precision, recall, accuracy score and F1-score, SHAP was used to concentrate exclusively on the significance of feature detection. After the dataset was trained, SHAP conducted a thorough study of the features and their influence in the prediction model. The results of SHAP were that "Reason for absence" that included medical reasons, "Transportation expenses", "No. of children" and "Work load Average/day" play a vital role in the current work. They are the most significant attributes that drive the prediction of Excessive Absenteeism. To report how the features affected the exploration, LIME was also used. The significance of the features in the prediction model was clarified using data that were extracted from various contexts.

V. CONCLUSION

Employee absenteeism can have adverse effects on work execution, work culture, work environment, employee productivity and the overall business of an organization because absenteeism causes unwanted heightening of employer liability, stress among peers, and loss of time and energy. Our study on employee absenteeism addresses this issue, and the findings are that excessive absenteeism is caused by the following major factors:

- Medical issues as highlighted by "Reason for absence", which include illnesses of the circulatory, respiratory, digestive, skin and subcutaneous tissues, as well as neoplasms and ailments of the blood and hemoglobin- forming organs.
- Average Work load per day as indicated by "Work load Average/day".
- Expenditure on transportation as specified by "Transportation expenses".

Handling absenteeism becomes vital for the sustainability of an organization. It can be reduced by knowing through polls and surveys about how an employee feels about his or her coworkers, job duties, and organization. A flexible work schedule should be implemented so that employees can be highly connected to the organization. Additionally, it aids individuals in maintaining a balance between their personal and professional lives. Organizations should assign a complaint-addressing team to uphold office discipline and manage delicate circumstances such as harassment or bullying. Grievance management of employees is also a focused area in this juncture for lowering absenteeism. The current study addressed important attributes related to employee absenteeism. However, there can be multiple other features that could help optimize the performance of the chosen XGBoost classifier or might introduce better classification models. The study also concentrated on a thorough examination of the features, using SHAP and LIME to describe the characteristics and significance. Additional parameters, such as relationships with peer members, training and development opportunities, employee participation in management, leadership, and motivational factors, may be included in future studies, and they may undertake additional studies utilizing a variety of explainable AI frameworks.

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The Impact of R&D Activities on Total Factor Productivity in Serbia: Application of the Generalized Method of Moments Approach

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Abstract-Total Factor Productivity (TFP) is a key indicator of the economic growth and progress of any country, which provides every society with the opportunity to raise living standards and social well-being. The purpose of this article is to research the factors influencing the TFP of the Republic of Serbia (RS) in the period from 2006 to 2019. Using the Generalized Method of Moments (GMM) it was found that gross investments and trade openness have a statistically significant positive impact on TFP, research and development (R&D) expenditures have a statistically insignificant impact, while the impact of the labor force participation rate is negative and statistically significant, indicating a distinct work intensity of the domestic economy. The economy of Serbia is largely based on low technological and high resource and laborintensive investments. Therefore, further R&D investments in production projects should be encouraged, but also investing in education, training processes and the scientific-research base for productivity growth in order to ensure the sustainability of the domestic economy in terms of labor force. The economy of Serbia relies on an insufficiently qualified workforce and is dependent on international economic flows. Thus, it is also necessary to encourage the development of appropriate innovative, R&D and education policies with the aim of increasing the country's international competitiveness and its further sustainable growth.

Keywords – Total Factor Productivity (TFP), research and development (R&D) expenditures, innovations, economic growth, labour force

I. INTRODUCTION

In 1950, the famous American economist Robert Solow developed a simple model of economic growth with the purpose of describing the long-term development of the economy, deliberately ignoring some less important macroeconomic aspects such as short-term fluctuations in economic cycles, employment rates and savings. His epochal article A contribution to the Theory of economic growth from 1956 is still very influential today, providing a number of useful insights into the dynamics of economic growth [1,2]. Solow's dynamic growth model is an exogenous model of economic growth that tracks changes in the level of economic output over time conditioned by changes in the rate of population growth, the rate of savings, and the rate of technological progress. This model was the first neoclassical model that still today represents the basis of the modern theory of economic growth. As a short abstract of the functioning of a complex economy, Solow's model shaped the approach not only to the issues of economic growth, but also to the entire contemporary macroeconomic science [3]. This model is based on the Cobb-Douglas production function that relates production to used inputs, indicating that capital accumulation cannot be a source of constant growth. Unlike it, it is rather a technological progress as a root of sustainable economic growth [4].

This model is also related to the concept of the Solow residual as a reflection of the growth

of the engaged production factors' total productivity. In his next seminal article, Solow [5] defined Total Factor Productivity (TFP) as the efficiency with which companies transform production factors into outputs, considering it the basic source of generating economic growth [6]. In this sense, TFP is considered a key indicator of the growth and economic progress of each country. TFP growth provides every society with the opportunity to raise living standards and social well-being [7]. The Solow residual is measured as the excess of the output growth rate over the growth resulting from the contribution of labor and capital. Robert Solow received the Nobel Prize for Economics in 1987 for his Theory of economic growth, paving the way for new generations to understand the impact of technology on productivity-led growth. The analysis of the factors that contribute to productivity growth is exactly the intellectual framework on which this article is based.

The aim of this article is to examine and review the contributing factors of the Total Factor Productivity of the Serbian economy in the period from 2006 to 2019. The next section is devoted to a review of the relevant literature sources on the main factors of productivity at the macroeconomic level. The third section of the article describes the data, their sources and the research methodology used, shedding light on the obtained results and their discussion. The last section concludes the paper, giving useful recommendations to policy makers in terms of fostering research and development (R&D) and innovation policies.

II. LITERATURE OVERVIEW

A large body of literature is devoted to the analysis of Total Factor Productivity as a mainstream investigating concept for sustainable economic development. Numerous empirical studies particularly emphasize the relation among R&D expenditures, human capital and productivity increasing. Ulku [8] applied the Pooled OLS model, the Fixed Effects (FE) model and the Arellano-Bond GMM technique, on the example of 20 OECD countries and 10 non-OECD countries, in the period from 1981 to 1997. She found a positive effect of R&D activities on economic growth in OECD countries with large markets. However, the author concludes that innovations do not lead to permanent economic growth because there is no evidence of constant returns to them.

Aydin et al. [9] applied the Pooled Mean Group approach to a sample of 29 OECD countries in the time frame from 1993 to 2014, founding a positive significant long-term relationship between TFP and ICT capital services, as well as a short-term relationship between TFP and ICT capital services, on one, and TFP and R&D expenditure on other hand. This research shows the great importance of investing in R&D activities for developing countries with the aim of catching up with developed ones, as well as of achieving long-term sustainable and competitive economic growth.

Erken et al. [10] analyze 20 OECD countries from 1969 to 2010. The authors introduce four different R&D capital approach models for estimating TFP from which a fifth one (so called joint) model is generated using the Superior Dynamic Panel DOLS technique. They conclude that entrepreneurship has a statistically significant effect on TFP growth. Saleem et al. [11] investigate the drivers of economic growth and Total Factor Productivity in Pakistan from 1972 to 2016. Using the FE estimator, the Two-Stage Least Squared (2SLS) method, and the ARDL cointegration approach, the authors find that innovations significantly contribute to economic growth and production levels, as well as that they are in a long-term cointegrating relationship with TFP and economic growth.

Hammar and Belarbi [12] conduct a Panel Smooth Threshold regression on a group of 36 countries, in the period from 2002 to 2014, examining nonlinear relationships among R&D expenditures, innovations, productivity and exports of high-tech products. They suggest that there is a threshold effect within the relationship among R&D expenditures, innovations and productivity, pointing also to the importance of prioritizing economic policy objectives in favor of innovations. Some other studies also show that the relationship among R&D expenditures, human resources and TFP is nonlinear. On a sample of considered European regions, Kijek and Kijek [13] found that after reaching the threshold, additional R&D investments become unproductive. Also, overinvesting in human capital can have the same effects. Mannasoo et al. [14] indicate the existence of a critical minimum start-up level of R&D expenditures and human capital investments in overcoming the productivity gap among European regions of different levels of development. Based on the results of their research, they assume that underdeveloped institutions can influence the

incomplete realization of R&D and human capital positive effects on TFP in the emerging EU-13 regions.

Fedyunina and Radosevic [15] test the validity of the Crépon, Duguet and Mairesse (CDM) model on a sample of emerging economies from Central and Eastern Europe, former Soviet republics and Turkey. They prove that the CDM model does not capture the specific characteristics of productivity in these countries' economies and offer an alternative productivity model driven by investment and production possibilities. Finally, Madžar [16], investigating the state of the art of innovative activities in Serbia in the period from 2004 to 2020 and using linear regression, the Vector Autoregressive (VAR) model and the Granger causality test, concludes that the number of registered patents does not contribute, while R&D expenditures contribute positively and significantly to the growth of Serbia's GDP. The author also concludes that scientific and research work in Serbia is not efficient enough because it draws funds from the GDP, but does not produce the expected results, especially not from the aspect of introduced innovations.

III. DATA, METHODOLOGY AND DISCUSSION OF RESULTS

A. Used Data and Considered Variables

The purpose of this article is to examine the influence of certain important factors on the TFP trend in Serbia in the period from 2006 to 2019 for which there are available data. This time frame was chosen for analysis primarily since the total number of registered patents in the observed countries began to be monitored in detail only from 2006, as well as there was data available for the observed variables only until 2019. The data are derived from the World Development Indicators database, which ensures their full comparability. The only exception was the data on TFP that were taken from the Penn World Tables (PWT) database. PWT defines Total Factor Productivity as a portion of output that is not explained by engaged inputs in the production process [17]. This indicator measures production efficiency and can be viewed as the ratio of output and the moving geometric mean of the rate of utilization and augmentation of production inputs [18]. TFP is one of the classical Solow model components that identified technological

progress, that is, improvements in TFP as a key factor of long-term economic growth [19].

TABLE I.	DESCRIPTION OF THE VARIABLES USED.
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Variable	Variable Description	Source of Data
Total Factor Productivity	TFP measured at constant national prices (2017=1), annual data	Penn World Tables
Research and development expenditure	R&D expenditure as a % of GDP annually	World Development Indicators
Gross fixed capital formation	GFC formation as a % of GDP annually	World Development Indicators
Labor force	Labor force participation rate in %, annual data	World Development Indicators
Trade openness	Trade value as a % of GDP annually	World Development Indicators
Total patents	Total number of registered residential and nonresidential patents annually	World Development Indicators

Table I provides a short description of the variables used in the model and their data sources.

While the level of labor force participation rate was mostly stagnant, in the observed period from 2006 to 2019, there was an increase in the share of R&D expenditures in GDP by 0.45%, an increase in the share of GFC formation in GDP by 1%, as well as a growth of the country's trade openness by as much as 35%. Also in this period, TFP itself remained quite stable, increasing only by 0.02 percentage points, while total residential and nonresidential patents showed a gradual worrying decline of even 528 registered units (a decrease of 74.89%), indicating all the weaknesses of the domestic innovation policy. However, since the indicators of R&D expenditure and total patents had a high value of negative and statistically significant Pearson correlation (r = -0.9028), from these two indicators, in the rest of the article the authors decided to analyze only the impact of R&D expenditures on TFP.

It is is also interesting to emphasize that a brief insight in the comparative data on the number of registered patents in some countries of the Western Balkan region indicates that innovations, with the exception of Romania, showed a similar trend (see Fig. 1).



Namely, in the observed period, in Serbia, Bulgaria and Croatia, the total registered patents experienced a tendency of gradual decline, with the exception of Romania where their average number fluctuated at a much higher level.

In addition, the average amount of registered patents in Romania was about 1093 patents, in Serbia 311, in Croatia 264, while for Bulgaria this figure amounted to only 253 in the observed period. In Serbia, in the given period, the number of patents dropped from 705 in 2006 to 177 in 2019, representing a drop of as much as 74.89% and pointing out the weaknesses of the domestic innovation policy

B. Research Methodology

The article first approached to correlation analysis with the aim of reducing the risk of multicollinearity and increasing the trustworthiness of the results. Multicollinearity occurs in case of high and significant mutual correlation between explanatory variables in multiple linear regression frameworks.

Corr. and Prob.	TFP	R&D	GFC	Labor	Trade
TFP	1				
R&D	0.5995* (0.0141)	1			
GFC	-0.2248 (0.4026)	-0.2040 (0.4486)	1		
Labor	-0.8591* (0.0000)	-0.2121 (0.4320)	0.1882 (0.4852)	1	
Trade	0.0249 (0.9272)	0.6094 [*] (0.0122)	-0.2159 (0.4220)	0.4361 (0.0913)	1

TABLE II. CORRELATION ANALYSIS RESULTS.

Note: *denotes significance at the level of 5%.

The presence of multicollinearity increases the standard errors of regression parameter estimates, which in turn changes the results of the analysis making them biased and unstable [21]. Table II shows the results of the conducted correlation analysis.

Since the values of the calculated correlation coefficients r between observed explanatory variables were less than the adopted threshold of 0.8, the absence of multicollinearity among the independent variables was determined. In the next step of the research, all variables were transformed using the natural logarithm with the aim of stabilizing and normalizing the data.

The article further approached to the application of the Generalized Method of Moments (GMM) with the aim of evaluating the influence of the observed factors on the TFP trend in Serbia. Otherwise, Arellano and Bover [22] and Blundell and Bond [23] proposed the GMM estimator for dynamic panel data models in their seminal articles. When it comes to the individually observed time series as in this case, this method uses intuition and moment conditions, i.e. instrumental variables in the analysis of a wide range of contemporary econometric problems [24]. GMM combines analyzed economic data with information about population moment conditions based on which it estimates unknown regression parameters of interest [25]. In addition, this estimator takes into account the problems of heterogeneity, simultaneity and endogeneity of the explanatory variables [26]. The empirical specification of the considered model can be represented by the following equation [27]:

$$TFP_{i,t} = C + \beta_1 R \& D_{i,t} + \beta_2 GFC_{i,t} + \\ \beta_3 Labour_{i,t} + \beta_4 Trade_{i,t} + \mu_i + \varepsilon_{i,t}, \quad (1)$$

where *C* is a constant term, μ_i is an individually specific error component, while $\varepsilon_{i,t}$ is its idiosyncratic term. Table III provides an overview of the results of the applied GMM estimators. For the purposes of this analysis and its subsequent calculations, the econometric program EViews was used.

C. Results and Discussions

The adjusted coefficient of determination of the proposed model was 0.7093, suggesting that the model explained 70.93% of the variation in the dependent variable TFP.

Variable	Coeff.	Stand. error	T-stat.	Prob.
С	3.8725*	0.5024	7.7076	0.0000
Ln(R&D)	0.0514	0.0455	1.1282	0.2884
Ln(GFC)	0.1728*	0.0587	2.9448	0.0164
Ln(Labor)	-1.3620*	0.1710	-7.9634	0.0000
Ln(Trade)	0.2291*	0.0544	4.2142	0.0023
R-squared	0.7987			
Adjusted R- squared	0.7093			
Sargan J- statistic	1.2704			
Prob.(Sargan J-statistic)	0.2596			

TABLE III. RESULTS OF THE APPLIED GMM TECHNIOUE.

Note: ^{*}denotes significance at the level of 5%; robust standard errors.

In addition, the Sargan's J-statistic test value amounted to 1.2704, with an observed probability of 0.2596, indicating that there were no over identified restrictions and that the instrumental variables were well defined. Ex post tests also indicated the normality of the distribution of the residuals (Jarque-Bera = 0.0326, prob. = 0.9839 > 0.05), as well as the absence of serial correlation, as all observed probability values of the O-statistic of autocorrelation coefficients the were significantly higher than 0.05.

While gross investment, labor participation rate and trade openness showed a statistically significant impact on TFP, the observed impact of R&D allocations was not statistically significant. At the same time, an increase in R&D expenditures by 1% affects TFP growth by 0.0514, an increase in the gross investments share in GDP by 1% affects TFP growth by 0.1728, an increase in the labor force participation rate by 1% reduces TFP of the Serbian economy by 1.362, while an increase in trade openness by 1% increases the TFP itself by 0.2291. These results are very indicative since, contrary to all expectations, they show that labor force growth reduces TFP, as well as that this occurs as a result of the exceptional labor intensity of the domestic economy, which

is based on labor-intensive jobs and investments. The economy of Serbia is laborintensive and inefficient and is characterized by declining returns to scale. At the same time, labor- and resource-intensive products have a dominant role in the structure of domestic production, indicating an extremely low level of production specialization [28].

All this points to the need for a serious reform of the educational policy and training system, as well as for undertaking more systematic and comprehensive investments not only in the technological base, but also in human resources as one of the key drivers of the growth of every country. For the effective implementation of R&D activities, investments in increasing the number of employees in the fields of science and technology, as well as in the development of their knowledge and skills are especially necessary. In particular, it should be borne in mind that in Serbia in 2021, the share of the number of employees in R&D sector amounted to 1.05% of the total number of employees. At the same time, researchers accounted for 70.74% of the total number of employees in research and development sector [29].

It also follows from the analysis that further investments should be made in productive and developmental R&D projects and activities that would improve the research and development base and ensure the sustainability of the domestic economy from the aspect of labor factor. In the observed period, the share of state and local government spending for research and development activities in the total R&D expenditures had no major fluctuations and at the end of 2021, it amounted to 26.60%. On the other hand, there is a noticeable increase in the share of private and public R&D investments in total R&D expenditures from 25% in 2012 to 45.20% in 2021. The share of foreign investment for R&D in total R&D expenditures is characterized by significant oscillations, with the lowest share being 7.80% in 2013, and the highest 21.60% in 2018. In 2021, 15.90% of total R&D expenditures were financed by foreign investments [29].

IV. CONCLUSION

This article is devoted to the analysis of the impact of some important factors on Total Factor Productivity in Serbia in the period from 2006 to 2019. It is well known that there is a relation among R&D expenditures, human

capital development and productivity growth, but also that R&D efforts contribute to costeffective production and the growth of quality of existing products and services. In addition, intensive R&D activities lead to the creation of inventions and innovations, which in turn also raise productivity. On the other hand, the possibilities of realizing R&D activities, as well as inventions and innovations in the national economy depend on the level of human capital development itself. For this reason, the increase in research and development expenditures must be simultaneously accompanied by the growth of investments in human capital.

In the article, using the GMM technique, it was determined that gross investments, labor participation rate and trade openness showed a statistically significant impact on Serbia's TFP, while the observed impact of R&D allocations was not statistically significant. At the same time, an increase in R&D expenditures by 1% affects TFP growth by 0.0514, an increase in the gross investments share in GDP by 1% affects TFP growth by 0.1728, an increase in the labor force participation rate by 1% reduces TFP of the Serbian economy by 1.362, while an increase in trade openness by 1% increases the TFP itself by 0.2291. These results are very indicative since, contrary to all expectations, they first of all indicate that labor force growth reduces TFP, as well as that this situation occurs as a result of the exceptional work intensity of the domestic economy, which is based on laborintensive jobs and investments. The economy of is labor-intensive, technologically Serbia inefficient and is characterized by declining returns to scale, with the pronounced dominance of labor- and resource-intensive products in the structure of domestic production. All this indicates the absence of production specialization, as well as the insufficient and suppressed role of R&D activities in driving TFP in Serbia.

The article also noted the weaknesses of the domestic innovation policy framework expressed by the constant decline in the total number of registered patents, while allocations science, research and technological for development are not nearly enough, moving on average below 0.5% of GDP. This share of expenditures for science, research and technological development shows that Serbia is significantly lagging behind EU members, as well as some countries from the region (like Slovenia and Croatia). In addition, the lack of appropriate management mechanisms and coordination of bodies responsible for innovation policy lead to the fact that R&D results do not find their way to a competitive products or services. Moreover, even the largest number of scientific and research organizations in Serbia do not have a strategic approach in managing research and directing it towards specific innovations.

All of the above points to the need for a serious reform of the educational and research policy and the training system of employees with the aim of upgrading and developing their ICTs and other skills. There is also a need for undertaking more systematic and comprehensive investments not only in the technological base, but also in human resources as one of the key drivers of each country's growth. Since the investments of domestic companies in fixed assets, including the manufacturing and IT sectors, lead to an increase in the number of employees in these sectors, there is a clear need for investment in the workforce with the aim of further encouraging the development of the domestic economy. It also follows from the analysis that Serbia should further invest in productive and developmental R&D projects and activities and direct them towards competitive products and markets with the aim of improving the national research and development base and ensuring the sustainability of the domestic economy from the aspect of labor factor. Finally, the economy of Serbia is also dependent on international economic flows, based on which we can conclude that it is necessary to encourage further development of all aspects of innovative, educational and R&D activities with the aim of increasing the country's international competitiveness and its further sustainable growth.

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Evaluating the Influence of ICT on Economic Growth: Insights from the MINT Countries

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Abstract-The relationship between ICT and economic growth is one of the central topics in the literature. Understanding how technology, as one of the key determinants of economic growth, affects growth and its dynamics is of significance for both developed and developing countries. However, this relationship is not static in nature; but it exhibits a dynamic structure depending on various factors. In this sense, deploying a causality analysis, this study aims to analyze the impact of ICT on economic growth in MINT countries over the period 2003-2022. Our findings show that, on the panel level, there is a one-way causality from ICT to economic growth. On the country basis, however, our results show that there is no causality between ICT and economic growth in Mexico and Indonesia while there is a unilateral causality from ICT to economic growth in Nigeria and Turkiye. These findings indicate to academics and policymakers that technology should be considered a significant factor in the design of growth models and policies.

Keywords – ICT, economic growth, MINT countries

I. INTRODUCTION

Economic growth and the factors influencing it have long been at the forefront of significant discussions among economists. The importance of economic growth is emphasized not only for its role in generating resources for countries but also as a fundamental factor contributing to their development and socioeconomic advancements.

Previously, technology was assumed to be an exogenous variable in determining economic growth [1,2]. However, especially since the 1980s, the technology factor began to be treated

as an endogenous variable in growth equations [3,4]. In this context, Information and Communication Technologies (ICT) have been employed in the growth literature as one of the most critical factors determining economic growth.

It is argued that the impact of ICT on economic growth occurs through facilitating new products production processes and [5]. increasing investments [6], enhancing productivity [7], and lowering transaction costs and creating processes that firms and countries can take better decisions [8]. However, not only the adaptation of ICT but also how it is utilized plays a decisive role in its impact on economic growth. Indeed, the way in which ICT is used can also influence productivity, thereby affecting the level of economic growth [9].

Some studies in literature have empirically found a positive effect of ICT on economic growth [10-12]. On the other hand, there are also studies that have not concluded this relationship but serve to guide future research [13]. These variations in the findings can be attributed to the period under investigation, differences in the levels of development of the countries, and unobservable factors unique to each country. Studies in the literature generally apply methods aimed at measuring the magnitude of the impact of ICT on economic growth. However, the causal relationship and directionality between these two variables often appear to be overlooked.

This situation in the literature has provided motivation for this study and encouraged an examination of the causal relationship between ICT and economic growth in MINT countries during the 2003-2022 period. Thus, we aim to contribute to the dynamic literature addressing the relationship between ICT and economic growth. Panel level causality analysis implies that there is a one-way causality from ICT to economic growth and not vice versa, providing a basis for inference that changes in ICT explain changes in economic growth. Additionally, we may also reach some causal conclusions on each country basis that there is no causality between ICT and economic growth in Mexico and Indonesia while there is one-way causality from ICT to economic growth in Nigeria and Turkiye.

Within the MINT country group, the causation of economic growth by ICT in Nigeria and Turkey highlights the significance of technology in achieving high growth rates in these countries. In this light, policy makers should consider this factor in their growth models.

II. A LITERATURE REVIEW

As mentioned in the previous section, the relationship between ICT and economic growth has been a topic of discussion in the literature for a long time. To make the picture of nexus between ICT and economic growth clearer, various authors have employed different methods and approaches. For instance, deploying a panel data analysis for 29 countries in the 1990s, Ref. [10] analyze the nexus between ICT and economic growth. The authors highlight the positive correlation between ICT and economic growth. In a similar vein, [12] aims to explore the three-wav relationship between financial development, ICT, and economic growth for 72 countries over the period 2000-2015. Their findings show that ICT positively contributes to economic growth in high-income countries, whereas the nexus among them is relatively ambiguous in middle- and low-income countries.

Considering 34 OECD countries and deploying panel vector autoregression (P-VAR) method in analyzing the interrelationships between ICT, economic growth, and R&D; Ref. [14] stated that there is a bilateral causality between economic growth and ICT diffusion. In a similar vein, [15] analyzed the causal nexus between ICT and real GDP per capita in G-20 countries over the period 2001-2012 by performing panel vector error correction models (P-VECM). The authors concluded that there is a long-term causal relationship between ICT and economic growth. On the other side of the coin, investigating the ICT investment and economic growth nexus for 43 countries for the period 1985-1999, [13] found no correlation between ICT investment and economic growth. Similarly, employing an autoregressive distributed lag (ARDL) bounds test approach, [16] analyzed the nexus between ICT, energy consumption, and economic growth in Japan for the period 1980-2010 and found that ICT does not necessarily lead to higher economic growth.

The level of countries' development appears to be the most significant factor in the variations in the relationship between ICT and economic growth. From this perspective, the use and benefits of ICT differ among countries at different stages of development, which naturally impacts their economic growth. Ref. [17] examined the impact of ICT on economic growth across a total of 59 countries with varied levels of development, and the author observed that developed countries obtain greater benefits from ICT compared to developing countries. From a perspective, [18] similar analyzed the relationship between ICT investment and economic growth in a panel sample of 62 countries and found a positive impact of ICT investment on economic growth in high-income countries while the author proposed that there is no statistically significant impact of ICT investment on economic growth in lower-income countries.

It is observed that the causal relationship between economic growth and ICT has been addressed by very limited studies in the literature. In this regard, a more detailed investigation of the causal link between these two variables will contribute to the literature. In the following sections, we will explore this causal relationship using the example of the MINT country groups.

III. DATA AND METHOD

In this study, we aim to analyze the impact of ICT on economic growth in MINT countries over the period 2003-2022 by deploying a causality analysis. The economic growth (GRW) is represented by GDP per capita based on constant 2015 US\$ from World Bank [19]. On the other hand, ICT is proxied by ICT development index of UNCTADSTAT [20].

The study sample consists of MINT (Mexico, Indonesia, Nigeria, and Turkiye) economies and

study duration is specified as 2003-2022 taking notice of the related data presence.

The descriptive characteristics of real GDP per capita and ICT index are shown in Table I, and they indicate that mean of real GDP and ICT index are respectively 6168.050 and 35.47661. However, both real GDP per capita and ICT index display significant variations during the study period.

 TABLE I.
 SUMMARY STATISTIC OF ECONOMIC GROWTH AND ICT.

	ICT	GRW
Mean	35.47661	6168.050
Median	36.23327	5320.219
Maximum	58.58639	13990.75
Minimum	6.118579	1769.883
Std. Dev.	14.19818	3696.373
Skewness	-0.348753	0.236515
Kurtosis	1.952316	1.505585

The reciprocal interplay between ICT and growth tested economic is with Emirmahmutoglu and Kose [21] causality test owing to the availability of heterogeneity and cross-sectional among EU members under consideration. The causality test performs the causality for each cross-section through the bootstrap approach to Fisher statistic. The optimal lag length (p_i) and integration levels of the series (d_{max_i}) are specified before conducting the causality test. The error terms for each cross-section are subsequently derived from the following regression:

$$\begin{split} ICT_{i,t} &= \alpha_{i,t} + \sum_{j=1}^{p_i + d_{max_i}} \beta_{ij} ICT_{i,t-j} \\ &+ \sum_{j=1}^{p_i + d_{max_i}} \gamma_{ij} GRW_{i,t-j} + \varepsilon_{it} \end{split}$$
, (1)

$$GRW_{i,t} = \alpha_{i,t} + \sum_{j=1}^{p_i + d_{max_i}} \beta_{ij} GRW_{i,t-j} + \sum_{j=1}^{p_i + d_{max_i}} \gamma_{ij} ICT_{i,t-j} + \varepsilon_{it}$$
(2)

The null hypothesis of the causality test is non-existence of causality between ICT and economic growth.

IV. RESULTS AND DISCUSSION

In the results and discussion section, properties of cross-section and heterogeneity of GRW and ICT are first investigated via econometric tests of LM, $LM_{adj.}$ and LM CD and delta tilde tests and the consequences of these tests are presented in Table II. The being of

cross-sectional dependence is tested with three *LM* tests and null hypothesis of cross-section independence is rejected because probability values of two LM tests are uncovered to be less than 0.05 and in turn being of cross-section dependence between GRW and ICT is unveiled. On the other hand, the null hypothesis of homogeneity is rejected because probability values of delta tilde tests are uncovered to be less than 0.01 and the being of heterogeneity is concluded. Therefore, the being of heterogeneity and cross-section dependence is unveiled for two variables under consideration.

FABLE II.	RESULTS OF CROSS SECTION DEPENDENCE
	AND HETEROGENEITY TEST.

Test	Test Statistic	Prob.
LM	13.81	0.0318
LM adj	5.001	0.0000
LM CD	-0.5509	0.5817
$\tilde{\Delta}_{adj.}$	5.779	0.000
Δ	5.328	0.000

The stationarity of GRW and ICT is tested via CIPS unit root test by Pesaran [22] owing to being of cross-section dependence between GRW and ICT and the results of the unit root analysis are exhibited in Table III. The unit root test uncovers that GRW and ICT are integrated of one.

TABLE III. RESULTS OF CIPS UNIT ROOT TEST.

Variables	Constant	Constant + Trend
GRW	2.781	2.379
D(GRW)	-4.972***	-3.250***
ICT	-0.765	-0.671
D(ICT)	-3.913***	-2.931***

*** is significant at 1%

The causal relationship between ICT and economic growth is investigated by means of Emirmahmutoglu and Kose [21] causality test and the results of the panel causality test are displayed in Table IV. The results of panel level causality analysis uncover a one-way causal relationship from ICT to economic growth. On the other hand, the results of country level causality analysis unveil a unidirectional causal relationship from ICT to economic growth in Nigeria and Turkiye.

Countries	ICT +> GRW		GRW≁ ICT	
	Test statistic	P value	Test statistic	P value
Indonesia	0.792	0.373	0.018	0.894
Mexico	0.957	0.328	0.158	0.691
Nigeria	4.770	0.092	4.343	0.114
Turkiye	10.752	0.001	0.593	0.441
Panel	22.703	0.004	6.943	0.543

TABLE IV. CAUSALITY BETWEEN ICT AND GRW.

Our panel level causality analysis shows a unilateral causality from ICT to economic growth, which is in line with the findings of [10], [12], and [15]. On the country basis, however, there is no statistical evidence regarding the causal relationship between ICT and economic growth in Indonesia and Mexico. That is to say, changes in ICT do not explain changes in economic growth in these countries, and vice versa. On the other hand, the existence of oneway causality from ICT to economic growth in Nigeria and Turkiye highlights that ICT does granger cause economic growth in these countries. That is, changes in economic growth can be explained by the changes in ICT.

In the cases of Nigeria and Turkey, it is observed that the economic growth is influenced by technology. This scenario indicates to policy makers that investing in technology or encouraging the use of ICT will contribute to economic growth. From this perspective, in economic growth models and policies, these countries should consider the importance of ICT.

V. CONCLUSION

Economic growth is one of the most crucial macroeconomic factors for countries. High growth rates imply the supply of more resources for public expenditures and policies, playing a pivotal role in a country's development. Both theoretical and empirical discussions in the literature point to the significance of the relationship between technology and growth, viewing technology as a key factor in growth models. In this context, technology is believed to contribute to economic growth.

Nevertheless, it is observed that this relationship is not linear and static; it varies according to the countries' levels of development, the time periods investigated, and country-specific factors. In this context, this study is motivated to analyze the relationship between ICT and economic growth in MINT countries for the period 2003-2022 using causality analysis. Our empirical analysis reveals that there is a one-way causality from ICT to economic growth in Nigeria and Turkiye, whereas there exists no causality among the variables in Mexico and Indonesia.

The existence of unilateral causality between ICT and economic growth in Nigeria and Turkiye implies that changes in ICT explain changes in economic growth these countries. Therefore, policymakers in these countries should consider factors related to ICT when designing growth policies.

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Ethical Problems in Communication with Consumers when Declaring, Labeling and Advertising Food Products

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Abstract—Deceptive marketing practices within Serbia's food industry have raised significant concerns, affecting consumer trust and public health. This study delves into the manipulative marketing strategies employed to mislead consumers when it comes to food products. Deceptive claims such as "organic" or "locally sourced" create a false perception, resulting in financial losses and potential health hazards. Marketing plays a pivotal role in perpetuating these fraudulent practices, capitalizing on consumers' preferences for healthier and locally produced options, ultimately harming ethicallyminded producers. To combat this issue effectively, a multi-faceted approach is recommended. This includes the implementation of stricter regulations, robust enforcement, industry self-regulation, and comprehensive consumer education initiatives. Collaborative efforts involving government bodies, industry stakeholders, and informed consumers can collectively mitigate food fraud, safeguarding the integrity of Serbia's food industry. These actions aim to restore trust and ensure that consumers make informed choices, while also fostering a fair and transparent food market.

Keywords – Food labeling ethics, consumer communication, product declaration issues, ethical advertising challenges, food industry integrity

I. INTRODUCTION

The motive behind food fraud is to gain economic benefit. Companies constantly seek new ways to reduce production costs and maximize their profit. In the pursuit of economic gain, it often happens that food manufacturers, who aim to operate within the bounds of the law but also gain a competitive advantage over their competitors, label products they introduce to the market as "homemade" food, "vegan" food, "organic" food, or "natural" food, which can mislead consumers if these claims turn out to be untrue.

For a food product to secure its place on the shelves of retail and wholesale outlets, it is necessary to meet numerous quality and safety standards. Although compliance with these standards guarantees that the product is safe for human consumption, it does not necessarily mean that the claims on its packaging are true.

II. FOOD FRAUD AND ETHICS

A. Defining Food Fraud

Food fraud is a phenomenon that was rarely found in academic literature until the European horsemeat scandal in 2013, which led to increased interest among researchers and a rapidly expanding body of literature [1]. Food fraud is defined as an intentional or unintentional act aimed at gaining economic benefit, encompassing various actions such as unauthorized or incorrect food representation and providing false statements about food [2].

In an era when food safety laws are undergoing significant changes, particularly due to increased international trade, opportunities for food fraud in any of its numerous forms are prevalent throughout the entire food supply chain and can be associated with any food product.

Therefore, food fraud represents а concerning phenomenon in the food industry, involving deliberate false representation, counterfeiting, or mislabeling of food products for economic gain. While food fraud encompasses a wide range of deceptive practices, one aspect of this issue that requires careful analysis is the use of deceptive marketing tactics to manipulate end consumers.

In today's hyper-competitive market, where consumer trust and loyalty are paramount, unscrupulous individuals and companies resort to deceptive marketing strategies to increase sales and profit margins, which can undermine the integrity of the entire food supply chain.

B. Business Ethics Behind the Problem

Companies often turn to legal regulations when facing ethical dilemmas in their daily operations. The question arises: *is the law a good enough guide for business, and should companies even concern themselves with morality and ethics, or is it sufficient to abide by the letter of the law when making business decisions?*

Today's consumers often protest, react to, and condemn immoral and unethical business behavior. The protection of the environment is increasingly in focus, along with anti-consumer and anti-capitalist ideas that guide many powerful groups of individuals. Additionally, with the development of modern media, companies' business practices are scrutinized in real-time from multiple angles, and the opportunities for errors are limited.

Most companies turn to the letter of the law as a solution to all their uncertainties. Relying on the law as the sole norm to govern business is partly due to the fact that many managers do not know how to manage moral issues in business [3]. The law is largely reactive. There is a lag between practices that society discovers as harmful and the drafting and approval of legislation that makes those practices illegal [3]. Often, scandals are exposed in the media, which puts the relevant authorities in a position that requires action, or public pressure prompts action from the authorities. Public reaction significantly influences the authorities because, if it is mild, the mechanism of action will be slower, and vice versa.

In the legal regulations of the Republic of Serbia, there are clearly defined statements that can be found on the packaging of certain food products. However, for such a statement to appear on the packaging of a product, the manufacturers must meet specific requirements regarding the composition or structure of the product. There is a small number of legally regulated statements, and alongside them, there are numerous statements that manufacturers regularly use and which are important for them but are not legally regulated.

Examining the moral background of companies operating in the food industry, with a focus on marketing tactics used by these companies, involves considering the ethical implications of marketing strategies and tactics used to promote food products. This includes assessing the impact these strategies and tactics have on consumers, the well-being and health of all participants, and considering fairness and transparency in advertising.

One of the main aspects subject to ethical consideration in food industry marketing is the potential to influence consumer behavior and health. Companies in the food industry have a moral obligation to promote healthy lifestyles and provide accurate and truthful information about their products. This involves avoiding manipulative marketing tactics such as deceptive health claims or misrepresentations of nutritional or product characteristics. The advantage of using labels compared to other forms of information (such as advertising messages) on which consumers base their decisions lies in the fact that approximately 75% of decisions are made at the point of purchase [4].

Another important aspect under ethical consideration in food industry marketing is the fairness and transparency of advertising. Companies have a responsibility to ensure that their marketing phrases and messages are not misleading and do not unfairly target vulnerable populations such as children. This means avoiding marketing tactics that exploit emotions, values, attitudes or promote unhealthy dietary habits. If what a label suggests is not scientifically proven, such information is considered potentially misleading to consumers and may lead to the stigmatization of conventional product manufacturers [5].

Ethical companies in the food industry strive to promote transparency in marketing and

provide consumers with access to clear and accurate information about the products they market. This includes providing transparent information about ingredients, nutritional values, product characteristics, and its origin.

There is a large body of research, studies, and scientific papers whose conclusions indicate that a large number of consumers prefer to have a large amount of nutritional information on the packaging of their chosen food products [6]. However, consumer preferences for details in this area vary. Consumers want labels that they can easily read and understand without the need for additional calculations and combining different pieces of information [7]. Most often, consumers prefer short statements on the front of the packaging, combined with detailed nutritional information on the back, which, according to Wansink [8], represents the optimal level of nutritional information on a product. From all the above, it can be concluded that consumers pay special attention to the labeling of food products and their interpretation, and that consumers strive to be well-informed with data to make an informed decision when purchasing. However, some consumer demands for accessible information may be conflicting. Grunert and Wills [9] emphasize that consumers, on the one hand, want simple, easyto-understand labeling of food products, while, on the other hand, they want as much data as possible to be adequately informed about the product and to be able to assess the truthfulness of nutritional and health claims on food packaging.

III. EXAMPLES OF PROBLEMATIC LABELS ON FOOD PRODUCTS

A. Geographical Origin Labels

Kireeva [10] interprets geographical origin labels as the first forms of stamps. Geographical origin labels represent names associated with quality products originating from specific regions, where the product's origin influences the specific qualities, characteristics, and reputation of those products [11]. It can be concluded that the geographical origin of a product has a certain impact on consumers' perceptions of the characteristics of the chosen food product and on creating a positive or negative impact on the image of the country of origin. Authors Watson and Wright [12] unified this stance by defining the Country of Origin Effect (COO) as the positive or negative influence that the country of origin of a product has on a consumers purchasing decision, which is often more important than the brand, price, or quality. Thus, geographical origin labels possess properties relevant to the marketing and promotion of the respective product and the country of origin [13].

One example of deceptive marketing tactics and food fraud is the placement of food products on the market characterized as locally produced or made in the Republic of Serbia, when they are not. This tactic aims to exploit consumers' preferences for locally or domestically produced products.

For example, a company may promote a product by declaring it as "Made in Serbia" or may use Serbian images, symbols, or nationalistic messages in its advertising to shape consumers perception that the product is locally produced and that by purchasing it, consumers are supporting the local economy. However, further investigation may reveal that the product is actually imported from another country or contains a significant proportion of foreign components, which constitutes consumer deception.

By using such deceptive marketing tactics, consumers who consciously choose to support local products under the assumption that they are supporting domestic production are misled. Additionally, such tactics can negatively affect the reputation and competitiveness of genuine Serbian food producers who are genuinely dedicated to local production.

To address this issue, regulatory authorities in the Republic of Serbia must enforce stricter control over compliance with legal regulations related to the country of origin labeling on food product packaging. It is necessary for supervisory authorities to conduct regular inspections and audits to ensure that food products declared as "Made in Serbia" actually meet the criteria required to use such a label. If it is determined that a company has inadequately declared a certain food product and thereby misled consumers, appropriate legal penalties should be applied, and the company should be required to rectify the unethical marketing practice.

In this problem of inadequate labeling, consumer education, along with awarenessraising campaigns, plays a vital role in identifying and supporting authentic Serbian food products. Providing transparent information about the true origin of a food product empowers consumers to make informed decisions and support genuinely local and domestic food producers.

B. Organic Labels

If a domestic organic product is produced in accordance with organic production standards and legal regulations, the producer must, after receiving a certificate from an authorized control organization, prominently place the national label with a clear and visible inscription "Organic Product" on the packaging, according to the Law on Organic Production of the Republic of Serbia [14]. The national label guarantees that the product has undergone a control process and is certified in accordance with regulations by the certification body (authorized control organization) monitored by the Ministry of Agriculture, Forestry, and Water Management [14].

However, if a product does not possess the label "Organic Product" on its packaging but only uses prefixes such as "Bio", "Eco" or even "Organic" it means that this product is not certified and controlled by the certification body (authorized control organization).

Therefore, one example of food fraud is incorrectly labeling conventionally produced products as "organic." This deceptive marketing practice aims to exploit the growing demand for organic food and mislead consumers if they are looking for healthier options when purchasing food products.

In this case, manufacturers or distributors may inadequately label their food products as "organic" without adhering to the standards associated with organic certification. They may use deceptive words, images, or symbols on the packaging of the food product to create a perception that the product is organic.

For example, to implement such a deceptive marketing tactic or strategy, a manufacturer may label their food product as "organically grown" or use the previously mentioned terms "Bio" and "Eco" which consumers often equate with organic production. Additionally, they can enhance the "organic" image of the food product by decorating the packaging with images suggesting farms, greenery, and freshness, which can create a false perception about the product if such representation is not adequate. This deceptive marketing practice undermines the integrity of the organic food market in Serbia and erodes the trust that consumers have in such products. Besides deceiving consumers, it negatively affects legitimate organic producers and farmers who have diligently worked to meet the strict standards associated with organic production.

To address this issue and combat food fraud. the crucial role of competent state authorities and independent certification bodies must be emphasized. They must conduct regular inspection and supervision to ensure that food products labeled as "organic products" indeed meet the necessary certification requirements. Additionally, in combating such food fraud, awareness-raising campaigns play an essential educating consumers role in about distinguishing truly organic products from inadequately labeled food products, which contributes to making informed decisions when making purchases and supporting legitimate organic producers and farmers.

IV. THE IMPACT OF PUBLIC OPINION SAMPLING ON CREATION OF POLICIES

A. Public Opinion Sampling Example

Research on the perceptions and attitudes of consumer regarding ethical issues in the labeling, marketing, and advertising of food products was conducted using a quantitative method, employing a structured questionnaire. The questionnaire consisted of nine questions to which respondents provided responses indicating their level of agreement or disagreement with the statements. Response options were formulated using a four-point Likert scale, commonly used by psychologists worldwide to measure attitudes.

Regarding the Likert scale itself, the most significant point of contention among experts in this field pertains to the advantages and disadvantages of including a neutral response option. While the inclusion of a neutral option is intended to reduce instances of providing false answers, studies indicate that including a neutral or "no opinion" option significantly increases the number of people who claim not to have an opinion on a subject when they actually do [15]. Furthermore, selecting a neutral option allows individuals to avoid the cognitive effort required when choosing between positive and negative feelings about a particular issue [16]. For the purposes of this study, a "forced-choice Likert scale" was used, offering the following four response options:

- 1. I strongly disagree;
- 2. I somewhat disagree;
- 3. I somewhat agree;
- 4. I strongly agree.

The quantitative research included 133 participants, selected according to predefined criteria. For this research, full-age citizens of the Republic of Serbia with diverse social, demographic, and economic characteristics were chosen as respondents. Given that the researched topic pertains to individuals' purchasing habits, it is essential that each participant meets the condition of being 18 years of age or older, under the assumption that individuals in their earlier years cannot fully independently make decisions regarding the daily purchase of food products.

B. Results

Through consumer survey, this study explored the extent to which consumers pay attention to labels on food products, statements on its packaging, and the level of trust consumers have in regulatory mechanisms in the Republic of Serbia. Additionally, it investigated the transparency of food producers in the market. This research also provided insights into consumers' understanding of the legal regulations related to the topic in question and whether consumers genuinely comprehend the nature of their purchases.

The fact that 64% of respondents claim to read labels and pay special attention to statements on food product labels during their purchases reflects the tendency of today's consumers to make informed decisions when buying food products. Nearly half of the respondents (48%) state that they choose products they consider a "healthier" option compared to other products on the shelf, highlighting the significance of labels on food products. Through the analysis of these labels, consumers distinguish "healthier" food products from conventionally produced ones.

A significant percentage (86%) of respondents, to a greater or lesser extent, have trust in the regulatory mechanisms established in the Republic of Serbia concerning the labeling, declaring, and advertising of food products. This underscores the substantial responsibility that regulatory authorities bear in this matter. It is incumbent upon them to protect consumers from deceptive and unethical business practices, thereby justifying the significant trust they enjoy from consumers.

Regarding the trust enjoyed by food product manufacturers, this research demonstrates that 61% of respondents have trust (to a greater or lesser extent) in manufacturers who label their food products as "organic", "eco", etc. Building trust between consumers and manufacturers can be influenced by conducting educational campaigns and raising public awareness, enabling informed decision-making during purchases. Additionally, the actions of regulatory bodies in the Republic of Serbia, coupled with stricter penalties for unethical behavior by manufacturers in food fraud cases, can positively contribute to fostering trusting relationships between these two interested parties.

When it comes to price as a factor in making purchasing decisions, it is important to highlight that a significant 78% of respondents claim that they are willing, to a greater or lesser extent, to allocate more financial resources for food products they consider natural, organic, etc. This data reflects the decreasing significance of price as a factor when making decisions about purchasing food products and the growing importance of labels on these products.

As a reminder, the national label "organic product" cannot be equated with seemingly similar labels such as "organic" which indicates similar product properties. The use of the national label "organic product" is strictly regulated. Although 79% of respondents claim to be somewhat familiar with the use of the national label "organic product," a slightly smaller percentage of respondents (76%) equate labels like "organic" with the national label "organic product," indicating a lack of understanding of the meaning of this label by consumers. This data underscores the importance, urgency, and significance of educational campaigns and raising consumer awareness on this topic, enabling them to make informed decisions with every purchase.

Perhaps the most significant finding of this research pertains to the fact that 71% of respondents unequivocally state that they will lose trust in a brand and avoid future purchases of food products from a manufacturer they determine has engaged in deception. This confirms that unethical food manufacturers can be most easily punished through consumer response - by being ignored. A quality product, brought to the market by a transparent manufacturer, will always find its way to the right customer. Such a consumer reaction in the case of deception is entirely understandable and may come from a negative experience. Trust is a crucial aspect of the manufacturer-consumer relationship, as evidenced by the interpretation of the results of this research. Transparency, ethical approaches, and delivering on promises are key factors for sustainability and market success.

V. CONCLUSION

Frauds related to food in the Republic of Serbia, especially those involving manipulative marketing tactics and strategies, represent a significant problem that erodes consumer trust in the entire food supply chain, jeopardizes health, and undermines the integrity of the food industry. Addressing all manipulative practices used to deceive consumers when purchasing falsely represented products requires a comprehensive approach in combating this increasingly prevalent issue.

Marketing tactics play a pivotal role in foodrelated fraud, with unscrupulous actors exploiting consumers' preferences for healthier, local, and environmentally friendly products. Baseless claims that portray products as organic, low in sugar or additives, low in calories, or locally produced deceive consumers, resulting in financial losses and potentially endangering human health. Furthermore, these tactics and strategies erode consumer trust and have a negative impact on the reputation of producers who adhere to transparent and ethical marketing practices.

To take preventive action in addressing food fraud and to combat manipulative marketing tactics effectively in the Republic of Serbia, it is necessary to implement appropriate measures. Strengthening the regulatory framework is crucial, along with tightening requirements for proper labeling, advertising, and declaration of food products, coupled with stricter penalties for non-compliance. These measures must be accompanied by rigorous and continuous inspection oversight by competent authorities, including sanitary, phytosanitary, and veterinary inspectors.

The enforcement of punitive provisions is essential in deterring fraudulent activities, but regulatory bodies must be provided with adequate resources and training to enhance their enforcement. capacity for Additionally, promoting initiatives in research and development can potentially lead to innovative solutions for preventing food fraud, ensuring the authenticity and quality of food products.

Self-regulation within the industry is vital in addressing this problem, achieved through strengthening industry associations that develop and implement codes of conduct, quality assurance programs, security measures, and quality control while promoting transparency in the food supply chain. Moreover, campaigns aimed at educating consumers are essential to empower individuals with the knowledge necessary to identify deceptive marketing practices, read labels and declarations, and make informed choices.

Therefore, resolving the issue of food fraud in the Republic of Serbia requires collective efforts from government authorities, industry stakeholders, and informed consumers. By implementing the measures outlined in this paper, Serbia can protect the interests of consumers in the food supply chain while fostering a trustworthy food market that supports ethical marketing practices. With a calculated and proactive approach, the Republic of Serbia can significantly reduce food-related fraud and strengthen the integrity of its food industry for the benefit of all stakeholders affected by this pressing issue.

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Project Financing of Local Selfgovernment Units in the Republic of Croatia with Funds as a New Development Concept, Risks and Benefits

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Abstract—**Project** financing of local selfgovernment units implies the concept of collecting investments through various market models that contribute to local development. The aim of the paper is to show which financing models are available to local self-government units, the methods of determining the risks involved in project financing, and to show which benefits are obtained through the implementation of projects. The paper will look at the available options that affect the justification of the investment through the analysis of market models of project financing, perform an analysis of the participants, give an overview of the stages of project financing and the main risks that are encountered with this type of financing, and compare conventional, traditional lending with project financing. The methods that will be used in the paper are the analytical method and the descriptive statistics method. Based on the considered methodology, the discussion in the paper will be focused on risk minimization options on the one hand, and those options that bring the greatest benefit to local self-government units.

Keywords – Project financing, local selfgovernment units, risk assessment methods, local development

I. INTRODUCTION

Local self-government units (further in the text LGUs) can use project financing for the construction, maintenance and use of assets they

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manage and which are used by the wider community. Project financing implies the term of lending, borrowing, the repayment of which is expected from the income generated from the project itself [1]. The physical assets of the project are most often used as an instrument to secure debt repayment. LGUs use three financing models [2]:

- State funding,
- Private financing,
- Mixed financing, i.e. public private partnership (PP).

State financing implies state investment in strengthening local capacities through the use of the state budget, funds from state funds and funds from state banks. From these funds, projects are financed in those LGU-s whose local development budgets are below average. This financing encourages the strengthening of local capacities and increases the recognition (branding) of LGU-s [3].

Private financing implies the use of private capital to realize local projects. Through this financing model, the state budget is protected, and the funds are intended for those projects where there is a low risk for the return of the invested funds [4]. With this financing model, special attention is paid to the financial aspects
of guaranteeing the return of invested funds [5]. The negative side of this model is the social (un)acceptability of private financing and investment in local infrastructure [2].

Mixed financing, i.e. public-private partnership, involves joint investment by local authorities and the private sector. Mutual rights and obligations are regulated by a separate agreement. This type of financing implies various forms of ownership and management structures. The distribution of risk through this type of financing ensures several benefits for both the private and public sectors [6]. This model is represented in developed countries because it simplifies procedures, encourages creativity, increases project effectiveness and animates expert teams, which contributes to the success of project implementation.

Project financing is used in the public sector to encourage production and exploitation of systems (electricity, energy gas, oil, telecommunications, etc.), improvement of water supply and drainage systems, improvement of the health system, education, protection of the human environment, and development of traffic infrastructure. Projects financed by this model long-term, complex and financially are demanding. Because of this, operational costs are high, preparation time is long, and the risk rate is high. With project financing, due to the considerable amount of borrowed money, the appropriate risk distribution delineates the rights and obligations of all project actors in all phases, which ensures quality implementation of the project [7]. Actors of project financing are [4]:

- Project holder whose role is to prepare and develop the project and organize work bodies. The project holder can invest his own capital, and together with other actors, through a contractual connection (establishment of a project company), realize certain rights and obligations, all to achieve business interests.
- The lender is a financial institution that approves financial resources for the realization of the project. Assets acquired during the duration of the project are used as a security guarantee for the invested funds.
- The contractor is an entity that has a contractual relationship with the project company whose primary task is the

management of the facility that is the subject of the project.

- The supplier is a legal or physical person who also has a contract with the project company whose task is to deliver energy, raw materials and other necessary resources.
- Beneficiaries are all persons who use or consume the results of realized project activities.

Every business activity, including the project itself, is accompanied by risk. Risk is defined as a situation that threatens the realization of the project. The total risk of the project consists of systemic and specific risks [8]. Systemic risk arises from external circumstances that the project company cannot influence (cyclical economic trends, inflation, interest rate policy, etc.). This type of risk follows all market actors, so this risk cannot be avoided by diversification, so it can be called a non-diversifying risk [8]. The specific risk of the project depends on the profitability of the project activity and other related factors, i.e. it is influenced by internal factors. It can be called a mitigating risk [9]. In the process of determining the risks for which there is a possibility of influencing the realization of the investment, it is necessary to carry out the following steps [10]:

- define project risk factors;
- define the probability of occurrence on an annual level of each factor in all years of the project duration, which is determined through a weighted value;
- value-wise predict the level of impact of each risk factor in the event of its occurrence in all years of the project;
- evaluate the total impact of each individual factor on the expected net receipts of the project.

In practice, a risk matrix (Table I) is used to determine the level of risk, which quantitatively shows the probability and consequences that may arise according to the value scale. The general term of investment evaluation refers to a set of actions aimed at determining the justification and acceptability of the investment. The border of the red line shows that it is recommended to implement the project in which the consequences and probability of the risk do not exceed the value of 5.

TABLE I. RISK MATRIX [11].

Consequences Probability	Insignificant	Limited	Severe	Extremely severe	Catastrophic
Very low - 1 1 time in 25 g	1*1=1	2	3	4	5
Low – 2 1 time in 10 g	2	4	6	8	10
Middle – 3 1 time in 5 g	3	6	9	12	15
High - 4 1 time in 1 g	4	8	12	16	20
Very high - 5 1 time in half a year	5	10	15	20	25

A detailed evaluation of the project brings knowledge about the very justification of the project idea. In the operational sense, evaluation can be defined as the stage of investment project planning in which the following activities take place [12]:

- defining the development goals within which the investment is planned;
- defining criteria and choosing methods for investment evaluation;
- creating a documentation and information base for the application of assessment methods;
- application of criteria and methods;
- proposing the sequence of projects for execution;
- making an investment decision (positive or negative).

Concerning the effects it produces, the investment project can be observed and evaluated from the perspective of the local selfgovernment in which the investment is made and from the perspective of the wider social community or society. Therefore. the consideration of the effects of the project and the use of appropriate evaluation criteria are different [7], depending on which aspect is involved. From the LGU aspect, the project evaluation methods used in determining the effects of the investment in the LGU must also satisfy the social benefit.

II. MATERIAL AND METHODS

LGUs in the Republic of Croatia have available funds for project financing from the following sources:

- Budget Republic of Croatia (RC);
- European Fund for Regional Development (ERDF);
- Cohesion Fund (CF);
- European Social Fund (ESF);
- The Just Transition Fund (JTF);
- Budget Republic of Croatia (RC);
- Mixed financing, i.e. public private partnership (PP).

According to data from the Ministry of Regional Development and European Union Funds of the Republic of Croatia, in the period from 2021 to 2023, LGUs collected a total of 25,000,000,000.00 euros from the aforementioned funds for various areas of investment. The data are presented in Table II.

The most common evaluations of investment projects imply the omission of cash flows (discount cash flow - DCF), that is, all those calculations that do not take into account

opportunity costs - benefits based on investing in an investment [12]:

- Annual profit method;
- Average rate of return;
- Payback period;
- Internal rate of return.

		Source of financing in %		
Areas of investment	Value in euros	Budget RC	EU	PP
Research and innovation	1.055.000.000,00	52	39	9
Intangible assets	3.500.000.000,00	46	36	18
Traffic	8.840.000.000,00	41	47	12
Environmental protection	7.350.000.000,00	44	56	0
New technology	1.100.000.000,00	28	57	15
Energy	1.880.000.000,00	32	57	11
Digitalization and lifelong learning	1.275.000.000,00	39	49	12
In total	25.000.000.000,00	40	49	11

TABLE II. VALUE OF WITHDRAWN FUNDS IN THE REPUBLIC OF CROATIA ACCORDING TO AREAS OF INVESTMENT.

- Net present value method;
- Profitability index;
- Internal rate of return method;
- The benefit-cost method;
- Annuity method;
- Multi-criteria analysis.

Given that every investment represents a certain business risk, the mentioned methods help the holder of the project activity to find out which project is profitable, where the return on investment is the shortest, to estimate the net present value in the future period, etc.

III. RESULTS AND DISCUSSION

The research in the paper is focused on the local self-government units' project financing model, based on the data from Table II. According to the author's calculations, the results are as follows:

- Cities used 46% of the total attracted funds, while municipalities used 54%.
- Of the total funds, 40% was financed through the state budget, 49% was financed from EU funds, and 11% was financed through mixed investment, i.e. public-private partnership.

When evaluating projects, the most frequently used methodology is shown in Fig. 1.

The data in the graph shows that the net present value methods of multi-criteria analysis

are the most used, which are also the most coexisting. Other methods were used in a percentage of 38% - to 50%.

Table III shows the projects according to the areas of investment from Table II as follows:

- Percentage of project completion value from 0 to 100%;
- Probability of risk occurrence weight from 1 to 25 (1 min 25 max);



Area of investments	Percentage of project implementation	Probability of the occurrence of risks	Consequences of the occurrence of risks	Percentage of social benefit
Research and innovation	84	6	8	6
Intangible assets	87	4	10	5
Traffic	83	4	8	10
Environmental protection	71	8	12	8
New technology	49	12	6	8
Energy	56	12	16	8
Digitalization and lifelong learning	89	4	4	5

TABLE III. PROJECT REALIZATION IN THE REPUBLIC OF CROATIA ACCORDING TO AREAS OF INVESTMENT.

- Times of occurrence of risk weight from 1 to 25 (1 min 25 max);
- Social benefit of the project weight from 1 to 10 (1 min 10 max).

The values in the table show that the smallest percentage of the project's realization is in the area of energy, in which there are high weightings of the probability of risk occurrence and the consequences of risk occurrence, and a high weighting of social benefits. On the contrary, the field of digitization and lifelong learning have opposite values, a high probability of realization with minimal risks and a weak social benefit. It is evident from the above data that, apart from transport, the area of environmental protection, new technologies and energy have the greatest benefit for the wider social community. However, other areas should not be neglected either, because the implementation of research and development, digitization and lifelong learning projects can greatly contribute to the local community and local development.

Risks can be reduced through adequate risk management. Risk management involves the creation of various analyses as additions to project evaluation methods. Based on these analyses and estimates that are reached, it is possible to reduce the risks. Both for creditors and for local self-government units, the risks must be as low as possible, which increases the chances of obtaining financial resources for the realization of the project.

IV. CONCLUSION

Project financing of LGUs represents an increasingly interesting topic in the scientific sphere. This topic is very complex because it explores the possibilities of LGU development from different sources of financing. Through the research material, areas of investments were covered using the sources of project financing. The results in the paper showed that there are three most common sources of funding for LGU projects. Most of the projects were financed from EU funds, 49% of them, from the state budget 40%, and only 11% from public private partnership. A condition for approving projects is a good preparation of the project proposal. Investment evaluation methods play an important role in the preparation itself.

Project evaluation is a complex process that includes a number of different methods and calculations. The results also showed that it is not enough to carry out the evaluation with only one method, but it is necessary to implement a combination of methods in order to get a comprehensive picture of the justification of the project. The results showed that in practice the net present value method is used the most in an average of 78%, and multi-criteria analysis 69%, which represent the two most complex methods. Other methods are represented in an average of 38 to 50%, which is a satisfactory indicator considering the amount of realized project funds of 25,000,000,000.00 euros.

Risk management adds additional complexity to this topic. The results showed that the greatest risks exist in projects in the field of energy, environmental protection and new technologies, because these are the areas most dependent on systemic risks. However, in these areas, the greatest benefit for the social community is achieved, the weighting value is between 8 and 10. Through project financing, LGUs achieve benefits through a higher level of local development, which is a prerequisite for attracting additional investments that should correlate with the needs of the social community and the economy environment.

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The Role of Brand Re-innovation in the System of Reinnovation Radar

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Abstract—In order for established and well-known brands to reinvent themselves, reinnovate, and remain relevant and competitive in today's rapidly changing business environment, reinnovation is essential. The objective of the desk research was analysing the process of how to perform brand reinnovation and which type of tools could be used. It the paper there are several examples of longlived brands that have been reinnovating permanently. Leading companies today are directing their managerial objectives towards intangible assets, as global competition intensifies and many competitive advantages (such as technology) become increasingly short-term, thereby amplifying brands' contribution to shareholder value. Consequently, the need for brand valuation is growing from both a corporate management and transaction perspective. Consumers are viewed as intangible assets that an organization and brand should strategically acquire, nurture, and maximize the value of, much like other financial assets. In 1975, intangible value accounted for 17% of the total value, whereas in 2015, tangible value reached 61%. These figures clearly demonstrate the growing importance of nurturing employees, developing brands and new products, securing licenses, contracts, and all elements constituting intangible value. The contribution of the paper is understanding the power of reinnovation via management tool named the innovation radar and its role in analysing the brand performance.

Keywords – Reinnovation, brands, brand reinnovation, customers

I. INTRODUCTION

We find ourselves in the era of permanent crisis, a collective term encompassing numerous environmental changes such as climate change, digital transformation, the consequences of the COVID-19 pandemic, global inflation, financial crises, labor shortages, ongoing global conflicts, and others. Managers are increasingly tasked with supporting the construction and reinnovation of companies and their brands in light of various influences, including economic, political, social, demographic, and more [1]. With the advent of the Fourth Industrial Revolution, many aspects of our world are undergoing transformation, from shifts in thinking to changes in learning and work methods, as well as modes of communication. Artificial intelligence has given rise to 3D printers, drones, rapidly advancing robotics, autonomous vehicles, IoT (Internet of Things), and the abbreviation SMART now encompasses Social-Mobile-Analytics-Robots-Transformation.

Culture has become transformative. embracing open innovation and value-driven processes. Social networks engage all target groups (B2P, P2P, G2C, C2G, B2B, B2C). Massive databases enable data processing for operational use and predictions through machine learning and big data analytics. The emergence promises Web 3 further changes, of incorporating blockchain, cryptocurrencies, Augmented Reality (AR), Mixed Reality (MR), Extended Reality (XR), NFTs, and new forms of gaming, among others. This creates opportunities to meet the digital generation's needs for brand engagement, virtual brand shopping, and creating a user experience within the Metaverse.

II. BRAND REINNOVATION

Brand reinnovation is a process that is often necessary when brands, or the products within

those brands, as well as consumer attention, begin to decline. Nevertheless, the core of the brand must be clearly defined for successful brand reinnovation. Marketing managers must be able to identify critical and latent signs of brand aging and apply brand reinnovation elements and strategies that are most suitable for a particular brand. The marketing environment is constantly changing, with shifts in consumer behavior, competitive strategies, technological advancements, and other aspects of the marketing landscape making the jobs of marketing and brand managers challenging. Reinnovation preserves and respects the brand's history and heritage while demonstrating to its target audience (both current and future) that the company is adapting to changes. Change is essential to remain relevant in the times in which the brand exists and to ensure its future success.

There are compelling reasons for the attention that companies pay to their brands. As assets, brands can be highly valuable, even when they are no longer in their golden years. Consumers recognize a strong brand, can identify it among many others, and have developed attitudes toward its use [2]. When a brand starts to weaken, the brand's value diminishes simultaneously. Companies may sometimes only consider repositioning, but telling the brand story could benefit companies in building a stronger relationship with consumers. Overall, companies should prepare a long-term strategy for maintaining the "life" of the brand. Moreover, brands must create multiple channels of communication. Through this, the brand's image can also expand in the consumer's consciousness [3]. According to Kapferer, brands are assets that could bring benefits to a company over an extended period [4]. Therefore, companies must continually manage their brand value to avoid losing market presence. Specifically, the brand lifecycle could be defined as birth, growth, maturity, decline, and disappearance, with the latter being replaced by brand reinnovation to promote the brand's sustainability over the long term. During a brand's lifecycle, companies inevitably encounter market dynamics and must react with reinnovations to sustain the brand. However, brands never lose their value all at once. Their image and name remain "stored" in the long-term memory of consumers, so even after many years, a brand can evoke a range of positive or negative associations.

from the market. To regain lost brand value or acquire new sources of added brand value, brand reinnovation is required. Every brand is at risk of losing its vitality and value, regardless of how powerful and successful it may be. Therefore, even brands that have been on the market for a long time must reinvent their concept and message from time to time to adapt to changing trends, meet the needs and desires of modern consumers, and address new competitive threats. Brands that fail to do so often quietly fade from the market and are quickly forgotten due to the dynamism of the market and the constant emergence of new brands. In 21st-century marketing, the future of marketing lies in creating products, services, and organizational cultures that inspire and incorporate customer values [5]. III.

WHAT IS THE INNOVATION RADAR?

Brand reinnovation is a marketing strategy

adopted when a product reaches the pre-maturity

phase of the product lifecycle, and profits have

not yet started to decline. It can be considered an

attempt to return the product to the market and

secure a source of capital, i.e., consumers.

competitors, new technologies, or changes in the marketing environment can affect brand

revenues. Consequently, many brands that were highly respected by consumers have lost their

good market position or, ultimately, disappeared

customer preferences,

new

in

Changes

There is a common belief that only research and development departments should be responsible for innovation in organizations, and that they should bring about significant technological advancements. However, this is not entirely accurate. Organizations need to reinvent themselves to remain competitive in turbulent times. On one hand, rapid digitalization creates new value and opportunities for organizations to use influence and innovate. On the other hand, established norms are at risk due to the impracticality of traditional industrial definitions and the formation of new ecosystems.

Many companies have a narrow view of innovation, considering it synonymous with the development of new products or the responsibility of research and development departments. In many cases, companies, as a result of competitive analysis, mimic the practices of other more successful firms in their industries, targeting the same customer segments with similar products, which does not create additional value for consumers. Therefore, the



common perception of innovation is often too narrow, leaving many companies vulnerable to the actions of competitors with broader perspectives [6].

In order to better understand innovation and enable employees to think in broader business contexts for its improvement, a framework called the Reinnovation Radar can be employed.

This tool represents and connects all dimensions in which a company can seek innovation opportunities and consists of four key dimensions that serve as business anchors [7]:

- The offerings a company creates (what value we are creating),
- The consumers it serves (for whom we are creating value),
- The processes it employs (how we create value), and
- The points of presence it uses to deliver its offerings to the market (where we deliver value).

Embedded within these four anchors are eleven other dimensions of the business system that can serve as pathways of exploration. Thus, the Reinnovation Radar encompasses a total of 15 key dimensions, as depicted in the following figure (Fig. 1).

The brand plays a crucial role in the dimension of creating value for clients, customers, and consumers. Therefore, the brand should undergo continuous reinnovation, whether changes are anticipated, created, or implemented.

IV. THE ROLE OF REINNOVATED BRAND IN STRENGTHENING BRAND AND COMPANY VALUE

The majority of a company's business value originates from intangible assets, such as a brand, which influences the choices of consumers, clients, and employees, as well as investors and the community [8]. In a world where choice exists, such influence is crucial for sales success and creating shareholder value. Even nonprofit organizations have started to embrace the brand as a critical tool for gaining donations, sponsorships, and volunteers [9].

The two most prominent companies measuring brand value, Millward Brown and Interbrand, as well as Forbes magazine, showed in their 2020 report that the most successful brands were technology (tech) brands. Despite many companies facing bankruptcy during the COVID-19 pandemic, tech giants and major tech brands continued to thrive. Results based on Millward Brown research (3.8 million consumer interviews and financial data from 17,800 brands in 51 markets) indicate the dominance of the top 20 tech companies in 2020 in terms of brand value [10]. According to Forbes' list of "The World's Most Valuable Brands in 2020," companies including Amazon, Netflix, and PayPal showed significant gains in brand value from the previous year's list, in line with ecommerce, streaming, and digital payment trends. Their list of the top five brands illustrates tech brands: Apple, Google, Microsoft, Amazon, and Facebook [11].

Similar results were shown in Interbrand's 2020 report, which demonstrated a leading cluster consisting of Apple, Amazon, Microsoft, Google, Samsung, Facebook, LinkedIn, and PayPal. All of them proved their value and sustainability during the COVID-19 pandemic and demonstrated resilience during the upheaval. Since 2017, the top brands have been tech brands: Amazon, Google, Apple, Microsoft, and Samsung.

However, when a brand loses value, it first loses something vital—the ability for consumers to spontaneously recall it from memory and experience when making a purchasing decision. The key measure of brand value is precisely its presence in consumers' minds and their user experience.

For organizations to succeed in turbulent times, re-innovating their thinking and business

practices requires constant scrutiny of their own weaknesses and vulnerabilities. Therefore, situational diagnosis is becoming increasingly important in brand management because, as in medicine, prescribing treatment without diagnosis is incorrect. Open questions that can help in business re-innovation when the employer is in the shoes of consumers, clients, and customers may [12]:

- How strong is my brand in consumers' minds? How do consumers perceive it?
- What is the current potential of my brand?
- Are market conditions favorable for my brand to fully realize its potential?
- Do the current market performance of my brand reflect its potential?
- If not, what is preventing it from realizing its potential?
- If so, how can I further improve market performance?
- What actions can I take to boost the market potential of the brand?
- What types of communication will strengthen the brand's power?
- What is the nature of the category in which the brand operates?
- What are the possible growth strategies, and how should resources related to the brand be distributed:
 - Invest in market communications (direct or indirect)?
 - Invest in distribution channels?
 - Is it time to introduce a new variant?

V. BRAND REINNOVATION STRATEGY

To meet their brand improvement goals, companies need to redesign their marketing mix. However, before all these activities, brand research is the most crucial technique. Brand research can be beneficial to companies in understanding the needs of the new generation. Additionally, marketing managers must monitor changes in consumer perception and needs to implement appropriate strategies to adapt to trends.

As part of brand re-innovation, any positive characteristics that have disappeared must be strengthened, and any negative characteristics that have appeared may need to be neutralized, with additional positives potentially created. This can be accomplished by appealing to a new generation demographic (Gen Ζ and Millennials). For example, Old Spice dramatically re-innovated itself from being perceived as a brand for consumers aged 50+ into the largest brand in its category. Old Spice produced unconventional advertising and online programs, including social media, video games, mobile apps, and highly entertaining YouTube clips.

Brands must continually evolve to ensure they remain in sync with changing market needs. However, the most critical question is the required level of change. Brand and market research will help assess what type and magnitude of change are necessary. Even some of the world's largest brands need rejuvenation. Brands like Guinness, Coca-Cola, and Kellogg are globally recognized, yet when one examines their market presence over the decades, all of them have undergone certain changes, even if those were mostly incremental adaptations. The brand Levi's Jeans is an example of missing out on new trends in a timely manner. Levi's, in its prime, relied on young consumers who loved the Levi's 501 model and were loval to it. By 2001, surveys showed that the young population had as many as 112 preferred denim brands. In such a fragmented market, Levi's faced new challenges. How to best compete with the growing competition - Diesel, Pepe Jeans, Versace, Armani, and others? These companies offered new, urban models and designs for different subcultures. Levi's refused to change and, as a result, no longer appealed to many. Therefore, the company saw the change but chose not to follow it, losing a significant number of loyal customers [13]. Nokia, Kodak, Blockbuster, Sears, and others are examples of brands that did not timely work on the re-innovation of their brands.

Examples of successful brand re-innovation in the digital world are:

a) IBM was once primarily known for its mainframe computers, but as the industry shifted toward personal computers and later mobile devices, the company had to reinvent itself. IBM turned to cloud computing, data analytics, and artificial intelligence. This change helped IBM

remain a major player in the technology industry, with annual revenue exceeding \$60 billion.

b) Burberry is a classic British luxury brand known for its iconic trench coats and recognizable check pattern. However, in the early 2000s, the brand lost some of its luster and became associated with the "chav" culture in the UK. To reinvigorate itself, Burberry undertook a series of brand image revamping initiatives to appeal to a younger, more global audience. This included leveraging social media. Burberry's revenue nearly tripled in the decade following these changes. Today, Burberry is making another shift: focusing on accessory sales, which now constitute over 50% of its revenue.

c) Lego was in trouble in the early 2000s. The company had expanded rapidly, diversifying into various products and licensing agreements. But sales were declining, and the company was heavily in debt. To turn things around, Lego CEO Jørgen Vig Knudstorp implemented a new strategy focused on simplifying the company's product offering, improving quality, and engaging customers in developing new products through its Lego Ideas platform. Lego's revenue increased by more than 50% in just four years, and the company is now one of the most valuable toy brands globally. Digital transformation is not a goal in itself; it is much more than technology. LEGO transformed its business by exploring potential new offerings to customers, new ways to bring offerings closer to customers, and new ways of doing business [14].

d) Argeta and Cockta are two Slovenian brands launched between 1950 and 1957. During their lifetimes, they went through many different periods, but recently, it became evident that they had used some brand re-innovation strategies [15]. Analyzing the elements of reinnovation and re-innovation strategies, we can see that in the case of Cockta, several reinnovation elements were employed, such as expanding the product portfolio (adding more flavors), innovative advertising (using creative illustrations), and refreshing the brand's visuals (changing the brand slogan). The re-innovation strategy used by the brand is emotional branding because what we see is a direct and emotional approach to consumers. The brand is focused on expanding its product portfolio, which means that one element of re-innovation is still included in the overall strategy. In line with the brand's values, all bottles are available in 50% recycled plastic packaging. Argeta uses various reinnovation elements such as innovative advertising (an interactive concept, the selection of candidate moms who later became brand ambassadors and "approved by moms"), and refreshing the brand's visuals (a complete change in the way the brand communicates with consumers). The re-innovation strategy used by Argeta is storytelling through brand ambassadors and their unique stories about product quality and excellence. The brand changed its packaging design. The storytelling re-innovation strategy continues to evolve through redesigned materials and overall brand communication. The brand received one of the Euro Effie awards for effective marketing communications, specifically for the mentioned campaign "approved by moms."

VI. CONCLUSION

Taking into consideration the new trends, for organizations, sustainability means defining a new organizational philosophy and mindset, shifting from the traditional concept of marketing to sustainability marketing in order to establish sustainable relationships with customers, society, and the environment. The integration of sustainable processes and principles into marketing strategy affects both communication and branding.

The contemporary marketing model views consumers as complex, multidimensional human beings. In turn, customers choose organizations and products that satisfy deeper needs for their participation, such as co-creation, creativity, and community responsibility. To engage everyone in sustainable development, communication is necessary to develop critical awareness of issues, their relevance, and how they connect to social values and norms.

To stay up-to-date with changes, companies should regularly innovate their brands to adapt to the dynamic environment. Companies can enhance brand-related performance to increase its value. One of the tasks of marketing and brand managers is to constantly monitor the brand performance and periodically reframe the brand value elements in line with customers' needs, general marketing principles, global trends, market conditions, and competition. Therefore, it important to simultaneously integrate is consistency and freshness into brand reinnovation plans and action steps, which, if wellplanned and executed, help organizations and companies to enhance their position and thrive in challenging time.

The role of brand re-innovation in the system of re-innovation radar is to represent and connects all dimensions in which a company can seek innovation opportunities.

Limitation of the paper is that there are no examples of those brands that did not succeed to stay relevant in the market. According to the BCG matrix we could speak about those who are stars in comparison to those who have become question marks. It would be useful to measure where the breaking point is when a brand should act upon to stay a star.

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The Knowledge Economy and Technology Bubble in the IT Sector

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Abstract— The "knowledge economy" increases its weight as a special form of modern economic development. It defines the format of technological dynamics and, ultimately, sovereign development. The purpose of the study is to describe the modes of knowledge exchange with an impact on the creation of new technologies, including those types of technologies that generate a technological multiplier, including the effect of the formation of a "technological bubble". The conditions of the emergence of a technological bubble in the are information sector considered. The methodology uses the theory of technological development, methods of taxonomy and morphological descriptive analysis. As a result, the modes of full and partial knowledge exchange in the economy of two agents are described, and three components of demand in the IT product market are identified, generating a "technological bubble" during their interaction, with the probable possibility of its collapse and thereby generating a financial and economic crisis. It shows the change in economic well-being under different modes of knowledge exchange, as well as, on the one hand, the stimulating influence of the technological bubble in terms of technology change, on the other hand, provoking an economic crisis that clearly technological constrains economic and development for a certain period of time.

Keywords – Knowledge economy, information technology, technology bubble, speculative potential

I. INTRODUCTION

The "knowledge economy" has long been a new attribute of the functioning of economic systems, their competition in various fields, especially in the field of technology, as well as a factor determining social development [1-3]. This concerns both the microeconomic [3-4] and the macroeconomic level [5] of an economic organization, although in relation to a firm [4] the issues of knowledge management [6], information support, impact on human capital [7,8], the relationship of knowledge with technological development have been worked out quite well [9-10]. However, the effects generated by the "knowledge economy", especially at the level of macroeconomic consequences, are clearly insufficiently studied, from which is evident the existing underestimation of the impact of "technological bubbles" on the acceleration of growth, then the resulting slowdown and crises. Technological development in the "knowledge economy" acquires a peculiar specificity that has not been observed and noted in theoretical studies before. In particular, there is the importance of the influence of the "knowledge economy" as a sector on the dynamics of GDP and its structure [5,9,11], social indicators of economic development, as well as the emergence of technological development regimes, as one of which can be considered the effect of a "technological bubble" that arises not only because of some combination of knowledge exchange regimes, but also because of the organization of the technology and finance market. This allows us to set the goal of the study as an analysis of knowledge exchange regimes that affect the welfare of agents and technology, with the identification of the structure of demand in the framework of the formation of a technological bubble in the IT sector of the economy and its corresponding markets. The methodology of the research consists of the theory of technological changes, taxonomic and structural-morphological descriptive analysis. To achieve this goal, we will consider the full and partial (incomplete) exchange of knowledge,

their impact on technology and the emerging "technological bubble".

II. METHODOLOGY OF KNOWLEDGE ECONOMY RESEARCH: EXCHANGE MODES AND TECHNOLOGIES

The "knowledge economy" is usually measured by the share of gross value added in the types of activities that relate to this sector of the economy.

Let's imagine the exchange of knowledge between two agents on the basis of work [9]. Let their wealth value be W1, W2, tangible assets, respectively, U1, U2, knowledge as a type of intangible asset K1, K2. Then it is not difficult to write: W1=U1+K1, W2=U2+K2, denoting W,U,K, respectively, the welfare of the economy of two agents, the material base of the economy U and the total amount of knowledge of economics is K, we have: W=U+K, U=U1+U2, K=K1+K2. Let the institutional setting of knowledge exchange channels be given by b1,b2 (Fig. 1).

Knowledge is transferred between agents, detecting one or another magnitude of the buildup effect. If there are two agents, each of which has a certain tangible asset (product), then, in the case of an exchange, one for the other, the total value of assets for two agents does not change, and for each of them, too. However, each agent owns the received asset, but already another as a result of the exchange.

Firstly, when exchanging knowledge, each of the two agents involved in the exchange receives a larger amount of knowledge: the original, which he transfers to another agent, plus the knowledge received from this agent. Consequently, the position of each agent is improved by greater knowledge ownership.



Secondly, the total amount of knowledge does not increase, remains unchanged if there is no increase in knowledge during the exchange process. The latter case arises due to the fact that having received knowledge, the agent can transform it taking into account the thesaurus that he possessed before receiving it. Thus, he expands his thesaurus, accumulating new knowledge during the transformation, which he receives during the exchange from another agent or from some kind of knowledge carrier (databases, the Internet, books, encyclopedias, mass media, etc.). Thus, the total amount of knowledge may not increase during the exchange of two agents, but it may also increase if a transformation occurs during the acquisition of new knowledge (for example, at the time of obtaining knowledge, when there is interaction with the accumulated thesaurus). Usually, the value of the increased knowledge of each agent during the exchange always increases significantly, if we neglect the effect of rapid obsolescence of the transmitted knowledge, or intentional participation in the exchange of outdated knowledge [9].

Knowledge sharing can be:

- complete, when both agents receive from each other all the knowledge they possess,
- partial, when each of the agents gives only a part of the knowledge at his disposal,
- to be absent when, for some reason, the exchange of knowledge does not occur.

The rules of education, the organization of the education system and the conduct of scientific research strongly influence both the generation of new knowledge and the exchange of knowledge. It should be noted that the process of knowledge generation should be considered independently, but the exchange of knowledge is immanently connected with the processes of knowledge reproduction, as it forms the basis of their generation. It is difficult to imagine a highly effective process of creating new knowledge when the exchange of them is extremely difficult. Such difficulties lead to limited access to knowledge for a wide range of people and scientists, which cannot but affect the overall effect of creating new knowledge. For this reason, the growth of transaction costs, the tightening of the rules for the presentation and protection of research – all this plays to limit the

process of reproduction of new knowledge, that is, contradicts the "knowledge economy", at least, does not contribute to its effective functioning and deployment [9].

With the full exchange of knowledge between the two agents, there is an alignment of knowledge. In this case, each of them has K = K1 + K2, so that the total welfare of the economy of the two agents increases by *K* and becomes W = U + 2K (before the exchange W = U + K, U = U1 + U2, K = K1 + K2).

Thus, the exchange of knowledge increases well-being by increasing its intangible part. If U = f(K), then the material part of the agents" welfare also grows over time.

The well-being of the economy varies depending on the type of knowledge exchange. In the absence of exchange (W = U + K) [6]:

$$\begin{aligned} \frac{dW}{dt} &= \frac{dU}{dt} + \frac{dK}{dt} > 0, \\ g_k &= \frac{1}{k} \frac{dK}{dt}; g_u = \frac{1}{U} \frac{dU}{dt}, \\ s &= \frac{U}{K}, \\ g_k &> -sg_U. \end{aligned}$$
(1)

where $s = \frac{U}{K} \frac{U}{K}$ is the structure of the wealth of the economy, the ratio of the material and non-material forms of wealth (knowledge).

If the exchange of knowledge between the agents is complete, that is, there is a learning effect (W = U + 2K), we have:

$$\frac{dW}{dt} = \frac{dU}{dt} + 2\frac{dK}{dt} > 0$$

$$g_k > -\frac{1}{2}sg_U$$
(2)

Based on (2), the growth rate of knowledge should be more than half of the weighted growth rate of material wealth by the value of the wealth structure with a minus sign, so that the total value of wealth increases [9].

Next, we will consider the features of the formation and influence of a technological bubble, which is formed by technologies of a certain type, in particular in the IT sector.

III. THE TECHNOLOGICAL BUBBLE OF THE IT-INDUSTRY: THE FORMATION AND FEATURES OF THE IMPACT ON TECHNOLOGY

The speed of technological development of the modern world leads to the formation of a socalled technological bubble [5]. Moreover, this does not mean the situation of overheating in the stock market of technology companies, when technological development opportunities are exhausted, and the share price of high-tech companies continues to grow along with revenue to the limit, when the price decline will begin in the future. This decline is usually associated with a reassessment of the real value and development opportunities of these companies. This results in losses for startups, especially those funded with the involvement of venture capital, etc.

The bubble effect arises due to the fact that technology and the organization of market institutions program the expansion of product diversity, and it in one market segment programs the need in another market segment, which allows the promotion of guaranteed demand and acquired profits [5,9,10].

At the same time, the demand for the product is absolutely not important, it is programmed by the manufacturer himself, forcing agents to buy a product they do not need. As a result, there is a gradual saturation of the market, the profitability of firms that move from one stage of development to another increases sharply, knowing in advance what will happen and what high profit they will be able to get. It becomes profitable for firms to break the situation into stages - and at each to get a significant profit due to market coverage. This is what happens in the IT sector. Imagine an agent has a computer that works and performs those functions that are significant for the consumer, for which he was bought. However, due to circumstances beyond the consumer's control. the software manufacturer offers new programs for working with texts, data, communications, the Internet, and so on. The consumer was not the initiator of innovations. such But his computer automatically either needs to expand memory, since new programs require more space on the computer's disk, or, if memory expansion is technically impossible, then replacing the computer. Note that the working product is changing, under the guise that the programs are more modern. However, there was no demand for them. It turns out that agents are being forced to replace hardware and software at a time when

this was not part of their plans. Moreover, in the initial phase of such a market, this happens at a fairly high price. New software may be developed using a new technology, for example, not suitable for a processor of a different bit depth. This also devalues programs, for example, that the consumer himself created on his computer using a processor of a different bit rate. These phenomena fit into the logic of increasing unjustified costs and profits to producers initiators of such a model of market development. This is a typical technological bubble, because there is a rush in the market to replace computers and software, and the possibilities of using the old software are blocked [9].

The general scheme of such "technological speculation" is shown in Fig.2.

Of course, in the general case, we cannot assume that there is no demand for software. However, the consumer, as a rule, does not realize the technological capabilities of the program, especially if the operating system is meant. Fig. 2 shows three types of demand:

- for computer elements (memory, disk), when it is possible to upgrade and not buy a new computer, to do less (D1);
- on ready-made computers that have the capabilities to install new software, including the operating system (D2);
- software (software), some new features, information about which the consumer mainly receives in advance from the manufacturer [6].

This creates future demand, which promotes the other two components of total demand in this market, which are much more significant and capacious in size (D1 and D2).



As can be seen from the existing links in Fig. 2, each type of demand multiplies another type of demand.

An unwinding and generally closed flywheel of the development of this sector, which includes many markets, is formed with a built-in speculative mechanism that allows you to squeeze significant profits out of the market, tying the consumer to a certain behavior model for the implementation of permanent costs for computers and software. And it does not matter whether these functions are needed by the consumer and they are so useful for him or not. In the knowledge market, this effect has an even more pronounced impact on the knowledge market and the mechanisms of exchange and dissemination of knowledge. The speculative potential here is significant, since knowledge itself has a high uncertainty in its application. At the same time, the need for it is often blurred. Moreover, this uncertainty is higher than in the computer and software market [9].

A technological bubble arises due to the fact that new technologies, being created, form through the expanding possibilities of their application the need for technological renewal, as it were, program it and make it inevitable. This expands the market capacity, allows companies to increase the price of the goods created. The demand for new technologies is increasing, and pushes the demand for improving existing technologies, but the demand for old technologies is sharply decreasing, as the technologies themselves are being replaced by new technologies, and quite actively (Fig. 3). Therefore, $\frac{dv_1}{dt} > \frac{dv_3}{dt}$ and $\frac{dv_3}{dt} < 0$, $\frac{dv_1}{dt} > \frac{dv_2}{dt}$, and the demand for improvement may increase, but by a smaller amount. A very important condition of the technological bubble is that the change in demand for new technologies becomes a function of this change, that is, $\frac{dv_1}{dt} = f(\frac{dv_1}{dt})$. This cycle works not only until the displacement of all the technologies used that can be displaced (to zero, ideally), but also until the possibility of generating new technologies is exhausted, as long as $\frac{dv_1}{dt} = const$, or $\frac{dv_1}{dt} < 0$. If we replace the word "technology" with "knowledge", then the above arguments will be entirely true about knowledge. Moreover, technologies assume a certain material basis, knowledge is deprived of such a basis, although their creation requires funds [9].



If a technology bubble provokes a general crisis, it undoubtedly reduces the opportunities for technological development, at least for the period of overcoming the economic crisis and restoring the positions of companies.

The assessment of "knowledge economy" [10-11], which assumes taking into account the gross value added of sectors creating new knowledge (the science sector), replicating it (the education sector), and the IT sector generating and using the latest information technologies, can give a different value of this sector in the GDP of countries [10-11]. This situation is reflected in Table I, comparing the value of the "knowledge economy" of Russia and the EU by share and contribution to the dynamics of GDP.

As we can see from Table I, the "net assessment" gives more modest results of the "knowledge economy", especially for Russia, since activities that are not directly related to the creation and replication of knowledge as such are

TABLE I.KNOWLEDGE ECONOMY IN RUSSIA AND
THE EUROPEAN UNION, 2003-2017.

Countries	The averag share o knowledge in GDI	e annual f the economy P, %	Average annual contribution of the knowledge economy to GDP dynamics, %		
	Eurostat	author's method ology	Eurostat	author's methodo logy	
European Union	34.3	30.9	0.51	0.48	
Germany	33.4	32.5	0.39	0.49	
Spain	28.8	19.5	0.46	0.31	
Russia	30.3	12.3	1.02	0.48	

deducted from the account. If for the European Union these data are slightly lower – the share and contribution to the GDP dynamics of the "knowledge economy", then for Russia and Spain - significantly lower. In the Russian economy, the share of the "knowledge economy" increased from 11 to 14% in the period 2000-2018, however, at the same time, GDP per capita slowed down growth, that is, the development of the "knowledge economy" occurred in a passive mode, while slowing down overall growth, clearly not making the necessary contribution to it. This greatly distinguishes the development of the "knowledge economy" from the European one, when this sector determined growth more strongly. Let's find out the fundamental features of knowledge exchange in the economy of two agents in order to describe the influence of emerging regimes in the field of "knowledge economy" on technological development.

the impact of the emerging Thus, technological bubble becomes twofold are stimulating and inhibiting technological renewal, unambiguously participating in but the generation of the modern financial and economic crisis, both national and global. It arises in the field of new technologies of wide application or "end-to-end" technologies. The IT sector is a good platform for this. That is, technologies that have an infrastructural purpose, when a lot depends on them in related types of labor and production, determine the conditions of the emerging bubble and its consequences. Although potentially similar phenomena can be formed in other technological spheres.

IV. CONCLUSION

Summing up the research, we will formulate the main conclusions.

Firstly, the rules included in the technology itself, as well as in the organizational infrastructure, determine the dynamics of the technological bubble. It is strongly influenced by the state of the stock market, and the technological bubble in the classical interpretation is an overheating of the shares of technology companies, after which a collapse occurs. However, the financial content of the bubble in no way cancels its technological nature.

Secondly, existing institutions have a significant impact on the reproduction and dissemination of knowledge. The regime of knowledge exchange affects the growth of the

well-being of agents and the economy. The accumulated intellectual capital, expressed in the form copyright certificates, of patents, inventions, created utility models, perfect discoveries, developed techniques, formulas forms the basis for the application and generation of new knowledge. However, intellectual property, fixed in these institutions, ensures monopolism in the knowledge market and at the same time acts as an institutional restriction on the full exchange of knowledge. It is due to the presence of these institutions that a partial exchange of knowledge takes place, that is, a full exchange is an ideal construction, although in some cases it is possible.

Thus, in order to accelerate technological development, it is necessary to enrich the economy with knowledge that has its own application. Increasing the costs of knowledge sharing, replication and training will act in the direction of eliminating such acceleration. The general vector should be reduced to ensuring the completeness of exchange as the main condition for increasing the overall economic well-being, as well as to taking control of the formation and dynamics of technological bubbles, which requires not only technological means, but also financial control.

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Three Theories of Knowledge and Society

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Abstract—The paper examines three approaches to the information society and argues their differences are based on different definitions of knowledge. Daniel Bell's post-industrial society is the most well-known approach and it is focused of academic verified theoretical knowledge. Therefore, its influence is stronger in the realm of technologically manufacturing advanced industries. Manuel Castells' network society concept builds on Bell's definition but adds cultural aspects related to collective identities that abstract instrumentalism oppose the of contemporary digital economy that leads to global inequalities and insecurities. It focuses on global economic and political contradictions that lead to social crisis, democratic deficits and military conflicts. The knowledge society paradigm, related to Austrian School of Economics, has a very broad, even populist definition of knowledge as "what people believe they know". It is very useful in the case of media market, especially social media, where digital platforms business models are closely related to non-academic knowledge gathering and processing, called big data. The knowledge society paradigm, the paper argues, will be the most influential in the future, while Castells' network society concept needs to complete its critical framework.

Keywords – Post-industrial society, network society, knowledge society

I. INTRODUCTION

What is knowledge? And what about information? It seems like a lot of authors just skip these questions and assume everyone knows what they are talking about. In everyday life knowledge can assume many forms, but more importantly, it is considered in different ways by different scholars. We actually do not have a universal definition of knowledge because we do not know all that we know or what we can know. If we had a generally accepted concept of knowledge we would have only one perspective of the information society. Instead, we have many, and here three types of relationship between knowledge and society will be examined: Daniel Bell's post-industrial society, Manuel Castells' network society and Fritz Machlup and Peter Drucker's knowledge society.

They all focus on certain aspects of knowledge and consider other aspects as "notknowledge", with the exception of the latter, where knowledge is very broadly conceived and almost mystified. If knowledge is just academic, scientific, theoretical and verified knowledge, then knowledge related to one's ethnicity, race, gender or religion cannot be considered knowledge. Yet, we also talk about certain cultures that are more suitable for the "spirit of capitalism" and cultures that fail to be entrepreneurial. That would mean some cultures possess useful knowledge compatible with the global economy, while others contradict this economy. But why? And what kind of knowledge is embodied in these cultures? What is the relationship between knowledge and the market?

These questions are rarely answered. The three approaches described here will show the theoretical differences we face when we understand the notion of knowledge in different ways. Different understanding of knowledge leads to different focus on social transformations that information and technology bring to our contemporary world, and also accentuates different sectors of the society and their importance. Paradigms' attitudes towards modernity project will be demarcated, its relation to Enlightenment and scientific research as such, and the paper will examine possible consequences for our collective identities that are a part of our lives and help us to orient ourselves in the brave new world.

I. THE POST-INDUSTRIAL SOCIETY

The concept of post-industrial society was created by Daniel Bell. The central characteristic of post-industrial society was codification of theoretical knowledge and close relationship between science, technology and society. This approach is focused on established, proven knowledge and technological development. This knowledge is understood as "human capital" (education and skill), but also as "intellectual technology" needed for efficient machine use based on mathematical and linguistic principles [1]. Science is at the front of social change [2] and at the same time it is society's idealized image [1]. Science is a verified theoretical knowledge, it is more than mere information that is acquired and processed data. Knowledge is not just empirical but it has to provide an understanding of the purpose of certain actions. Therefore, it theoretically frames information and molds it into an expert judgment.

Theoretical knowledge is a strategic resource crucial for social development and economic growth. It orders the whole society that cannot maintain itself without social planning and significant change of the communication networks that now form an infrastructure of the post-industrial society [3]. The new society is chaotic and complex - it needs systematic knowledge in order to function and to be efficient. Scientific knowledge is central and it leads to the rise of service sector, the meritocracy of managerial class and further development of "intellectual technologies". Market economy is now impossible without information processing, and the management of the post-industrial society is based on the domination of scientific institutions and their "alchemical dream" of technological control [1].

Unlike the critical thinkers, Bell does not have a holistic perspective and sees the (techno-economic, subsystems of society political and cultural) as relatively autonomous. The post-industrial path is therefore focused on the use of information technology primarily in the techno-economic subsystem. Its contemporary representatives are primarily located within important global economic institutions and in charge of technological advancement on a planetary scale. Authors that we usually call futurists are most of the time postindustrial experts. Klaus Schwab, the founder of the World Economic Forum, claims we are on the verge of "The Fourth Industrial revolution", based on artificial intelligence, nanotechnology, genetic research and quantum computing. Along with the World Trade Organization these global institutions perceive digitalization as a necessary precondition for the functioning and advancement of world market and financial sector.

Schwab forecasts three major "megatrends": physical, digital and biological [4]. The physical domain is related to the production of autonomous vehicles and 3D printing in automobile, aircraft and medical industry (clothes and body implants). Robotics connect physical and digital megatrends because it is used both in the industry and in everyday life, where the Internet of Things (IoT) and digital assistants will lead to the phenomenon of house robots in the future. Schwab maintains that the year 2025. will mark the first billion sensors connected online, that 10% of humankind will wear IoT related clothes, and 90% of people on Earth will have access to the Internet. Platform economy, based on software linking of demand and supply, such as Uber or Airbnb, will become even more important and present in many areas of our lives.

Schwab believes that Covid19 pandemics would even accelerate the innovation process because technology will provide solutions for many problems. People will spend more time at home, they will work, eat and entertain themselves within a household, so we can expect that in the year 2035. jobs in the entertainment industry will be 59% automated [5]. Everything will work online, it will be digitalized, automated and surveilled. E-consumer will be a home consumer, and companies from many economic sector will have to adjust to the digital changes accelerated by Covid19 virus. We can expect more digital transparency, more data about human behavior, and more micro-targeting marketing campaigns on digital platforms. Biological megatrends will further the interconnectedness of human bodies, with technological implants for monitoring, tracking and/or recovery, along with tattoos that unlock cars and smartphones built into human tissue.

The idea of post-industrial society suggests and promises a Fourth industrial revolution and

acceleration in many private aspects of human lives, and almost incomprehensible progress within economy as such. World Trade Organization's prognosis is less radical and optimistic than Schwab's, but nevertheless examines the infiltration of digital technology in the lives of users worldwide [6]. According to the WTO analysts the most lucrative and advanced areas of post-industrial economy will be: big data, cloud computing and API (application programming interface). Internet of Things and artificial intelligence are also expected to be very profitable sectors but with many challenges ahead. This is sort of a gap in the post-industrial society concept. It can acquire enormous amount of data and IoT would introduce even more data. The cloud infrastructure would store and process this data. But the weak part seems to be the implementation of artificial intelligence. The question whether AI can be based of scientific verified knowledge and really represent completely superior simulated intelligence that could precisely analyze the big data is still open.

II. THE NETWORK SOCIETY

Manuel Castells has, according to Frank Webster, offered the most convincing theory of the information society today [7]. That does not mean that the concept of the network society is radically different than other approaches. It builds on the idea of post-industrial society and applies a certain critical perspective of the social structure. When it comes to the definitions of knowledge and information, Castells relies on Daniel Bell and considers Fritz Machlup's understanding of knowledge that is the basis of the third theory of knowledge and society in this paper, as to broad. Information is therefore organized and communicated data. and knowledge is a rational judgment of this data or the new ideas [8]. Informationalism is a mode of development of contemporary societies where knowledge refers to knowledge, knowledge acts on knowledge, unlike the industrial era that was based on acquiring and processing of natural raw materials.

What is essential in Castells' theory is the concept of network, which is related to the process of globalization as interconnectedness or networking of economic, political and social actors on a planetary scale. Network society encompasses the whole Earth and many countries, so that one corporation can have headquarters, production and distribution on three different continents, and can control the whole process in the real unit of time, thanks to the information technology and Internet. The metaphor of network is helpful to understand the power formations that connect political, socioeconomic and media field, how these relationships are "switched" or "reprogrammed", where some actors' power can be understood through the importance of the "knot" position they have within the network [9]. Now that information, knowledge, wealth and power are networked and beyond the nation state control, the new society on the rise is stranger than Daniel Bell could imagine.

The fundamental difference between Bell and Castells is the holistic perspective. For Bell social subsystems are differentiated and relatively autonomous, so that they function according to their specific principles [1]. Even though Bell argues about "cultural contradictions of capitalism", culture and capitalism are still seen as two largely independent subsystems. Bell was concerned with their mutual tension, the "radical I" of the counterculture in collision with the protestant working ethics and capitalist social structure, but Bell did not know whether the tension will become a deeper conflict or it will be technocratically resolved. The post-industrial society was primarily an economy and not culture. Manuel Castells assumed the sociological model of conflict in his research and proposed a critical view of the network contradictions within the new type of society.

The fundamental contradiction of the network society is between abstract universal instrumentalism of the informationalist global network economy, on the one hand, and collective identities rooted in history of present societies (ethnicity, religion primarily, but gender and environment too) [10]. In a word, network society is split between informationalist and social networks, communities and other older forms of social organization [10]. The conflict is an asymmetric power struggle because informationalist networks are backed by economic, political and military power holders, while particular cultural and historical identities rely only on the civil society's infrastructure that depends on informationalist networks as well.

In the Western Civilization the fundamental split can be registered on three levels: a) struggles between communication power and the power of identity; b) tension between mass selfcommunication and digital hypertext; c) and between culture of real virtuality and the public mind. The levels are not clearly differentiated but there is a complex interplay between them. For example, the phenomenon of populism is not just related to the social networks based on the power of historical identities against communication power. It can be seen as a mass selfcommunication formation positioned against digital hypertext power of platform algorithms and big data corporations, but also vice-versa as a top-down phenomenon created and steered bv informationalist networks. Therefore populism can be both a sincere citizen protest against the network society, but also the network society's product itself, constructed through media manipulation. What form it takes depends on social context.

Castells is concerned with meaning that people are looking to find in a society and base their identity on. Identities can be legitimizing, supportive of the existing society, very often clearly nation state oriented identities. They can also be resistance identities like populists or migrants and minorities in general. The new type, project identities, are critical of main features of the network society, that is, project identities are opposed to productivism and patriarchalism. Environmentalist and feminist movements are contemporary social movements that are opposed to these principles of capitalism and men-dominated society. Resistance and project identities position themselves against the communication power of the dominant structures of the society that is supported by legitimizing identity. So called "Twitter Revolutions" are clear examples of these contradictions, but also the region of former Yugoslavia, where we have interesting developments when it comes to religious movements such as in Montenegro or civil society in Serbia.

The second level of Castells' analytical framework is important for the examination of digital platforms. Mass self-communication is a new, hybrid phenomenon, because it forges older communication practices into one: interpersonal and mass communication [9]. Mass selfcommunication targets mass audience just like the old mass media. But it is also selfcommunication because there can be no organization behind the new communicator: e.g. Youtuber does not need newsrooms and producers nor significant infrastructure in order to communicate on a mass scale. The central change is that the audience becomes an active creator of media content and a consumer of user generated content at the same time. Media

corporations such as "Meta" have to produce the infrastructure for the amateur information flows, there is no need to produce the information themselves.

Castells is optimistic about the use of mass self-communication by alternative social actors, particularly ones led by project identities such as feminist or ecological, but nevertheless we have to pay attention to the power of digital technology to process data and control the population that is active on the social media. This is one of the weak spots of Castells' theory that should be further examined. It remains an open question whether the technology or ideology are decisive factors in political and social change today. Are algorithms, big data and digital analytics more important in contemporary political campaigns than old reformist or revolutionary narratives? Castells remains a firm believer in people's search for meaning and against technological solutions and statistics.

The least developed analytical level of Castells' theory focuses on the tension between culture of real virtuality and the public mind. Real virtuality is basically an integration of all human knowledge production within a virtual world of digital networks [8]. It is larger than big data because it forms the symbolic culture individuals around the world rely on in their everyday lives. This knowledge is not just amateur and ordinary but can also be fundamentalist, extremist, pornographic or just eccentric. It embodies the popular culture of the Internet era, the contradictions that we all live in simultaneously, but we do not know what will be its final form. We can speculate that real virtuality will be controlled by big data processing, algorithms and platform protocols, but Castells' theory is more suitable for the usual social science research and less applicable to the analysis of the role of digital technology as such within the network society. Nevertheless, it is more compatible with techno-centric approaches, like Bruno Latour's ANT (actornetwork) theory, and those theoretical combinations can be interesting [11].

III. THE KNOWLEDGE SOCIETY

Paradoxically, the knowledge society paradigm is the most obscure and the most popular at the same time. It is assumed knowledge society and post-industrial society are very similar, but actually their differences are crucial. The concept stems from Fritz Machlup's idea of knowledge industry and Peter Drucker's

concept of the knowledge worker. Both authors come from the Austro-Hungarian Empire and are part of the Austrian School of economics. Knowledge here is not defined ad verified academic knowledge, and scientific truth is not considered the only "truth". Actually, according to Machlup, scientific knowledge represents only 10% of all knowledge [12]. Before the so-called post-truth era, the Habsburg intellectuals called for the postmodern turn by rejecting Socratic and modern position of knowledge synthesis and Enlightenment [13]. Knowledge is now not understood as expertise nor as something through disciplined educational acquired process. The usual educational institutions could even be counterproductive. Knowledge has to be economically functional and its worth is based on application of that knowledge. Knowledge is not impersonal but embodied within specific people and it is always personal knowledge. Actually, knowledge is plural and there is no Queen of knowledge [14]. Nobody has the monopoly or authority in the realm of knowledge. The knowledge society relies on many forms of knowledge, even irrational, emotional, religious or superstitious.

Fritz Machlup defined knowledge as everything that people think they know [12]. He explicitly mentions alternative medicine or biased and discriminatory knowledge as knowledge that should not be judged but seen as any other thing that has its consumers. Even though we can consider this knowledge as "negative", may it be explosive or inflammatory, if it does not threaten the social order we can maintain it is a kind of knowledge. If someone find its use, and the buyers of this knowledge, than is as worthy as academic knowledge. Unlike Daniel Bell. that strictly differentiates information from knowledge, for Machlup those are synonyms and it is a waste of time to pay attention to the differences. The most important knowledge after all is "everyday knowledge of the common people" [12]. Knowledge is everything that changes existing things and people, influences future behavior or steers individuals to act and be more efficient [15]. This knowledge is far away from scientific verified knowledge and it a useful tool; not an encyclopedia that is a sum of expert knowledge.

Actually, what we do not know can be more important, because according to Peter Drucker's managerial vision every innovation is a jump into the unknown [16]. The paradigm of knowledge society assumes that different personal, ephemeral and local knowledge can be more decisive for the functioning of society than science. For Machlup knowledge can also be the knowledge of good jokes, the art of chatting, to have fun, the knowledge of saving your soul-Furthermore, knowledge accidentally picked-up here and there, like knowledge gathered through the media content consumption or in everyday life, can be useful and more profitable than expert knowledge [12]. While science has rigorous methods in order to create systematic intellectual knowledge (for the post-industrial society), what is needed for social progress for Peter Drucker is organization of our "ignorance"[16]. The final worth of this knowledge is not what can be known but who knows it, why or what for, on the market [12]. This subjectivist perspective clearly sees people as limited, bounded in their mental capacities, but their particular knowledge should be organized so that we can efficiently resolve social problems and evolve further.

Knowledge is never concentrated and integrated within something like an encyclopedia but dispersed all over society, so that different knowledge can even contradict each other with that little truth beliefs [17]. Examples are obvious when it comes to today's problems of populism or loss of trust in science. If there is no undisputed scientific truth, if its power is gone, then this academic knowledge is just "so-called" for Fritz Machlup [12]. The knowledge of antivaxxers or FlatEarthers is just as useful and equal to others within the knowledge society paradigm, if its market value is considerable. The knowledge society is postmodernist because it opposes directly to the Cartesian worldview, the universal language of truth and quantitative logic [16]. While Daniel Bell rejected these "street smarts" tendencies in favor of institutionalized education [2], Machlup and Drucker maintain this will not be crucial for the future society.

of digital The case platforms is representative. There is a cult of the amateur, the ideas of smart mobs or wisdom of the crowds. All forms of collective intelligence that can be constructed by organizing many people's limited and decentralized knowledge is welcome. For example, Wikipedia's founder Jimmy Wales said he was influenced by Friedrich Hayek, a member of the Austrian School, when he created Wikipedia. It is not a classical encyclopedia because it is not created by an organized group of experts, nor the producers of Wikipedia are working within a centralized institution and produce the sum of scientific knowledge - that is a collectivist, even socialist or totalitarian approach of French Enlightenment, that is now rejected by neoliberals of the knowledge society [18]. Wikipedia is a product of collaboration of the multitude and there is no command economy behind their spontaneously formed knowledge. The online encyclopedia is non-profit, unlike other platforms, but its mode of production is based on the market economy's organization of knowledge [19].

Everyday knowledge of the common people was relevant even in the era of television, so Machlup was interested in emotions and mental conditions of people, or their focus on ephemeral and not that important information in the form of entertainment. Machlup maintained all that knowledge has market value and the industry should pay attention and support it. His followers are certainly the majority in today's digital economy, and every popular digital platform sticks to the Machlup's definition of knowledge. Information flows on the social media are rarely professionally produced or related to scientific truth. There are no classic media narratives, no objective reporting, and no cultural or educational programs. In a word: today's platforms do not produce content (users do) but infrastructure for the traffic of that content. But the content is the source of profit.

IV. CONCLUDING DISCUSSION

We can compare Machlup's knowledge society with post-industrial notion of information. Klaus Schwab and WTO are interested in the usual data about e.g. automobile functioning, speed, fuel consumption and other technical characteristics related to the Fourth industrial revolution. For a knowledge society paradigm it is more important how the person drove the car, did she have unpredictable moves, what was her emotional and mental state, did she speak and how she said it, with what intentions etz. Bell's post-industrialists are more interested in objective data about people and machines. Machlup's neoliberals are focused on psychological traits (Ludwig von Mises), human tastes and habits (like Nobel Laureate Gary Becker), fears, hopes and wishes. Shoshana Zuboff thinks that prediction and modification of people's behavior based on psychological profiles of platform's users, constructed by digital analytics of their data bases, is the new industry of surveillance capitalism [20]. In a knowledge society, intimate information will become more relevant and experiments with personalization and customization more prominent, according to Google's economist Hal Varian [21]. More research on the neoliberal economic and social thought is therefore needed.

Comparison with Castells' network society can also uncover the power of the knowledge society paradigm. While Castells maintains that collective identities righteously resists and oppose the elites of the network society, that is now in crisis, he misses the aspect of populist projects that break away from modernist perspective, challenge scientific verified truth, produce many conspiracy theories, and most importantly, can also be produced and manipulated by elites themselves. Castells' view that those are mainly grass-roots movements created spontaneously, and not "astroturfed", algorithmically molded, anti-Enlightenment groups, objects of digital analytics of psychological human condition, manipulated through the lack of knowledge and post-truth, should be reconsidered. The paradigm of knowledge society and its neoliberal core is based on a very controversial understanding of knowledge that is populist as such, and can become a source or many problems in the days to come.

Of course, in reality, neither of the three theories completely reigns. Post-industrial society paradigm dominates the manufacturing sector and it is hard to use other paradigms in that realm, although Castells' critical view can be helpful when it comes to analysis of global inequalities and injustices. The network society approach can be fruitful in the political realm, especially questions of democracy and social movements and all other questions related to defending our life worlds and human condition as such, our identities. It is the least technical and more oriented towards cultural traditions and new projects such as feminist and ecological. The knowledge society paradigm remains firmly rooted in human, all too human weaknesses. Although some acknowledgement of human interest in the ephemeral, local and particular, and less in academic and intellectual knowledge, a good correction of post-industrial is understanding of contemporary society, this new neoliberal view of global economy and society seems to bring even more contradictions, many of which are related to too broad, even controversial definition of knowledge that is too personal, too subjective, too limited, and subsequently - problematic.

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Application of Machine Learning in Investment Portfolio Structuring

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Abstract—This paper analyzes the application of Machine Learning (ML) in developed financial sectors and its role as a valuable tool for investors in the decision-making process of structuring an optimal investment portfolio. Investors and financial institutions are increasingly recognizing the substantial growth of ML implementation in nearly all financial industry sectors in recent vears. ML utilizes mathematical data models and algorithms to enable computers to learn patterns from financial markets. These algorithms analyze real-time market data and provide investment recommendations to help investors construct an optimal investment portfolio based on their return objectives, risk profile, and any personal constraints. The analysis aims to determine whether ML can serve as a solid foundation for such investment decisions or whether further refinement is needed as these investment tools continue to evolve with new informational technology.

Keywords – Machine Learning (ML), investors' decision-making, investment portfolio

I. INTRODUCTION

When analysing the role of Machine Learning (ML) in the financial sector, it becomes evident that this industry continually seeks innovative operational solutions to maximize returns for investors and manage financial risks effectively. ML, in conjunction with other emerging technologies within the blockchain framework, has the potential to revolutionize the structuring of diversified investment portfolios. Today, thanks to ML's capabilities, it is possible to analyse vast amounts of data in real-time, uncover hidden market patterns, and generate valuable predictions and extrapolations regarding future financial trends. These insights are of utmost importance to investors seeking to optimize their investment strategies, mitigate uncertainty, and make data-driven investment decisions.

New informational technologies incorporate ML and deep learning, enabling software solutions to conduct predictive analysis when constructing an optimal investment portfolio. This approach aims to enhance investment outcomes by ensuring the portfolio remains adaptable to evolving market conditions.

This paper delves into the implementation of ML in the construction of diversified investment portfolios, elucidating the core concepts underlying these informational solutions. It explores various strategies and combinations of informational tools to showcase how ML can assist investors in identifying opportunities, managing financial risks, and achieving their financial objectives more effectively than traditional methods.

The paper presents real-case scenarios illustrating the benefits of incorporating ML in portfolio management. essence. In it demonstrates that informational new technologies represent the future of finance, with ML-based models emerging as reliable instruments for addressing the complexities of modern financial markets. What was once considered unattainable is now within reach, allowing for the creation of precise and accurate financial models. The paper has three sections two subsections and a conclusion remark at the end. Section II presents a literature review with the latest scientific data related to ML and measuring main financial risks which is the most important part of the process of structuring an optimal investment portfolio. Section III discussed the set-up of an optimal investment portfolio model which is based application of the ML algorithm through two regression models such as linear regressing and one nonlinear model such as K-nearest neighbors. Related to these two regression models' section III is divided into two subsections the first subsection explains linear regression and the second nonlinear regression model. Based on the findings in this paper section IV is the conclusion remarks and remarks for the further scientific development field of ML.

II. LITERATURE REVIEW

ML is a widely adopted informational methodology in various industrial sectors, which uses mathematical algorithms together with artificial intelligence techniques to develop AI applications. The financial sector leading the way in its usage and implementation of these AIbased applications. The financial sector's prominence in adopting ML is attributed to the complexity of analysing vast amounts of data for predictions, probability assessments, and extrapolations in constructing robust and precise financial models. The integration of advanced ML in finance has been propelled by the increasing availability of data and computational power.

In addition to the factors mentioned above, ML enables the transformation of different market scenarios, encompassing risk management, trading activities, fraud detection, portfolio management, and a wide range of customer-oriented services.

In this paper, it's analyzed how ML can be applied in various financial sectors across all the mentioned fields of application [1]. First, ML can be applied in the process of algorithmic trading. Algorithmic trading analyses large datasets to detect market patterns and executes trade activities with high speed and improved accuracy. ML can be particularly valuable in high-frequency trading, potentially enabling the generation of trading patterns. In his study, author [1] emphasized the importance of methodology in implementing ML, particularly the context of data pre-processing, in encompassing data cleaning and feature engineering in financial ML. Machines can be programmed to adhere to regulatory standards, which makes them a dependable choice. Both individual and corporate investors find it more feasible to enhance an algorithmic investment process compared to one relying on human decision-making, which can be influenced by subjective judgments.

The second significant area where ML finds application in the financial sector is in the development of risk management models. ML stands out as a technology with significant implications for risk management. When combined with artificial intelligence (AI), ML enables the creation of more precise risk models that can analyze complex nonlinear patterns within extensive datasets. Such risk management models contribute to establishing a more stable and accurate assessment of credit portfolios.

The primary risks that financial institutions face encompass interest rate risk, market risk, credit risk, off-balance-sheet risk, operational risk, foreign exchange risk, country risk, liquidity risk, and insolvency risk [2].

The primary risk in banking and financial institutions remains credit risk, and all participants in the financial market strive to minimize this type of risk in their investment activities. In light of the aforementioned risk, the key activities of financial market participants in any financial system involve compliance with domestic and international regulatory standards [3]. ML can be used to develop an internal rating-based credit risk model, as proposed by the Basel Committee on Banking Supervision [4]. ML computes client clusters with different internal rating scores based on the current credit portfolio of financial institutions. Using these clusters, it can predict and analyze potential scenarios that could significantly affect the capital requirements of banks or financial institutions. In addition to regulatory capital requirements, many major players in financial markets also calculate economic capital [5]. Economic capital is directly associated with the expectations generated by the internal rating system.

The off-balance-sheet risk, also known as uncovered risk, can substantially increase the expenditures any capital of financial institution [6]. Due to the substantial risk and cost pressures associated with this specific risk, ML can be used to proactively measure and calculate all potential future costs. In real-time, ML can calculate all costs related to specific clients or groups of clients (at the syndicate level of credit exposure). Utilizing the proposed financial model implemented within an internal rating-based credit risk system, ML will

compute costs associated with both on-balance and off-balance financial institution activities.

After considering the previously mentioned financial risks, operational risk has gained more attention in everyday financial activities and has become a more significant type of risk. The Basel Committee on Banking Supervision (BCBS) defines operational risk in Basel II [7-8] and Basel III [9-12]. The BCBS defines operational risk as losses resulting from inadequate or failed internal processes, people, systems, or external events. New informational technologies in the financial sector, based on ML, AI, and blockchain methodologies, can enhance the resilience of financial institutions against various losses associated with operational risk. Implementation of CMR Management) (Credit Risk [13], secure communication and transaction methods based on blockchain technology [14-15], and the utilization of AI in credit risk scoring can significantly mitigate operational risk at the operational level of any financial institution.

When analyzing the financial market, it is important to pay attention to market risk, which can be defined as losses experienced by individuals or institutions due to factors that affect the overall performance of investments [16]. Market risk cannot be eliminated through diversification. This is because market risk is associated with systematic risk, which can manifest at the level of the entire investment portfolio and reflect the cyclical economic trends of certain financial markets or national economies [17].

To reduce the level of market risk, various financial institutions can employ ML to predict cyclical economic trends and avoid negative economic downturns. Interestingly, what might be considered negative economic trends from one perspective can be seen as positive for investors. Investors consistently seek to predict trading outcomes for various financial instruments. identifying overvalued and undervalued assets in the financial market. They aim to diversify their investment portfolio to maximize profits or minimize losses and risk exposure.

This paper will analyze an economic model based on regression analysis supported by an ML algorithm, through which individual or institutional investors can extrapolate cyclical economic trends in a financial market. Employing the ML process in economic analysis can assist investors in the decision-making constructing optimal process when an portfolio, relying investment on market analyses, probability predictions, regression extrapolation, and cyclical economic trends across various economic periods. By utilizing the proposed ML algorithm, investors can enhance the quality of their investment portfolio and make better investment decisions over time.

III. SET UP AN OPTIMAL INVESTMENT PORTFOLIO

The optimal investment portfolio represents a portfolio with the lowest level of all financial risks that individual and institutional investors may face. When considering the creation of an investment portfolio, it's important to note that investors differ in their willingness to take on risk. One group of investors consists of traditional investors who are not inclined to take significant risks in their investment decisions. On the other hand, there is another group of investors in the financial market with the opposite approach; they are willing to take higher risks. Due to their higher risk tolerance, this group of investors, with a greater appetite for risk, can anticipate higher profits from their investment strategies. Investors aim to achieve portfolio diversification. When two investors with different amounts of funds for investment are willing to enter the market, we encounter a situation known as an 'investors' dilemma.

For example, if one investor is willing to invest 10,000 EUR in a financial asset and another is willing to invest 100,000 EUR in the same financial market, their actions appear similar. Even though these investors engage in similar investment activities, they are exposed to the same level of market risk. However, because one of the investors has a higher risk appetite and is willing to allocate a larger amount of money, in the event of a positive investment outcome, that investor can anticipate a higher profit. In this scenario, we encounter the same situation where a higher return on investment is associated with greater risk exposure in investment activities, highlighting the difference between traditional investors and those with a higher risk appetite.

Both individual and institutional investors can implement ML to enhance their investment decisions and create an optimal investment portfolio, addressing the aforementioned investors' dilemma. This paper will primarily concentrate on one of the statistical models that investors can employ to forecast future cyclical economic trends. The most commonly used statistical model is based on regression analysis.

Seven algorithms can be employed when establishing an economic model for regression analysis using ML. The first four are linear ML algorithms, including linear regression, Ridge regression, LASSO linear regression, and Elastic linear regression. The remaining three are Nonlinear ML algorithms, which encompass K-Nearest Neighbors (KNN), Classification and Regression Trees, and Support Vector Machines (SVM). It is important to mention that KNN and SVM are generally classification algorithms. In this paper, we use KNN as a regression model.

Due to the complexity of each of the mentioned regression models, this paper will primarily focus on linear regression supported by ML and one of the nonlinear ML algorithms such as.

A. Implementing Linear Regression Algorithm

Linear regression in ML analysis plays a crucial role in assessing and processing vast datasets to determine definitive relationships between two or more variables. Regression analysis illustrates how the dependent variable changes as the independent variable takes on different values. The most significant advantage of ML in regression analysis arises when we need to process extensive databases and seek relationships between variables that would be challenging to analyze manually. Linear regression can be expressed as follows:

$$y = \beta_0 + \beta_1 x + \varepsilon, \qquad (1)$$

where *y* represents the dependent variable, *x* is the independent variable, β_0 is the intercept of the line, β_1 is the linear regression coefficient (slope of the line), and ε represents the random error. Random error is necessary because the best-fit line doesn't perfectly include all the data points.

To achieve the best regression prediction, the ML algorithm aims to minimize the value of the cost function and reach its minimum. This can be expressed as:

$$J = \min \frac{1}{n} \sum_{i=1}^{n} (pred_i - y_i)^2 , \qquad (2)$$

where J is the cost function, n number of observations (i=1,...,n), Σ summation, $pred_i$ predicted output and y_i actual value. The difference in errors is squared for each value. These squared values are then averaged to obtain the sum of squares of errors, which constitutes the cost function.

Another important statistical technique in linear regression is known as gradient descent. In the ML algorithm, gradient descent serves as an optimization approach to reduce errors between actual and predicted outcomes. The optimization task for the ML algorithm is to minimize the previously explained cost function. Gradient descent is applied to minimize the convex function associated with variable iterations.

In Fig. 1, three learning curve rate scenarios are presented. The first diagram illustrates a slower learning rate, at which the model can reach a global minimum, although it is timeconsuming and demands significant computational power. The second diagram depicts a faster learning rate, in which the model may wander and end up in an undesired position, failing to achieve the global minimum. Therefore, the optimal scenario lies somewhere between these two learning rate scenarios, where the ML algorithm aids investors in reaching a global minimum.

Using ML in regression estimation of the variables with given distribution it is necessary to compute the probability of all samples in the dataset D, such as x and y. Estimation can be expressed as:

$$L(D, w, \sigma) = \prod_{i=1}^{n} p(y_i | x_i, w, \sigma).$$
(3)



From (3) we should find the optimal set of parameters. To find the optimal set of parameters we need to optimize w. Optimization of w could be set up as (4):

$$w^* = \arg \max \prod_{i=1}^n p(y_i | x_i, w, \sigma).$$
 (4)

If logarithm (4) we can get the following equation which is related to the optimization of w:

$$w^{*} = \sum_{i=1}^{n} \log p(y_{i} | x_{i}, w, \sigma) =$$

=
$$\sum_{i=1}^{n} \left\{ -\frac{1}{2\sigma^{2}} (y_{i} - f(x_{i}, w))^{2} - x(\sigma) \right\}.$$
 (5)
=
$$-\frac{1}{2\sigma^{2}} \sum_{i=1}^{n} (y_{i} - f(x_{i}, w))^{2} - C(\sigma)$$

In addition to the linear regression model, it is important to emphasize the advantages and disadvantages of the linear regression statistical model. The first advantage of linear regression is its ability to produce precise results when dealing with linear datasets, enabling the accurate determination of relationships between different model variables. The second advantage is the ease of implementing linear regression algorithms into ML.

An important disadvantage of linear regression algorithms is their assumption of linearity between variables, which is rarely seen in reality. The second disadvantage of the model is related to overfitting, where the algorithm begins to incorporate noise while constructing the model. Additionally, the model does not account for multicollinearity, which is crucial when dealing with real market data and their impacts on a set of dependent variables.

B. Implementing a Nonlinear Regression Algorithm

When we analyze the nonlinear models which use the ML algorithm in this paper is presented KNN regression. KNN regression is a nonparametric method that approximates the association between independent variables and the continuous outcome by averaging the observations in the same neighborhood [18-19]. The size of the neighbors needs to be chosen using cross-validation to select the size that minimizes the mean squared error. This



regression model could be impractical when dimensions increase. It happens when there are many independent variables.

In Fig. 2, it is explained how the KNN regression model works. We can find a regression which indicates a linear relationship between the dependent variables on the y-axis and the independent variables on the x-axis. The correlation is established by analyzing the data pattern formed by the line that is plotted closest to the data points in a regression graph. In the KNN regression model when we know what is an example to measure then all data which are closest to the measuring example will be taken in observation. In our graph, is all data in the circle in the middle of the graph.

The KNN regression algorithm in ML is used to identify the nearest neighbors of a given query point. So, to accomplish this task we should measure the distance between query points and the other data points. In the calculation of these distances, we can use a few methodologies such as Euclidean distance, Manhattan distance, Minkowski distance and Hamming distance.

Euclidean distance is the most commonly used distance measure and can be expressed as follows:

$$d(x, y) = \sqrt{\sum_{i=1}^{n} (y_i - x_i)^2}.$$
 (6)

The next distance measure methodology is the Manhattan distance it measures the absolute value between two points and can be present in (7):

$$d(x, y) = \sum_{i=1}^{n} |x_i - y_i|.$$
 (7)

The third distance measure methodology in the KNN model is the Minkowski distance. This

distance measure methodology can be expressed as:

$$d(x, y) = \left(\sum_{i=1}^{n} \left| x_i - y_i \right| \right)^{\frac{1}{p}}.$$
 (8)

The last distance measure methodology is the Hamming distance. Hamming distance is used for Boolean or string vectors identifying the points where the vectors do not match. The equation for this distance methodology is:

$$d(x, y) = \left(\sum_{i=1}^{k} |x_i - y_i|\right)$$

$$x = y; \quad D = 0 \qquad . \tag{9}$$

$$x \neq y; \quad D \neq 1$$

We can conclude that the KNN regression algorithm can be useful when there is no clear underlying data distribution.

The second conclusion from the KNN regression algorithm is that the performance of this nonlinear model depends on the choice of k as several neighbors and the distance metrics used. A smaller number of k can result in a more flexible and noisier model, while a larger value of k can lead to a smoother decision but may miss local patterns. As well, KNN regression as a nonlinear model strongly depends on data pre-processing. The scaling and normalization are necessary because KNN regression relies on distances between data points. The strength of KNN regression is its interpretability. It can provide insights into the data by showing which features or attributes are most influential in determining the class of value of a given data point.

The one of disadvantages of the KNN regression algorithm is computational complexity. The KNN regression can be computationally expensive, especially with large datasets. If the training datasets grow, the time required to make predictions decreases linearly. The second disadvantage of the KNN regression in high dimensional spaces, the algorithm can suffer from the curse of dimensionality, where distances between points lose their meaning as data points become increasingly sparse.

The KNN regression model in the finance sector can be used in different approximation and estimation cases. In the banking sector, KNN regression helps assess and estimate risk exposure for credit portfolio data. This model can be applicable to determine a loan applicant's creditworthiness for corporate or individual ones [20]. Also, the KNN regression can be used in stock market forecasting, currency exchange rates, trading futures and money laundering analyses [21]. The wide presence of the KNN regression nonlinear model in the current financial sector services can be solid ground for further improvement using ML methodology.

In conclusion, combining KNN regression with other ML algorithms in ensemble methods like bagging, also known as bootstrap aggregation, which is commonly used to reduce variance within a noisy dataset, or boosting, as an ensemble meta-algorithm for primarily reducing bias and variance [22]. Using the boosting in ML algorithm users can convert weak learners to strong ones. The previous two ensemble methods can often lead to improved predictive performance for the finance sector as a whole.

IV. CONCLUSIONS

The application of ML, especially the implementation of linear regression and nonlinear regression algorithms, in structuring an optimal investment portfolio represents a significant advancement in the field of finance and investment management. ML empowers individual and institutional investors, including portfolio managers, to make more informed and data-driven decisions that are more accurate and precise than ever before. ML algorithms can analyze historical market data and identify patterns from large datasets. On the other hand, the implementation of linear and nonlinear regression algorithms within ML can provide valuable insights into asset performance. In the linear regression models ML algorithm can improve test outcomes and save a lot of time in the process of measuring the correlation between dependent and independent variables.

Linear regression models can assist in assessing and quantifying the risk associated with various assets within an investment portfolio. By comprehending how changes in the performance of one asset can impact others, investors can efficiently diversify their investment portfolios, structure an optimal investment portfolio, and mitigate risk. Additionally, through the implementation of linear regression, investors can optimize their portfolios by identifying the optimal combination of assets to maximize returns while minimizing risk.

Its adaptability is the most significant advantage of implementing ML in structuring an optimal investment portfolio. ML models are flexible and continually learn from new datasets, a crucial feature for their integration into financial institutions, given the dynamic nature of financial markets. The algorithms employed by ML rely on quantitative analysis rather than human intuition, reducing the influence of subjective judgment to a minimum. In contrast, linear regression algorithms can aid in reducing bias in investment decision-making, resulting in more objective and consistent outcomes over time.

On the other side, the KNN regression algorithm is a versatile and interpretable ML model that can produce the requested results in structuring an optimal investment portfolio if we use suitable datasets. KNN regression models in ML are susceptible to overfitting (small k) and underfitting (large k). In structuring an optimal investment portfolio, cross-validation and learning curves are useful tools to diagnose and mitigate these issues.

Various studies have demonstrated that MLdriven investment portfolios, including those employing linear regression, have the potential to outperform traditional structured portfolios due to their ability to make decisions using large datasets, a capability that was not previously feasible.

However, ML is not a flawless financial solution. ML algorithms heavily rely on data quality, and overfitting can occur. Therefore, models led by ML should be continuously monitored and refined. Careful consideration is necessary to manage certain current issues when deciding to implement ML in investment strategies.

In summary, the integration of linear and nonlinear regression algorithms into investment portfolio structuring offers a promising solution for investors seeking to optimize their returns and effectively manage risk. By harnessing the power of data-driven decisions and the implementation of quantitative analysis models, investors can improve their decision-making processes and adapt swiftly to the complexities of financial markets. Nevertheless, it is crucial to approach this technology with care, recognizing its limitations and emphasizing the importance of continuous monitoring and refinement to ensure its effectiveness in the ever-changing investment landscape.

In real-time financial decision-making, ML can be structured as a complex solution utilizing various mathematical and statistical models, including linear and nonlinear regression models and other econometrics techniques. It is only through the integration of these diverse models that ML can learn from previous iterations, process large datasets, and improve its accuracy with each new investment decision and computational result over time. This opens up opportunities for further scientific insights in developing optimal financial solutions in the future.

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Risks of Consumer Behavior Changes: Reflecting on the COVID-19 Pandemic Changes

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Abstract—The most of the authorities have already declared the COVID-19 pandemic concluded. However, the impacts of the pandemic are still present in many aspects of lives in societies, especially the business environment. The aim of this research was to point out the major risks that had occurred during the COVID-19 pandemic in consumer behavior and their influences that may still pose a significant deciding factor for managers. This research was based on a survey conducted on a representative sample of Slovak consumers during the period 2021 – 2023. The results present a clear picture of main threats and also opportunities that the pandemic created.

Keywords - Consumer behavior, pandemic, risks

I. INTRODUCTION

Consumer behavior can change for various reasons, including shifts in societal, economic, technological, and cultural factors. During the recent years the most common drivers of consumer behavior changes were related to impacts of the COVID-19 pandemic on societies. Events like the COVID-19 pandemic have a profound impact on consumer behavior [1-3]. Lockdowns and health concerns led to increased online shopping, remote work, and changes in leisure activities.

Government regulations, such as restrictions on marketing certain products, can affect consumer choices under normal conditions. However, during the COVID-19 pandemic the restrictions forced both consumers and sellers to seek new ways of shopping that have significantly influenced consumption patterns [4,5].Convenience and accessibility have grown in significance since consumers sought convenience, feeling of safety and ease of access. Services like food delivery apps and subscription boxes have gained popularity due to their convenience especially during lockdowns [6,7].

The pandemic years were also the time of rapid development of technology which can significantly alter consumer behavior. For example. the widespread adoption of smartphones has led to increased online shopping, mobile payments, and a preference for digital content consumption. COVID-19 pandemic significantly altered the economic conditions of households and whole economies. Economic factors such as inflation, unemployment, and changes in disposable income can influence consumer spending habits. During economic downturn that occurred as a result of halting activities during the pandemic, consumers became more price-sensitive and prioritize essential purchases over discretionary spending. Cultural shifts and evolving societal norms also impacted consumer preferences. Consumers have recently become more aware of environmental changes in terms of planetary boundaries and therefore, they changed their behavior in response to changing attitudes toward health, sustainability, diversity, and other cultural values. Growing awareness of environmental issues has led many consumers to now prioritize eco-friendly products and sustainable practices, such as recycling and

reducing single-use plastic consumption. Effective marketing campaigns and advertising strategies have also started to influence consumer behavior by creating demand for specific products or services.

Various studies [8,9] proved that consumer behavior is also influenced by psychological factors, such as emotions and perceptions. The pandemic created the atmosphere of fear that led to various cases of panic buying [10,11]. On the other hand social media platforms enabled consumers to share their opinions and experiences, which influenced the choices of their peers. This peer-to-peer influence drove trends and consumer behavior changes since the face-to-face interactions were limited [12].

It's important for businesses and marketers to monitor and adapt to these changes in consumer behavior to stay competitive and meet the evolving needs and preferences of their target audience. Understanding the underlying drivers of consumer behavior can help in developing effective marketing strategies and product offerings. Therefore, this study aims to examine the most significant risks related to consumer behavior changes that occurred during the COVID-19 pandemic years.

II. LITERATURE REVIEW

Consumer behavior refers to the study of how individuals, groups, or organizations make decisions and take actions related to the acquisition, use, and disposal of products, services, ideas, or experiences to satisfy their needs and wants. It is a multidisciplinary field that draws upon psychology, economics, sociology, anthropology, and marketing to understand and explain the various factors that influence consumers' choices and behaviors [13]. Consumer behavior begins with the identification of needs and wants. Needs are basic requirements for survival and well-being, such as food, clothing, and shelter, while wants are desires for specific products or experiences that go beyond basic needs. Consumers typically seek information to make informed decisions. This may involve researching products services, reading reviews, or consulting friends and family, or comparing prices and features. Once consumers gather information, they evaluate different options to determine which one best meets their needs and wants. This evaluation may consider factors like quality, price, brand reputation, and personal preferences. After evaluating alternatives, consumers make a decision to either purchase a product or service or not. Factors like budget constraints, emotional appeal, and situational factors can influence this decision. After making a purchase, consumers may experience satisfaction or dissatisfaction with their choice. Their post-purchase behavior can include product usage, sharing their experiences with others, and potentially seeking customer support or returns [14].

Consumer behavior is influenced by a variety of external factors, including cultural, social, economic, and technological factors. These external influences can shape consumer attitudes, values, and preferences. Psychological factors, such as motivation, perception, attitude, and memory, also play a crucial role in consumer decision-making. Cognitive processes and emotions can affect how consumers perceive and respond to marketing stimuli. Social influences, such as family, friends, social norms, and reference groups, can impact consumer choices. Cultural values and traditions can also shape preferences and behaviors. The context in which a consumer makes a decision can be significant. Situational factors, such as time constraints, location, and immediate needs, can influence choices [15].

COVID-19 pandemic created unique challenges that marketers had to tackle in order to ensure that their companies survived. These challenges come from the changes that occurred in consumer behavior that have not yet been fully documented. Understanding consumer behavior is essential for businesses and marketers as it helps them design effective marketing strategies, develop products that meet consumer needs, and build strong brand relationships. Additionally, it provides insights into how consumer behavior can change due to various factors. This research strives to contribute to current pool of knowledge by summarizing the change and its impacts in a form of risks.

III. RESEARCH METHODOLOGY

The main aim of this paper was to examine the major risks that had occurred during the COVID-19 pandemic in consumer behavior and their influences that may still pose a significant deciding factor for managers. A survey was conducted to collect the necessary data. The sample file consisted of 531 consumers from



Slovak republic. Fig. 1 shows the structure of sample file according to gender and level education.

The sample file was created as a representative sample of base file that represented all Slovak consumers. The data was collected during the period of years 2021 and 2023.

IV. RESULTS

The impacts of the COVID-19 pandemic on consumer behavior have been severe. Mitigating risks related to consumer behavior changes during a pandemic has become crucial for businesses to adapt and thrive. Consumer behavior can be unpredictable during such times, and companies need to be proactive in addressing potential challenges.

Fig. 2 shows how the pandemic situation created the need to have the shopping performed by people outside of the household. The data shows that female consumers had more experience with this phenomenon than male consumers since 58.99% female consumers stated to have this experience and only 45.98% of male consumers declared yes to this question.

Obviously, companies needed to pay more attention to legal compliance during the pandemic. It was important to stay updated on relevant laws and regulations related to consumer rights and safety during a pandemic and to comply with these regulations to avoid legal risks. Such legal measures affected also consumers. Up to 87.3% of Slovak consumers declared that they paid attention of pandemic



development information and news regarding the safety measure implementation made mandatory by government.

Feeling of safety has become an important factor when consumers were making their shopping decisions. Fig. 3 shows how consumers of different opinions on pandemic information regarding this factor. The data clearly indicates that there was a dependency between these two factors. The calculated correlation coefficient at level 0.621 further proves the existence of strong direct relationships.

Since mandatory lockdowns were instituted in Slovak republic various times during the pandemic years, many consumers were motivated to seek new ways of shopping. Mandatory lockdowns imposed during the COVID-19 pandemic in the Slovak Republic, as in many other countries, indeed had a significant impact on consumer behavior and shopping patterns. These lockdowns, aimed at curbing the spread of the virus, led to several key changes in how consumers shopped. With physical stores closed or limited in capacity, many consumers turned to online shopping platforms resulting in online shopping surge.


E-commerce experienced a substantial surge in demand. This trend accelerated the adoption of online shopping, even among those who had not previously used this method. To adapt to the new normal, many retailers and restaurants expanded their delivery services. This allowed consumers to order goods and meals from the safety of their homes, reducing the need for inperson shopping. Grocery shopping especially underwent a significant transformation. Many consumers started ordering groceries online, either for home delivery or for curbside pickup. Grocery delivery apps and services gained traction. Up to 91.7% of Slovak consumers under the age of 60 used the food delivery services at least once during the pandemic. Some consumers made an effort to support local businesses that were struggling due to lockdowns. Buying from neighborhood stores and restaurants became a way to help the local economy. Consumers also became more conscious of the importance of contactless payments to minimize physical contact with surfaces and people. Mobile wallets and contactless cards gained popularity. This research discovered that 42.6% of consumers continued to prefer to pay contactless in 2023 when the pandemic has concluded. During lockdowns, consumers often focused on purchasing essential items like food, cleaning supplies, and personal hygiene products. Non-essential purchases declined. Therefore, almost a third of Slovak consumers stated that they reduced the amount of products they bought during the pandemic. There could be several other reasons for this finding. With many events and gatherings canceled or postponed, there was a decrease in demand for formal and fashion-forward clothing. Comfortable and casual wear, as well as athleisure, gained popularity. Lockdowns also led to a surge in DIY (do-it-yourself) projects and home improvement. People spent more time at home and invested in making their living spaces more comfortable and functional. It's worth noting that while these changes in consumer behavior were driven by the necessity of lockdowns, some of them may have lasting effects even as restrictions eased. Many consumers found convenience and benefits in these new shopping habits, and businesses adjusted their strategies to meet evolving consumer demands. As the situation continued to evolve, consumer behavior and preferences continued to adapt accordingly. Fig. 4 shows how the consumers change their frequency of



visiting shops in context of e-shops preference. The data clearly indicates that the majority of consumers who visited shops less preferred the online shopping. However, even consumers who visited shops more often during the pandemic showed a slight preference towards online shopping.

During the COVID-19 pandemic, there were significant changes in the frequency of visiting physical shops and a notable increase in eshopping preferences. These changes were influenced by various factors, including lockdowns, health concerns, convenience, and safety considerations. Reduced frequency of visiting physical shops was mostly caused by lockdowns and other restrictions. Mandatory lockdowns and restrictions limited the operating hours and capacity of physical stores, leading to fewer opportunities for in-person shopping. Some non-essential shops were temporarily closed. Many consumers were also concerned about the risk of contracting the virus in crowded reduced spaces, which their willingness to visit physical stores frequently. This was particularly true for vulnerable populations. Therefore, consumers began to prioritize their safety and the safety of others, leading to a decrease in the frequency of visits to public spaces like shopping malls and stores. The convenience of online shopping became even more apparent during the pandemic. Consumers could browse and purchase products from the comfort and safety of their homes, eliminating the need to travel to physical stores. E-shopping offered a contactless shopping experience, reducing the risk of virus transmission. Shoppers could make purchases without handling physical cash or interacting with store employees. Online retailers often have a broader range of products available compared to brick-and-mortar stores. This made it easier for consumers to find specific items,

especially when certain products were in high demand. E-commerce platforms often provided flexible delivery and pickup options, allowing consumers to choose a convenient time and method for receiving their orders. The availability of secure digital payment methods made online shopping more seamless. Many consumers adopted digital wallets and payment apps for their purchases. Online retailers often use algorithms to provide personalized product recommendations, enhancing the shopping experience and helping consumers discover new products. COVID-19 pandemic provided opportunities for consumers to try new products. The results of the survey show that up to a third of Slovak consumers significantly decreased their brand loyalty, especially during the second year of pandemic. The findings also indicate that both brand and previous experiences with product decreased in importance as significant factors influencing consumer behavior.

Shoppers could access reviews and ratings from other customers, aiding in their decisionmaking process and providing confidence in their online purchases. As the pandemic accelerated the adoption of online shopping, many consumers found these digital shopping experiences to be efficient and satisfying. While physical retail stores remain important, it is likely that the increased preference for eshopping will persist, even as pandemic-related restrictions ease, due to the continued convenience and advantages it offers. Up to 23.87% of Slovak consumers declared their continued preference for online shopping while not visiting the physical shops at all.

V. CONCLUSION

Studying consumer behavior is crucial for several reasons, as it provides valuable insights for businesses, marketers, policymakers, and researchers. Understanding consumer behavior helps businesses grasp the needs, preferences, and buying habits of their target audience. This knowledge is vital for developing products and services that align with consumer desires and solving their problems effectively. Therefore, documenting consumer behavior changes that occurred during the COVID-19 pandemic is essential to gain insightful understanding of how consumers react to adverse events with long-term duration [16,17]. By studying consumer behavior, companies can identify gaps in the market and discover opportunities for innovation. They can create products that better meet consumer demands and stav ahead competitors. The pandemic provided of opportunities for development of new products and their distribution especially hand-in-hand with rapid technology development. Consumer behavior insights enable companies to tailor their marketing strategies more effectively. Marketers can craft compelling messages, choose appropriate advertising channels, and develop pricing and promotion strategies that resonate with their target audience. Furthermore, understanding consumer behavior allows for effective market segmentation. By dividing consumers into distinct groups based on their behavior and preferences, businesses can target their marketing efforts more precisely, increasing the chances of success. Various studies on consumer behavior changes proved that different segments of consumers reacted differently to pandemic challenges [9,18,19]. Understanding consumer behavior can help businesses anticipate market trends and changes in demand. This knowledge allows them to mitigate risks and adapt to shifting consumer preferences more effectively.

Several risks have been identified that were significantly related to consumer behavior changes. Knowing these risks allows companies to develop risk mitigation strategies related to consumer behavior changes during a pandemic or any other similar adverse event that may occur in the future. One of the most direct measures that companies can implement is to diversify product and service offerings by offering a range of products or services to cater to changing consumer needs or to implement the diversification that can help businesses remain resilient in the face of shifting demands. pandemic showed the need for Since digitalization that even consumers desire, companies should accelerate their digital presence, including e-commerce platforms and online ordering systems and to ensure that their website and mobile apps are user-friendly and secure to accommodate increased online shopping. It is also important to maintain open and transparent communication with customers through various channels in order to keep them informed about any changes in operations, safety measures, or product availability. Moreover, companies should also be ready to adapt marketing campaigns and messaging to resonate with changing consumer sentiments and to constantly monitor social media and online reviews to respond promptly to customer feedback. By implementing various safety measures and protocols companies can attract consumers that are sensitive to feeling of safety. Therefore, it would be beneficial for companies to implement and visibly enforce safety measures to reassure customers and consequently, to make sure the staff is welltrained in following safety protocols.

By implementing these risk mitigation strategies, businesses can adapt to consumer behavior changes during a pandemic while maintaining resilience and ensuring long-term sustainability. Therefore, continuing to study consumer behavior is essential for businesses and policymakers alike. It provides valuable insights into consumer preferences, decisionmaking processes, and market dynamics, enabling organizations to make informed decisions, develop effective strategies, and meet the needs of their target audience while also promoting responsible and ethical business practices. This research study provides a contribution to this pool of knowledge.

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Digitization in the Application of the Quality 4.0 Concept

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Abstract—The connection between technology and quality creates a good basis for proactive transformations. This paper analyzes the impact of Quality 4.0 (Q4.0) on Industry 4.0 (I4.0). The paper discusses the Q4.0 concept as an imperative for employee education in that process. Advanced systems such as I4.0 and Q4.0 should start from defining and acquiring the necessary management skills for Q4.0 managers. Accordingly, the paper analyzes the initiatives of managers to master digital competencies. In addition, it examines whether organizations invest in the education and professional development of their employees. This paper provides guidelines for improving the digitization process and existing digital systems.

Keywords - Quality 4.0, quality management, Industry 4.0, digitalization, digital transformation

I. INTRODUCTION

The digital transformation of business in an organization has a great impact and transforms the entire value chain. It affects business and organizational models, as well as aspects of management. It also sets new strategic goals, builds capabilities and improves agility. This has led to a change at the level of traditional quality management methods. Today, organizations are leveraging technological advances to achieve new levels of business excellence, performance and innovation. Consequently, quality awareness is a basic condition for the adoption of quality development by all actors from any organization, which is confirmed by studies such as [1-3].

The aim of this paper is to explore the literature related to Q4.0 initiatives in I4.0. This implies the use of digital technologies in order to achieve better business performance. As a consequence, their impact and implications on

technology, processes and people in the organization are explored.

In order to cover a wide range of studies related to the areas of Q4.0 and I4.0, the search was performed using the following keywords: Quality 4.0, Industry 4.0, Impact of Q4.0, Implications of Quality, Q4.0. The literature source was Science direct, Kobson, Research Gate.

The paper consists of four subsections. The first part presents a framework for quality orientation and its implications for technologies and leadership skills. The second part deals with the concept of business process management. The third part analyzes the initiative Q4.0 in I4.0. Finally, the fourth part discusses the Total Quality Management (TQM) paradigm and its impact on technology, processes and people.

II. METHODOLOGICAL FRAMEWORK OF THE RESEARCH

In the following subsections, the authors present the methodological framework of the research.

A. Problem and Subject of Research

As technology evolves, new jobs require more skilled workers whose job it is to ask the right questions and identify critical problems. Quality 4.0 affects all aspects of production and improvement of business processes in organizations. In particular, an extended supply chain and quality management system is a way to create a competitive advantage. Accordingly, Q4.0 is one factor in product development, which should be essential for quality professionals in I4.0. The subject of this paper is the identification of Q4.0 initiatives in I4.0 and their impact and implications on technology, processes and people in the organization.

B. Research Objectives and Research Questions

The aim of the work is to identify and analyze the influence of Q4.0 on I4.0. Consequently, the paper analyzes the frameworks in terms of adequate skills for mastering digital competencies in the Q4.0 process. In addition, it examines whether organizations invest in the education and professional development of their employees.

In order to facilitate the realization of the work, the following research questions were formed:

- 1. What are the Q4.0 initiatives in I4.0?
- 2. What is the impact of implementing Q4.0 on value creation?
- 3. 3. What skills and leadership style does Q4.0 implementation require?

III. THEORETICAL FRAMEWORK

In the following subsections, the authors present the theoretical framework of the research.

A. Digital Transformation of Quality 4.0

Quality concepts gradually changed. This has affected the change in production methods and the variety of customer needs. As a result, this made it difficult to achieve high quality through traditional quality management procedures. Quality management therefore remains a key challenge for companies to meet customer expectations in the digital age. In addition to quality itself, three dimensions become apparent in the literature on Quality 4.0: people, technology and management systems.

According to [3] authors believe that digital transformation refers to the integration of new technologies for connectivity, intelligence, and automation. In this context, Q4.0 responds to this concept by using traditional quality methods and digital tools to achieve quality goals and achieve operational excellence. Study [4] argues that Q4.0 can be considered I4.0 as an approach that prioritizes quality and performance goals by looking at how individuals, systems and new technologies interact to improve connectivity,

intelligence and automation. This concept is supported by other studies such as [5,6].

Advanced systems such as I4.0 and in this case Q4.0 should start from defining and acquiring the necessary quality management skills for Q4.0 managers. A study by [7] state the role of technology in quality management and emphasize its relationship with the establishment of employees. The authors add that in the I4.0 era, employees are the main aspect of quality. A study by [8] points out that Q4.0 requires innovation and process-based learning. They state that the basic concept of Q4.0 is to bring the discipline of quality management through the new functions of I4.0.

References [9,10] developed a model to investigate the relationship between a firm's network structure, information-gathering capacity, and employee-related technology standardization opportunities. For some authors such as [11] and [12], this includes not only a new training program in companies, but also new perspectives of engineering education.

Furthermore, I4.0 evolves from automation to smart manufacturing, while Q4.0 moves from a process to a customer-centric approach. Reference [8] shows that Q4.0 adoption is often driven by the need for reliable and accurate quality management data. Therefore, big data is often needed to assess consumer needs for the delivery of high-quality goods and services. Accordingly, quality management programs based on big data and the increased willingness of customers to be loyal are also driving factors for the adoption of a new quality paradigm, which implies changes at all levels.

B. Quality and Process Management

Process management is the basis of ensuring and improving the quality of products and services. Accordingly, process orientation indicates that product quality can be improved if quality is managed during process realization, i.e. by controlling finished products/services. A process approach between quality management and process management best illustrates the Six Sigma concept. This concept implies a phased approach to quality management, where the emphasis is on the quality of the implementation of business processes, which then results in the quality of products/services.

In order to achieve flexibility in the execution of business processes, it is necessary that the elements of the business process indicate a certain level of flexibility. Thus, for example, the ability of manufacturing processes is to switch different products between productions with minimal delay. It also includes the ability to change the order of manufacturing operations for a given component, and so on. In addition to machines, an important element of both production and service business processes are certainly people, i.e. employees. Too narrow specialization of employees can be an obstacle to achieving flexibility in process execution. This implies that the employee is competent and capable of performing only one precisely defined task in the process.

The problem arises when the employee receives another task, to which he will not be able to respond at a given moment, and therefore it will not be possible to implement changes on time. This is often a problem when there are sudden changes that could not be foreseen when structuring business processes. In order to respond to such changes, employees need to possess a certain level of creativity and innovation. It refers to the qualities that are precisely encouraged and developed by the management of business processes. Such qualities are more often possessed by employees who are more "universal", i.e. capable of performing different types of work, than those who are narrowly specialized.

In this case, an integral part of their planning must be the provision of appropriate training for employees to prepare them for the change in the way they work.

Employees cannot develop a strategy on how the company develops products, manufactures them, distributes them, and sells them, precisely because their opinion is "limited" by the traditional, departmental approach. In order for employees to gain insight into this process, it is necessary to do the following:

- identify business processes that are key to creating value for consumers,
- determination of benchmarks for process performance monitoring,
- create a plan for improving business processes,
- defines the desired results,
- create a communication plan that inspires employees and moves them to action.

C. Quality 4.0 and its Impact on Value Creation

As technology evolves, new jobs require more skilled workers who are competent to identify critical problems. The increasing amount of data within an organization increases the need for human intelligence to understand how to use it. Quality and its implications for all aspects of production, the extended supply chain and quality management systems is a way to create a competitive advantage [13]. Also, it is one of the factors in product and service development in various businesses. Therefore, it is essential that quality professionals understand and use the technologies in I4.0. Quality 4.0 has ten basic pillars that are the result of technology developed within I4.0: data, connectivity, collaboration, application, implementation, management system. culture and leadership. Ouality development is a key task for vocational education and training, as well as for human resources, learning. New forms of digitally enabled value creation require a lot of knowledge. In this context four thematic areas were identified:

- digital enrichment of resources to improve human performance,
- cooperation and networking,
- leadership and learning i
- new forms of digitally enabled value creation.

Therefore, orientation towards quality, use of technology and leadership skills represents the new era of Q4.0. According to [14], digital transformation can promote the establishment of a knowledge-based economy. This paves the way for I4.0 and includes technological evolution and futuristic paradigms that use smart and intelligent systems, automation and digitized production [9,13].

Reference [15] emphasize that digital ecosystems change business processes and human resources management. Also, their results suggest that digital transformation flows through information technology learning processes to encourage internal learning processes. In addition [16] focus on the role of IT in employee empowerment. This includes recruitment and selection stages, training, development, rewards and bonuses. Their contribution shows that IT has a strong mediating effect on the relationship between high performance work and quality management in an enterprise.

According to [17] authors believe that a unique knowledge base on quality is necessary to be developed, setting benchmarks for the exchange of practices related to digitization. Therefore, quality management and IT directly advance corporate strategy. A year later, reference [18] described the boundaries of knowledge stating that quality management and I4.0 primarily rely on manufacturing process technologies. Thus, the I4.0 context can increase the complexity of data managed at the production level and provide practical knowledge inputs. This is confirmed by [19] which points out that knowledge management customer and innovation are two key drivers of a modern firm for a successful strategy of survival, growth and development, improvement of business efficiency, performance and sustainability of competitiveness. Empowering employees should be a priority for companies due to change. In this sense, digital age training is needed, such as human-machine working with data or collaboration.

Interactive and collaborative learning about quality through science supports better informed and skilled people to engage in quality outcomes. Also, the integration of innovation and quality contributes to a faster and more operational way of doing business. Accordingly, study [20] point out that a new effort should be invested in the training and retraining of existing employees, as well as in the training of new quality experts. Employees contribute to process management if they have the necessary power and preparation. It is necessary to redesign jobs taking into account factors related to employees such as job satisfaction. training and development, performance evaluation, compensation systems, work culture and autonomy.

Same research highlight the skills that organizations are looking for in quality professionals of the 21st century. Leadership competencies are most relevant, followed by communication skills, including teamwork and persuasion. Some companies have a strategic planning team consisting of directors of strategic business units along with the CEO or top management. The purpose of the quality committee is to identify the strategic importance of quality and to include quality issues in the formulation of business strategy. These committees may decide on the specific methods to be used, such as quality function development, meta-analysis, cost of quality, and process reengineering [21].

1) Competence and Quality Development

Competence and quality development are becoming increasingly important for the success of organizations and their operations. Research such as [22] state that the use of modern technology in quality control requires quality training. The necessary training must be sufficient and specific to successfully execute Q4.0, and top management support is essential for progress. Quality development is therefore a key task for professional education and training. In a broader sense, quality development can be defined as motivating employees to participate in quality planning that helps employees perform their tasks better. In particular, employees can participate in defining relationships with customers and suppliers. Motivating employees generally has a positive impact on creating better conditions for the efficient and effective application of quality and defining new products.

Quality 4.0 aligns quality management with digital era technologies. In this regard, the combination of known quality management methods and information technology enables the creation of new principles for the modern quality management system [23,24]. Reference [25] claim that in the period of changes and implementation of new technologies or new concepts, companies often face various problems related to human resources. For example, when employees need to acquire new competencies and knowledge, specific profiles of employees are often missing in the labor market. Therefore, it is necessary to emphasize the promotion of initiatives to prepare the workforce industry for the upcoming challenges. These include increasing the cost of education, increasing the connectivity of professional trainers by launching programs across the country, with the help of Q4.0. Regarding skills challenges, many countries have realized developing the importance of future skills development and have taken various measures to bridge the skills gap. The analysis of digital readiness in this context implies the analysis of cooperation between different departments and sectors of the organization, as well as the readiness for knowledge exchange. In addition, it is necessary to determine whether there is a clear systematization of jobs in the institution that defines the required skills for each job. It also points to the need to develop business and

technical/digital skills. In addition to the necessary skills, some jobs also require certain industry certifications.

Reference highlighted several [23] challenges for quality management in I4.0, including integration, using quality metrics for decision-making or process design from procurement to delivery. According to [26] "as global economic forces have changed radically, it is imperative that quality managers face the future with integrated quality-based management programs that fit the new business era, rather than continue with systems that may have worked in the past". Antony also mandates that quality professionals should maintain cross-disciplinary networks, including:

- excellent cooperation with stakeholders,
- the academic community
- professional communities,
- standardization organizations,
- partners for benchmarking,
- and the national quality movements.

The transition to Q4.0 is often limited by the necessary investments, mainly in cutting-edge technology. However, in the long term, the costs of business transformation could be offset by drastically reducing internal and external failure costs, as well as increasing customer satisfaction. This will further result in increasing the market share of products and services. This approach requires that the first investments go to the improvement of specific skills of quality managers. Then they will have the opportunity to carry out organizational transformation based on process more the approach effectively. According research [25] there to are competencies that define a professional quality manager of the modern age. Quality managers are expected to know how to motivate their teams and be open to change. They are also expected to know how to make decisions, and above all they need to know how to manage conflicts and know how to control their own emotions. One of the main skills of every Quality 4.0 professional is creativity and the ability to adapt to the changes and challenges that arise. In addition, they should acquire knowledge of new technologies as they emerge. In organizational processes, quality professionals will be able to make the right decisions supported by data analysis and produce first-class products.

2) Managing Quality 4.0 With the New Needs of Industry 4.0

The new quality era requires a management style that combines quality management practices with the new needs of I4.0. Modern technology and leadership are closely related in this segment. Leadership determines the ability to motivate, inspire and direct the organization's activities. Recent research such as [3] point out that the recognition and understanding of the importance of Q4.0 by the top management is of great importance for the integration of resources in the entire organization. It also affects the suppression of barriers to the adoption of Q4.0. Leaders are responsible not only for choosing the right technologies to implement, but also for preparing their managers to handle such technologies. Therefore, Q4.0 requires not only a transformational leadership style, but also special considerations for innovation and learning [27,28]. Transformational leadership is one of the most commonly used styles of innovation and learning, see for example [29].

Moreover, there is also the resistance of organizations to adopt new technologies, and the lack of management support for Q4.0 has been highlighted as an obstacle to the transition to Q4.0 [3]. The mentioned author emphasized the importance of data in the 21st century, and highlighted the two most prevalent directions. The first is the quality of data that can be collected and used for the benefit of the company, and the second is the use of data to improve traditional quality methods and tools. His earlier study provided a rough division (Fig.1) for sustainable and long-term quality development, in three steps based on three different levels to be covered and addressed.

Other studies such as [13] focused on the technical ways of promoting quality management in the context of I4.0 through new technologies. This includes IoT (Internet of



Things) applications, robotics, or data management.

D. Tqm and Its Impact on Technology/Processes/People

Quality managers apply various means to improve quality, reduce costs and increase productivity. That is, they seek continuous improvement of business performance. This includes total quality management (TOM), total productive maintenance, business process reengineering, manufacturing resource planning, independent work teams, etc. Quality 4.0 refers to the digitization of TQM and its impact on technology/processes/people. Information technologies can be vital to the development of customer satisfaction data collection and other measurement systems necessary to support TQM [25]. As it evolved, TQM included three managerial arenas: process management, human resource management, and strategic management.

The successful implementation of TQM in various industries relies on values such as total participation based on appropriate education and training. This leads to teamwork, continuous improvement, a corporate culture of quality, customer focus and a combination of management techniques within a quality management system. An important role in the process of continuous quality improvement is played by the commitment of all employees and a sense of personal responsibility for quality improvement. Employees are the source of ideas and innovations, so their expertise, experience, knowledge and cooperation must be used for the realization of ideas. Based on the above discussions, the maturity level of quality management can be divided into five stages: product quality, process quality, system quality, total quality.

Reference [30] indicates that organizations with more TQM maturity are more developed in basic TQM principles: four customer satisfaction, continuous improvement, employee empowerment and teamwork. Two of these principles have a direct impact on the perceived importance of system goals in information systems development. Also, this author suggests that, in order to satisfy and empower internal customers, in organizations with higher TQM maturity, greater emphasis should be placed on people-related goals during development. Such goals include improving the quality of work life, increasing job satisfaction, raising morale,

improving the quality of work, increasing employee skills, making work easier and increasing work efficiency. This approach implies that, on an individual level, everyone in the organization should change their attitudes about quality, and users of the system should be viewed as internal users. Finally, TQM is a management initiative that encourages employee participation in solving quality and organizational problems.

IV. FINAL CONSIDERATIONS

In the following subsections, the authors present the final considerations of the research.

A. Scientific and Social Justification of Research

The research provides a framework that facilitates the connection between the digital transformation of Quality 4.0 and its impact on business in the process. This includes quality development, management support for Q4.0 and challenges related to Q4.0 management skills.

B. Applicability of Research Results

The research provides a framework that facilitates the connection between the digital transformation of Quality 4.0 and its impact on business in the process. In this context, the commitment of all employees plays an important role in the process of continuous quality improvement. A sense of personal responsibility for improving quality while motivating employees generally has a positive effect. This has an impact on creating better conditions for the effective application of Quality 4.0 and defining new products. The existing literature in the field of competences and development of Q4.0 is not sufficiently elaborated, which is the main contribution of this paper.

C. Limitations and Further Research Directions

Considering that the area is complex and considering that the modern digital age is changing (in the context of Q4.0 to I4.0), it is necessary to investigate this area in more detail. With further research at the level of large and small companies, it is possible to monitor changes at the level of Q4.0 and the management skills of employees in organizations, and thus devise new business management strategies and develop quality management models.

V. CONCLUSION

The paper indicated a significant growth in the use of technology by quality professionals. The resistance of organizations to adopt new technologies and the lack of management support for Q4.0 were highlighted as obstacles to the transition to Q4.0. The transition to Q4.0 is often limited by business transformation costs, which could be offset by drastically reducing internal and external failure costs, as well as increasing customer satisfaction. In addition, it is necessary determine whether there is a clear to systematization of jobs in the institution that defines the required skills for each job. This indicates the need to develop technical/digital skills. Quality development is a key task for professional education and training, which must be specific for the successful implementation of Q4.0.

Analysis of digital readiness in this context includes analysis of cooperation between different departments and sectors of the organization, as well as readiness for knowledge exchange. We can conclude that interactive and collaborative quality learning through science supports better informed and skilled people to engage in quality outcomes. It is necessary to redesign tasks related to employees, such as:

- job satisfaction,
- training and development,
- performance evaluation,
- compensation systems,
- work culture and autonomy.

The most relevant skills that organizations are looking for in quality professionals of the 21st century are leadership competencies, followed by communication skills, including teamwork and persuasion. Some companies have a strategic planning team consisting of directors of strategic business units along with the CEO or top management. As a conclusion, we can highlight the competencies that define a professional quality manager of the modern era:

- openness to changes,
- ability to motivate employees,
- correct decision-making supported by data analysis,
- a wide range of knowledge about upcoming technologies,

- the ability to manage conflicts and manage emotions,
- creativity and ability to adapt to changes.

An important role in the process of continuous quality improvement is played by the commitment of all employees and a sense of personal responsibility for quality improvement. Also, it was indicated that motivating employees generally has a positive effect on creating better conditions for efficient and effective application of quality and definition of new products. Employees are the source of ideas and innovations, and their expertise, experience, knowledge and cooperation must be used to implement ideas.

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Smart City Risks

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Abstract—Smart cities represent a promising urban development paradigm, harnessing technology and data to enhance quality of life and sustainability. This paper introduces us to the smart city concept, its notable advantages and disadvantages. Smart cities are becoming more frequent, but not everyone is ready for such change. By examining these aspects, this paper aims to offer a comprehensive understanding of the smart city concept for informed urban planning and policy decisions.

Keywords – Smart city, risk assessment of a smart city, cyberattacks

I. PRELUDE

The concept of smart cities was introduced in 1990 to incorporate advanced ICT in urban planning [1]. Smart cities are characterized by their intelligent response to numerous needs, akin to industrial activities, citizen interactions, resource management, public and environmental protection, and city services. These cities utilize data collected through sensors to automate services, improve performance, and reduce costs and environmental impact. It's worth mentioning that governing a smart city is very complex issue [2].

The development process should not compromise established social systems and cultural uniqueness. To ensure successful transition, it is important to understand the attitudes of different sociodemographic groups towards smart city development [3]. Smart cities can be seen as a high-tech version of the entrepreneurial city, which has implications for policy, equality, and inclusion. However, it is crucial to consider the potential negative impacts.

The retrievability of personal information undermines the city's capacity to provide anonymity, as technologies like high-resolution positioning and facial recognition erode privacy. Overall, while smart cities offer numerous benefits, careful consideration must be given to governance, privacy concerns, and maintaining societal values [4]. Concept of a smart city also introduces a noticeable rise in political, socioeconomic, and technical challenge for integrators, designers and every organization that is intertwined with administrating these types of cities [5].

II. INTRODUCTION TO SMART CITIES

The idea of a smart city involves combining digital and physical infrastructures into a cyberphysical system. However, this integration also introduces the risk of hacking or infecting network-connected devices, potentially leading to cascading damage and data breaches [6].

An intelligent city is one that streamlines processes through technology integration and aims for sustainable development, citizen safety, and flourishing living standards. It encompasses various systems such as safe city, intelligent transport, intelligent energy, intelligent technology, intelligent housing, intelligent environment, intelligent citizens and education, intelligent economy, and intelligent governance.

These systems rely on communication and internet connectivity, including the Internet of Things, to function effectively. It is important to note that while smart cities can provide numerous benefits and opportunities, the integration of technology should be accompanied by a robust security measures to protect against cyber threats and safeguard citizens' data and privacy. Efforts must be made to ensure the safety, health, and well-being of citizens throughout the development of intelligent cities [7].

Smart city creators use modern technologies such as mobile cloud computing, electronic

objects, networks, sensors, and machine learning technologies to enable the various components of smart cities to collaborate and interact with the network architecture [5]. The ability to design the smart city ecosystem and integrate it with a more effective risk management process can support the goal of a smart city [1]. The complexity inherent in changing existing infrastructure and the new methods of citizen interaction required highlight the significant political, regulatory, and technical challenges for governments and regional authorities.

The multidimensional nature of smart city initiatives necessitates the use of technological solutions to interact with human and social capital, in order to achieve the smart city goals of improving citizens' quality of life. Trust is one of the most relevant concepts in the smart city context, as the integrated design and technical architecture rely heavily on the secure and efficient communication of large amounts of data [7]. Smart cities use information and communication technology (ICT) to enhance citizens' quality of life, boost the economy, address transportation and traffic issues through effective management, promote a clean and sustainable environment, and enable accessible interaction with government authorities.

While the term "smart city" is often used as a buzzword in many countries to refer to the use of technology in governance processes, achieving smart outcomes requires the appropriate use of technology, effective governance processes, and participation from various sectors of society [1].

III. ADVANTAGES OF A SMART CITY

Smart cities are characterized by three fundamental technology layers: the application layer, the network layer, and the perception layer. These layers contribute to the growing value, measurability, and interconnectedness of smart cities, enabling a high level of interoperability and intelligence.

In terms of functionality, smart cities enclose plethora of aspects such as wireless connectivity, intelligent homes, advanced transportation systems, efficient public services, effective social management, smart urban planning, healthcare innovations, environmentally friendly initiatives, tourism optimization, modern infrastructure, efficient governance, intelligent policies, agriculture advancements, progressive education, innovative economic strategies, sustainable environmental practices, advanced industrial processes, smart energy solutions, and responsive feedback systems, among other crucial components of smart city operations [2].

The propel for smart cities is not only encouraged by corporations, but also by government initiatives that are tailored to the unique urban landscapes of the 21st century [4]. A sustainable smart city utilizes information and communication technologies to enhance the well-being of its residents, improve urban efficiency, and promote competitiveness, all while adhering to the principles of sustainability.

As a result, it aims to address the economic, social, environmental, and cultural needs of both present and future generations [2]. In order to explore the integration of crisis management in smart cities, it is an imperative to establish a relationship between the concept of a smart city and the broader field of security engineering [7]. The Internet of Things (IoT) is employed to connect individuals with the objects in their surroundings [2].

IV. DISADVANTAGES OF A SMART CITY

Trust holds a crucial role in the context of smart cities, as the efficient and secure communication of large amounts of data relies heavily on the integrated design and underlying technical architecture [5]. Sociodemographic factors give rise to unique characteristics that influence how would individuals and population perceive risks in urban development programs, including the development of smart cities [3].

Smart cities encompass a complex and multifaceted ecosystem involving various agencies and stakeholder groups with conflicting interests. Consequently, smart cities face multiple varying risks that necessitate an effective governance system. This system should facilitate the connection of all stakeholders, enable knowledge transfer, and streamline decision-making processes to optimize the socioeconomic and environmental performance of smart city governance [2].

Numerous studies have highlighted that social risks pose significant obstacles to the successful development of smart cities. It is recognized that social risks are just as relevant as technological risks in the context of smart city development.

There are two categories of social risks associated with the transition to smart cities: individual-level risks and project-level risks. Moreover, the social risks present in a smart city can vary depending on sociodemographic factors, as the introduction of technologies in cities affects individuals' lifestyles differently. Failing to consider individual-level social risks when planning and implementing smart city development can give rise to various issues that pose significant threats to society [3].

The distinct requirement and interests of the corporate and local governance worlds often overshadow concerns related to the legal, social, ethical, and human rights implications and risks of smart solutions. Consequently, not only are empowerment, participation, and bottom-up approaches neglected, but the integration of technology solutions also occurs in an uncritical manner [4]. It's important to remember that a smart city is an ecosystem that wraps in many aspects of human life, such as transportation, healthcare, logistics, education, and maintenance, all controlled and accessed through smart devices. Each aspect relies on different technologies and necessitates human resources and budget. Consequently, the development of smart cities entails risks from multiple dimensions [1].

The complexity of the systems required for smart city development makes smart city systems vulnerable to potential functionality issues. Additionally, change is followed by a digital divide in smart cities, as individuals in society have varying levels of access to digital technologies based on their demographic backgrounds. When planning a smart city development projects, the assumption is often made that citizens possess a basic level of digital technology knowledge and proficiency. Shifting into smart cities involves various social risks influenced by sociodemographic factors such as age, educational attainment, income, and gender [3]. The development of smart cities can inadvertently reinforce existing social inequalities and biases instead of dismantling barriers to greater inclusion and integration. While the coherent connection between the material and digital world in the future smart city promises significant benefits, there is a risk that it may also disenfranchise sectors of the population who either cannot or choose not to engage with the smart city's digital infrastructure [5].

V. RISKS OF LIFE IN A SMART CITY

Smart cities face an increasing number of cybersecurity risks. These risks include complex cyberattacks on critical infrastructures; for instance, automated control systems, as well as hacking of communications between smart IoT/IIoT devices and blocking of VANET nodes. Ransomware attacks and manipulation of sensing data in alarm and emergency systems are also potential threats [6]. The use of technology, integration systems, and governance in smart cities can bring both technical and non-technical risks [1]. Maneuvering these risks is an imperative, as they can impact the objectives of smart city projects and initiatives. Risk management strategies should focus on identifying and mitigating the negative risks or threats, while increasing the probabilities and impacts of positive risks or opportunities [2].

It is important to note that associated risks are inherent in the technologies used in smart cities, which can create threats to their operation [1]. Entailed devices have different functions, capabilities, and features. They are forged by differing manufacturers and come with different hardware and software versions. Additionally, they adhere to different security standards. This makes an ideal opportunity for an intruder to exploit software vulnerabilities and applied protocols. The primary concern is that an attacker can successfully target a poorly protected device, which can then directly or indirectly connect to the target device or digital service of the attack through a chain of interconnected devices.

Software vulnerabilities can range from developer mistakes to intentional backdoors, and they can exist at both the hardware and application levels. Simultaneously, security researchers and experts emphasize the significant importance of addressing smart city cybersecurity [6]. One of the main challenges in the development of smart cities lies in effectively handling and managing data.

The threats associated with information security, data privacy, and cyber-related factors underscore the critical need to address these issues early on in the design and development stages of smart cities. Information security warps in not only privacy, confidentiality, integrity, and availability, but also interoperable security, which refers to the overall failure of urban systems. Effective risk management is crucial in evaluating and responding to threats within smart cities, including the challenges posed by the technical sophistication gap and standards immaturity. Researchers have been exploring technological solutions to address privacy and broader information security issues [5]. Network attacks cause significant damage as they disrupt the functioning of the entire smart infrastructure. Key indicators for assessing cybersecurity risks include the likelihood of a cyberattack and the resulting damage, usually measured in monetary terms.

However, when evaluating risks in smart city networks, it is important to recognize that not only data integrity, confidentiality, and availability are at stake, but also the lives and well-being of individuals. Typically, cybersecurity risk assessment involves classifying the current risk level as acceptable or unacceptable or predicting classes based on historical data using a regression tree [6]. Mobile devices serve as the spine for interacting with smart city network infrastructure but present new challenges to user security and privacy. Sensitive data is vulnerable to third-party attacks, which can lead to digital disenfranchisement.

This situation particularly impacts certain demographics who may have concerns regarding privacy, security, or hesitations about engaging with new processes and systems due to perceived risks to personal data. There is a risk that smart city initiatives may primarily benefit the technologically savvy and affluent, while potentially exerting control and regulation over citizens, especially those on the outskirts of society and lower social classes, who may have limited knowledge about safety and security complexities [5].

VI. COUNTERMEASURES FOR RISKS

A significant amount of research is dedicated to analyzing cyber threats and developing methods to protect smart cities against them [6]. Risk management involves several key steps: identifying, analyzing, evaluating, treating, and monitoring and controlling risks. Adopting innovative methods and novel approaches can increase risks due to their relative newness and lack of understanding by management.

Sustainable smart cities are a new concept and therefore have their own share of risks, which are further amplified by the use of nontraditional technologies, approaches, and modern management principles, making the governance of these cities more complex than traditional counterparts [2]. IoT plays a crucial role in the infrastructure of smart cities by providing the network architecture responsible for collecting and processing data from distributed sensors and smart devices.

However, collecting and transferring data through IoT infrastructure can greatly impact the security and privacy of smart cities if precautionary measures are not implemented [5]. Cyberattacks, and any other cyber hijacking means, on the dynamic self-organizing networks of smart cities can be categorized as passive or active. Passive cyberattacks typically violate confidentiality, where the intruder listens in and intercepts information transmitted over the network without causing any damage, making detection challenging. Active attacks, on the other hand, aim to interact with the information flow, compromising integrity and availability. Active intruders manipulate or tamper with data packets, disrupting the network's functionality.

These attacks can be orchestrated by both external and internal attackers [6]. Data within smart city applications should be able to withstand modification, disruption, inspection, unauthorized access. disclosure. and destruction [5]. However, these challenges make it difficult to accurately estimate the calculated cities, for smart hindering risks the implementation of effective protective measures [6]. Security and privacy in smart cities require confidentiality, integrity, availability, non-repudiation, access control, and privacy.

Vulnerabilities in smart city apps can expose residents to security and privacy issues, potentially discouraging public usage without adequate security and privacy protection. Privacy is a significant concern in smart cities, often tied to a lack of understanding from local governments and businesses regarding how they collect and process personal data. Communities are frequently not given the opportunity or mechanism to provide consent for data collection [5].

The security risk assessment methods of the smart city infrastructure is the process of identifying vulnerabilities, cybersecurity threats and security risks associated with the assets, and counter-measures that mitigate these threats. There are three primary approaches to cyber risk assessment: qualitative, quantitative, and combination. They are presented in three aspects;

- Expert assessment,
- Rating estimates,
- Checklists of risk sources,
- Method of analogies.

The expert evaluation involves a blend of logical and mathematical techniques to articulate the specialist's viewpoint on specific security concerns within a scrutinized system. The crux of this approach lies in leveraging the expertise and intuition of a domain specialist to arrive at optimal decisions. Precise data and costly software toolkits are unnecessary for this method. Nevertheless, its primary limitations are the subjective assessments and the challenge of engaging unbiased and highly proficient experts. Questionnaires, brainstorming sessions, SWOT analysis, SWIFT, and the Delphi method are examples of the expert estimation techniques.

There is plethora of applicable methods for assessing the cybersecurity risks when it comes to information system. A vast amount of security monitoring data about the cyberattacks and the protected assets is very valuable, yet it is not always possible to implement because of large scale of the uncontrolled environment, the limited time available for the risk analysis and measurement. and the limited financial. knowledge, and computing resources. Moreover, there are distinct issues for the cybersecurity risk assessment in a mobile inter-device network of the smart city:

- A huge amount of data for knowledge processing,
- An undefined number of assets: users, connected nodes, communications, etc.,
- Insufficient formalization of the risk calculus and the requirement for the regular risk expertise,
- The inability of the detailed risk analysis in the case of the limited awareness of the smart network hosts about the current state of the cyberattacks,
- Incomplete and inaccurate rules for statistical data calculations to obtain a

probability of the cybersecurity risk events [6].

VII. CONCLUSION

Smart cities will be the future of our civilization, regardless of what it brings to us. They are prevalent at the beginning of this century, and we have yet to expand technological knowledge even further. Smart cities can enhance efficiency and convenience in daily life. bring benefits of optimized transportation systems, streamlined services and influence more the tech-driven development and environment. However, it brings privacy concerns and dependency on technology in ways that we cannot imagine. When everything is close with one click, but also away at the same time, with all information being virtual and with risk of cyber attack or cyber hijack, people grow more concerned. Balancing the advantages and disadvantages when living in a smart city is essential.

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Adopting Digital Business Models: The Pivotal Role of Big Data in Guiding Managers

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Abstract—In the digital age, an increasing number of organizations are adopting digital business models to ensure market survival and achieve long-term growth and development. This paper highlights the role and significance of Big Data in shaping digital business models. Big Data facilitates real-time interaction with all date sources and structures, allowing for fact-based decision making. Furthermore, Big Data paves the way for the emergence of new organizations with business models predominantly based on data.

Keywords – Digital business, big data, decisionmaking, digital technology, organizational behavior

I. INTRODUCTION

Big Data is more than just one of the recent trends in the realm of information and communication technologies [1]. It has become a significant, and perhaps even a crucial factor, in the competitiveness of companies navigating the deluge of data [2,3]. Experience indicates that no industry or sector is immune to Big Data. In today's world, every action leaves a digital footprint, which translates into data that can be harnessed [4].

Big Data technologies are considered to have ushered in a completely new phase in the digital economy, which many theorists and practitioners refer to as the Big Data era [5-7]. This era is shaped not only by the emergence of contemporary technologies and tools but also by their widespread acceptance and application. The hallmark technological shifts in recent years encompass mobility, cloud computing, machine learning, artificial intelligence, robotics, extensive use of social networks, and sensors networking various devices. Given the rapid pace of technological advancement, data volumes are projected to grow continuously [8]. As such, Big Data technologies have carved a niche for themselves in both practical and academic circles.

This paper underscores the managerial shift towards digital business models through the application of Big Data. The initial section elucidates the definitions and primary characteristics of Big Data. The subsequent section delves into pivotal technologies and techniques. The third segment outlines factor that management must heed when integrating Big Data to shape digital business models. The concluding section highlights key considerations for organizational management in formulating digital business models rooted in Big Data.

II. BIG DATA DEFINITION AND KEY CHARACTERISTICS IN THE DIGITAL AGE

In the final decade of the 20th century, and particularly during the first two decades of the 21st, data and information permeated every aspect of life and work [9]. They have become integral to modern business operations [10]. The widespread adoption of various social networks, smartphones and smart devices networked with sensors has resulted in an exponential growth of real-time data [11]. This influx of data was named "Big Data," sparking the development of numerous techniques and technologies for its collection, processing, analysis and storage. Over the years, many definitions of Big Data have emerged. Big Data encompasses vast quantities of structured, semi-structured and unstructured data that exceed the capacities of relational databases [12] and a computer's working memory [13].

Big Data refers to datasets so immense and complex that they demand unique and innovative methods for storage, management, processing, analysis and visualization [14].

Several characteristics define Big Data. While authors may differ in their descriptions, there is consensus around three main attributes, collectively known as the 3Vs: Volume, Variety, and Velocity [15,16].

Volume refers to the vast amounts of data, exceeding traditional databases' processing capabilities and is quantified in terabytes, petabytes and zettabytes. It is estimated that 2.5 quintillion bytes of data are generated daily [17].

Variety, as another feature of Big Data, refers to the diversity and consequently the structure of the data [16]. Data comes from different sources such as social networks, websites, blogs, forums, e-mails, and various sensors. This data can encompass text, images, video, sound and can be structured, semistructured, or unstructured. The World Economic Forum has classified unstructured data as an important resource, emphasizing its significance in a company's operations, such as monitoring millions of tweets per day or scanning customer comments on social networks, forums, and websites [6].

Velocity pertains to the rapid generation, collection, processing, and analysis of data. More companies aim to process real-time data to extract actionable insights. The proliferation of the Internet, sensors, and social platforms has magnified data transmission rates, creating a business ethos of immediacy [18]. Real-time data processing allows companies to (1) swiftly detect and rectify errors, (2) adapt to competitors' strategies, and (3) understand customer sentiments and respond appropriately [19].

Beyond these three "Vs", literature sometimes references other Big Data attributes, also symbolized by the letter "V". Some highlight the "Value" derived from data analysis, emphasizing the challenge businesses face in leveraging data for tangible benefits. Others point to "Veracity", touching on data consistency, relevance, and quality [20]. Indeed, with vast data volumes come questions about their accuracy and validity, directly impacting the data's utility and decision-making quality based on it.

III. BIG DATA TECHNOLOGIES AND TECHNIQUES

The importance of Big Data analytics, which involves applying various analytical techniques to large amounts of data from different sources to uncover hidden patterns and other valuable insights, has been increasingly emphasized [1]. Data today is largely unstructured, vast, and available in real time. Instead of analyzing samples, the entire data population is now scrutinized. This reveals answers to questions companies might not have even considered before. Therefore, a new and different way of thinking is needed to create value for the company based on the available data [21]. The solution is found in a number of data analytic techniques that originate from disciplines like computing, mathematics, statistics, and economics.

Some of the most commonly applied techniques include machine learning, neural networks, social network analysis, optimization methods, and visualization, among others [22]. Big Data analytical methods encompass A/B testing, association rules. classification, genetic clustering, algorithms, machine learning, neural networks, network analysis, modeling, regression, predictive signal processing, spatial analysis, simulation, and time series analysis [23].

Machine learning, a branch of artificial intelligence, focuses on designing algorithms that learn from past patterns to predict future trends. By applying algorithms, better and faster decisions are made on the basis of the identified regularities in the data. The choice of algorithm depends on the specific business issue at hand. Some of the most commonly applied machine learning algorithms are [24]:

- Association rule learning: This algorithm identifies relationships between variables. A common use is in retail, determining which products are frequently bought together.
- Classification: This categorizes data based on its traits. It helps segment products and monitor their behaviors.

• Clustering: This groups objects based on common attributes. For instance, it can segment customers based on behavior to tailor marketing strategies.

Social media sentiments have become pivotal for the survival and success of products and services on the market [25]. Sentiment analysis, which gauges opinions, attitudes, and emotions about products, services, companies, or events, is extensively employed for such data [23]. Also widely used are linear and logistic regression, neural networks, outlier detection, time series analysis, correlation, and data mining [26].

In terms of technologies for Big Data, the 2000s saw Google pioneering tools that sparked the development of other technologies and tools for efficient real-time data handling [11]. Some technologies were innovated, while others were enhanced for Big Data.

Different authors present and classify technologies for working with Big Data in different ways. There is no single exhaustive list of Big Data technologies as they are continuously evolving. Also, many of these technologies overlap or are dependent on each other. Hadoop, Map Reduce, and Big Table are commonly used for quick processing of large amounts of data in real or near real time [27]. Among the more well-liked visualization methods in the Big Data era are [28]:

- Tag cloud is used during text analysis and refers to the frequency of use of certain words or expressions. The outcome displays parts of the text with emphasized words that appear most frequently or infrequently, based on the given criteria.
- Clustergram represents a technique that is applied in cluster analysis and shows the connections and relationships of individual elements in the data contingent on the cluster to which they belong.
- Motion charts represent a plethora of different data on two-dimensional charts.

In practice, various visualization techniques, such as heat maps have gained prominence. These maps typically display desired business outcomes based on distinct categories including location, brand, market, and sales managers, among others. Furthermore, dashboards consolidate essential business information on graphs in one central location, aiding the decision-making process.

Numerous software and tools tailored for the Big Data era are designed around the foundational principles of cognitive psychology. This is evident in their emphasis on color, size, and the portrayal of relationships between different variables. The goal is to simplify the process of identifying patterns within data and subsequently, to derive insightful conclusions.

It is worth noting that while Big Data technologies are transformative, they are not prohibitively expensive. A multitude of opensource solutions mirrors the functionalities of technologies established that successful companies have become accustomed to. However, the key difference lies in the evolving methodologies needed for processing and analyzing this new magnitude of data. Across the corporate landscape, it is evident that these novel technologies have revolutionized data utilization. Yet, with the plethora of technologies available for Big Data, the primary emphasis should remain on the pivotal business decisions at hand, rather than being purely technology driven. A common pitfall for many managers is to be swayed by prevailing tech trends, leading them to adopt the latest Big Data technologies without assessing their genuine business relevance or efficacy. The integration of every new technology amplifies the complexity of the information system, making it increasingly challenging to manage. This complexity is a critical factor to consider when deliberating on the implementation of a particular technology.

IV. DIGITAL BUSINESS MODELS AND BIG DATA

Throughout history, data and information have always been important for every sector of the economy and for every organization [29]. However, in recent years, the manner in which data is collected, processed, analyzed, and stored has undergone significant changes. Companies have recognized opportunities to create value based on this data [30].

The potential for creating strategic value based on data has always existed. Today, with the increase in the availability and variety of data coupled with the advancements in technical capabilities for their processing and analysis, this potential has grown exponentially. Data has become a "lever of innovation, competitiveness and productivity" [23]. It is viewed as the resource responsible for the "management revolution" [15].

Digital business models can encompass numerous segments, including price transparency, consumption-based pricing, buyer aggregation, rebates, rewards, customer choice, personalization, automation, and also marketplaces, crowdsourcing, peer-to-peer models, sharing economy and data monetization [31]. Digital businesses are those that conduct digitally mediated transactions or offer digitally oriented products or services [32]. If developments in digital technologies induce fundamental changes in the way a company operates and generates revenue, then its business model is digital [33].

Several key characteristics of Big Data technologies can assist companies in creating value through their application. These include [23]:

- Transparency: All data within and outside the company become accessible in one location, ensuring there is "one version of the truth" within the company. Employees can easily locate the data they require by accessing this central location, leading to significant time savings. Furthermore, data integration provides a holistic view of the results.
- Experimentation: This is aimed at discerning the diverse needs and desires customers of to craft varied products/services accordingly. Companies can collect more accurate and detailed data regarding customers preferences, opinions, and perceptions about products and services. By leveraging Big Data technologies and techniques, companies can evaluate the impact of changes in product or service offerings.
- Segment identification: This allows tailoring of products/services based on customer needs and requirements. By segmenting customers, companies gain insights into how they can better address their needs, providing a foundation for improving existing products and services, or creating new ones.

Segmentation is possible based on various criteria, including income, age, location, habits, and the likelihood of making a purchase [34].

- Decision-making support: Sophisticated software has the ability to refine the decision-making process using automated algorithms that analyze data and initiate corrective actions. The use of controlled experiments to test a hypotheses and analyze the results can significantly improve the decisionmaking process [10]. Additionally, authors highlight numerous the significant shift from intuitive decisionmaking to data-driven decisions [16].
- Product and service enhancements: By identifying certain patterns and correlations in the company's data, valuable insights about products and services can be extracted. Analysis can lead to the development of new products, improvement of existing ones, or changes in pricing strategies [35].

Companies that apply Big Data technologies can gain a better understanding of their customers, employees, business processes, and partners. They can pinpoint activities that need and can be improved [36]. By examining data from different sources, companies can weigh different options for product redesign early in the development phase, thereby minimizing opportunity costs and the risk of failure. Furthermore, Big Data provides new avenues for growth, allowing for the emergence of entirely new companies with business model rooted in data [10].

V. FACTORS THAT IMPACT THE CREATION OF DIGITAL BUSINESS MODELS

Organizational management must recognize and consider the factors that dictate the successful application of Big Data technologies when formulating digital business models. These influencing factors can be divided into external and internal, whereby internal factors can be further subdivided into technical and organizational.

External factors concerning the success of Big Data technologies pertain to the degree of support and facilitation by governments, state organizations, and institutions. This involves the regulatory framework governing data privacy and usage, infrastructure provisions, and the public's perception and awareness [37].

Contrastingly, internal factors that affect the application of Big Data technologies center on the company's intrinsic capacity to generate value from data. Primarily, these factors encompass technological infrastructure, data availability, as well as the company's capabilities, available resources, and an organizational culture that encourages decisionmakers to rely on data. Companies must foster an information ecosystem that promotes the adoption and effective utilization of Big Data technologies by their workforce [36]. Beyond technical factors, the presence of favorable organizational elements is paramount. Although the availability of technology and data collection capabilities are essential, the pivotal elements are the company's ability and proficiency in deriving value from the data [38,39]. Numerous studies show that organizational factors, when compared to technical ones, play a more influential role in determining the trajectory of Big Data technologies within a company [34]. These organizational factors entail setting clear objectives for Big Data technology applications, strategizing their deployment, ensuring commitment from both management and staff, investing in training and development of employees, and adjusting various facets of organizational design and structural parameters.

Key factors, including data management, data comprehension, and company culture, significantly affect the success of Big Data technologies. Beyond managing data and having the analytical skills and tools, it is necessary to cultivate a company culture that advocates for a "data-driven" approach, thus enabling the formation of digital business models based on data.

VI. THE KEY CONCERNS REGARDING BIG DATA

The ongoing technological revolution has diverse effects on modern society and necessitates extensive research from multiple fields in order to handle its risks, dangers, and negative consequences [40]. The application of Big Data raises numerous questions and challenges regarding data privacy, security, scalability, accuracy and ethical considerations regarding the potential misuse of data [41]. Data privacy concerns the protection of individual privacy during the data collection process, as well as safeguarding the data during its processing and application. In the digital age, every individual acts as a "data generator", making the issue of data privacy even more critical. Aside from the numerous benefits, one of the key problems and vulnerabilities of big data is its storage and handling, as well as the danger of misuse. Misuse can manifest itself in a variety of forms and for a variety of reasons. It could refer to internet information theft, sabotage, industrial espionage, or intellectual property theft [40].

Organizations should implement data security policies and clearly define ownership and access rules for different sets of data. To tackle the primary issues of data privacy, managers should answer the following questions [42]:

- Retain What data is retained and for how long?
- Access Which employees and which organizations have access rights, and to which data?
- Share Which data can be shared, with whom, and under what conditions?
- Merge Which sets of data can be merged?
- React Based on the data, how should one respond, i.e., take the appropriate action?

The utilization of Big Data should align with individual, social, and cultural values while fully respecting citizens' privacy [43].

VII. CONCLUSION

Within a short span of time, Big Data entered the scene and attracted attention from national economies, the academic community, businesses, and individual researchers. The advantages of applying Big Data into digital business are manifold, offering avenues to create new digital business models and identify new directions for company growth and development. The amount of data that is generated is increasing every day, and it is certain that such a trend will persist, solidifying the ever-growing prominence and relevance of Big Data in digital business models in the future.

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Real Economic Challenges of the Republic of Serbia's Exchange Rate

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Abstract—The importance of the exchange rate for the economic policy of a country is unquestionable. The exchange rate is the most important price in all economies, because it affects all other prices, affects production, inflation, foreign trade, and other macroeconomic variables. At the same time, the tendency of the exchange rate of a country in the long term reflects the health of the economy. Bearing in mind that the exchange rate can be under the influence of the government or can be formed by itself, the choice of the most adequate regime of the exchange rate is one of the most important goals of economic policy because it affects both monetary and fiscal policy, as well as foreign trade the politics of a country. By using monetary policy instruments, the exchange rate can be used to achieve critical macroeconomic goals. That is why it is very important for underdeveloped and developing countries, such as the Republic of Serbia.

Keywords - Exchange rate, balance of payments, exchange rate regime, stability

I. INTRODUCTION

Managing the exchange rate policy is a challenge for every holder of macroeconomic economic policy. First of all, it is necessary to decide on the exchange rate regime, whether to let the currency play a free game of supply and demand (so-called "free swimming") or fix it, i.e. tie it to one solid currency or a common denominator (euro, dollar, basket of currencies and fig.). Then, should a single exchange rate be applied in all transactions with foreign countries or a model of multiple exchange rates, etc. The exchange rate policy should be in interaction with the overall economic policy of the country, especially with the policy of money and credit supply, i.e. monetary policy, and the policy of

public revenues and expenditures, i.e. fiscal policy [1].

The importance of the exchange rate for the effective management of economic policy is particularly pronounced in open economies, where the relationship between the domestic and international economies is of key importance for the practical realization of all other economic goals [2]. Namely, the exchange rate affects the economy of a country in many ways and has various macroeconomic and development impacts. The exchange rate can act as an anchor, keeping prices at a relatively low level through appreciation (overvaluation of the domestic currency). The balance of the current account largely depends on the relative price of foreign goods and services compared to the domestic one, that is, on the real exchange rate. Then, the exchange rate significantly affects the expectations and behavior of the financial market, which means that it can be used as a mechanism for its control and stabilization. A relatively low exchange rate, along with an adequate industrial and foreign trade policy, affects the increase in competitiveness, thereby creating the necessary conditions for increasing productivity and economic growth. The exchange rate has significant effects on the allocation of resources in a certain society by affecting the price level. As it affects simultaneously the allocation of resources and overall demand, a relatively low exchange rate can contribute to dynamizing the growth rate and increasing employment in the long term. Therefore, the exchange rate affects several economic spheres, namely: inflation, current balance, finance, economic development, and resource allocation [3].

II. SELECTION OF EXCHANGE RATE REGIME - CHALLENGE OR ROUTINE

One of the key questions when choosing an exchange rate regime is which regime to choose as the official exchange rate policy of the economic policyholder. The choice is implied by the economic characteristics of the country,

Characteristics of the economy	Implications of the desired system
The size of the provision	The larger the economy, the stronger the demand for a flexible exchange rate.
Openness	The more open the economy, the less attractive the flexible exchange rate.
Diversification of the production/expo	The more diversified the economy, the more acceptable a flexible exchange rate.
The geographic concentration of trade	If a larger share of a country's trade is with one large country, there is a greater incentive to peg the exchange rate to that country's currency.
Deviation of domestic inflation from world inflation	If the deviation of the domestic inflation rate from the inflation of the main trading partners is greater, a more frequent adjustment of the exchange rate is necessary.
Degree of economic/finan cial openness	If the degree of economic and financial development is greater, the more acceptable the flexible exchange rate regime is.
Labor mobility	If there is a greater degree of labor mobility, when wages and prices are inflexible downwards, it is easier to apply a fixed exchange rate.
Capital mobility	The higher the degree of capital mobility, the more difficult it is to maintain a pegged but adjustable exchange rate
Foreign nominal shock	If foreign nominal shocks are more frequent, a flexible exchange rate is preferable.
Domestic nominal shock	If domestic nominal shocks are more frequent, a fixed exchange rate is preferable.
Real shocks	If the economy is more sensitive to domestic or foreign real shocks, the more desirable is a flexible exchange rate.
Credibility of Economic Policymakers	The lower the anti-inflationary credibility of economic policymakers, the greater the attractiveness of a fixed exchange rate as a nominal anchor.

TABLE I. EXCHANGE RATE SELECTION CRITERIA [1].

primarily the size of the economy, the credibility of economic policyholders, i.e. whether they apply rules or discretionary rights in their functioning, state of the country's balance of payments, price level, way of conducting monetary and fiscal policy, budget deficit, etc.

When choosing a currency regime, there are elementary criteria that every economic policy should take into account, which are given in Table I. Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

The choice of exchange rate regime is very important for every economy. It influences how and to what extent the state will control the exchange rate of the national currency, the

volume of the money supply, the level of interest rates, and changes in the real sector of the economy (on production, consumption, and employment). Therefore, the importance of the exchange rate is more significant, the greater the participation of foreign trade in the social product.

Bearing in mind the complexity imposed by factors and circumstances, when choosing the exchange rate regime, the outcome itself gives advantages and disadvantages in the field of monetary-financial and fiscal stability. Therefore, the choice of exchange rate regime is far from routine. There is no single exchange rate regime that can be applied for all countries or at any time, so when choosing an exchange rate regime, countries are faced with a situation where it is impossible to simultaneously achieve three important goals (stability of the exchange rate, monetary independence and financial market integration), the so-called "the impossible trinity".

III. EXCHANGE RATE REGIME IN THE REPUBLIC OF SERBIA

In countries with an unstable foreign exchange market, there is a risk of significant fluctuations in the exchange rate, which is why interventions by the Central Bank are frequent. In the Republic of Serbia, the Central Bank intervenes only to prevent excessive oscillations on a daily basis in order to prevent speculation on the foreign exchange market. Therefore, the Central Bank of Serbia does not directly influence the formation of a certain level of the exchange rate [4]. The economic events in the past period, and above all the period of hyperinflation, have greatly influenced the loss of confidence in the monetary authorities. For this reason, it should not be surprising that in October 2000, at the beginning of the transition process, the Republic of Serbia decided, like most countries in development and transition, to use the monetary regime of the exchange rate as a nominal anchor and thus establish macroeconomic stability [5].

The last decade of the twentieth century was marked by a fixed exchange rate regime, but without full convertibility, which led to the emergence of the so-called "black" foreign exchange market. So the Republic of Serbia had two foreign exchange markets, officially where the fixed value of the exchange rate was controlled by the central monetary authority and unofficially, the so-called "black" market where the value of the exchange rate was determined in a market way.

The supply of dinars has been constantly increased thanks to the expansive fiscal and monetary policy. This influenced the devaluation of the national currency on the "black" market [5]. The different values of the exchange rate on the official and "black" markets have led to an increasing bypassing of the official foreign exchange market. In order to prevent further negative consequences of using the unofficial market, at the end of 2000, the monetary authority tried to equalize the exchange rate on the two markets by devaluing the dinar. The initial devaluation should have been higher, due to the higher level of the exchange rate on the "black" market.

A more significant devaluation could have stimulated Serbia's exports and provided a relatively longer period of adjustment to the export sector. Although introduced, judging by the results, it did not last long, nor was it adequately controlled. Considering the weak financial system, high inflation rate, high inflation expectations, and low level of confidence in the national currency, it was a logical move. The goal of using the exchange rate as a nominal anchor is to replace the bad credibility of the domestic monetary policy with the "imported" credibility of the central bank to which the domestic currency is pegged. The fixed exchange rate served as a nominal anchor for the domestic price level and contributed to ending the period of high inflation.

The regime of conventionally fixed parity, which was applied from October 2000 to January 2003, gave good results. The exchange rate has been largely stabilized and confidence in the local currency has been restored to some extent. There was a decrease in the inflation rate, and the foreign exchange reserves of the central bank were significantly increased. However, fixing the nominal exchange rate had certain negative consequences. Despite the fixed exchange rate, thanks to inflationary pressures and failures in the domain of economic policy, prices and wages continued to rise, which over time led to an appreciation of the real exchange rate [6]. The growth of nominal wages in dinars followed the rate of inflation, which resulted in a strong growth of wages expressed in euros. The growth of prices at the macroeconomic level on the one hand, and the growth of wages expressed in euros, on the other hand, contributed to the fact that it became more profitable for the population to import products from abroad. In the absence of a means of payment, there was a credit expansion. The problem was that those loans had a foreign currency clause, which led to the emergence of the so-called financial erotization and currency mismatch, i.e. a distinction was made between the currency structure of demand and debt positions [7]. Significant financial erotization opened up the problem of exchange rate depreciation because a large drop in the value of the domestic currency could cause problems in the repayment of loans to the population, the economy, and the state, with the risk of a financial crisis. On the other hand, the growing current account deficit and the decline in the price competitiveness of the domestic economy have become a serious threat to the sustainability of this monetary regime in the long term. Bearing in mind that the policy of using the exchange rate as a nominal anchor in conditions of consistently higher inflation in the country than in the Eurozone led to rapid growth and a high degree of unofficial erotization, it is obvious that the right moment to continue conducting a successful exchange rate policy was missed in the Republic of Serbia.

At the beginning of 2003, the Republic of Serbia changed the exchange rate regime and monetary strategy. The bearers of the macroeconomic and financial policy of the Republic of Serbia chose greater flexibility of the exchange rate, as did Poland, the Czech Republic, Slovakia, and Hungary. The goal was to enable the greater flexibility of the dinar to solve the growing problem of the growing external imbalance. Greater flexibility of the dinar in relation to foreign currencies was achieved. In the period of application of this strategy (from January 2003 to the end of August 2006), the dinar depreciated in nominal terms by 27.12%, in contrast to the previous period (2000-2003), when the dinar depreciated by only 2.57% [8].

However, the change in exchange rate policy did not achieve much in terms of external imbalance, because the current account deficit continued to grow, for two reasons. First, the nominal depreciation was not accompanied by a real depreciation of the dinar. Second, the strong and rapid transmission of exchange rate changes (in this case, depreciation) to prices also affected the increase in the inflation rate in the observed period. Transferring the exchange rate to prices, as a consequence of psychological factors, but also the high import dependence of the domestic economy and the high degree of unofficial erotization, made significant changes in the exchange rate impossible in order to balance the current balance. without endangering macroeconomic stability. This created a conflict between the realization of these two goals.

The aspiration of monetary policymakers, to assign another role to the exchange rate in addition to suppressing inflation - balancing the balance of payments proved to be unsustainable. Balancing between these two goals in that period led to the fact that the exchange rate of the dinar neither contributed to macroeconomic stability nor to balancing the balance of payments. This course of events is just one more in a series that confirms the position that it is impossible to achieve two (conflicting) goals with the help of one economic policy instrument, and it is directly related to the so-called "impossible trinity" [2].

By adopting the Memorandum of the National Bank of the Republic of Serbia on the principles of the new monetary policy framework, at the end of August 2006, the National Bank of Serbia announced a change in monetary strategy. The regime of monetary policy where the exchange rate was used as a nominal anchor was abandoned and the so-called inflation targeting.

Since then, the National Bank of Serbia has been implementing a policy of controlled fluctuating exchange rates, which appears as a net consequence of the supply and demand of money on the financial market. On the other hand, the fixed exchange rate was maintained at an unrealistically high level, primarily through the control of the reference interest rate. The existence of a fixed and overvalued exchange rate in the Republic of Serbia was necessary in order for the National Bank of Serbia to free the domestic economy from the possible consequences of inflation.

In practice, in the Republic of Serbia, the policy of an overvalued and almost relatively stable exchange rate of the dinar has been applied for years. The National Bank of Serbia determined the exchange rate based on supply and demand, and it intervened in the foreign exchange market only in case of preventing large daily fluctuations of the exchange rate, but without directing the exchange rate in a specific direction. The higher growth of domestic prices due to the change in the exchange rate against the most important world currencies led to a huge foreign trade deficit, and increasing indebtedness of citizens, the state, and the economy [9].

The value of the dinar in 2001 compared to the end of 2000 was higher in real terms by about 30%, while the average customs duty on the import of goods was about 9%, which strongly influenced the large increase in the price competitiveness of imports. Before the outbreak of the global economic crisis in the fall of 2008, the exchange rate of the dinar was in real terms as much as 110% higher than at the end of 2000 [7].

The dinar found itself in a paradoxical situation, because it strengthened, that is, was overvalued in years of extremely low competitive power of the economy and insufficient production activity in industry, with an illiquid real sector and an outdated economic structure. Imports and foreign trade deficit were constantly growing, and huge foreign currency funds were spent on the import of consumer goods, in modest exports, about two-thirds were products of a low stage of processing, i.e. raw materials and raw materials (iron and steel, clothes, cereals, fruits and vegetables, colored metals). This means that in the economy of the Republic of Serbia, there was a continuous appreciation of the domestic currency, without real coverage, instead of the dinar depreciating and logically having a lower value [10].

The conclusions of the research reached by the researchers of the National Bank of the Republic of Serbia in 2008 are in favor of the fact that the increase in the exchange rate can help exporters to a small extent, while imports depend to the greatest extent on the pension and salary fund. Also, it is pointed out that the decrease in the value of the dinar had a negative impact on macroeconomic stability (increase in inflation, decrease in the real exchange rate, increase in indebtedness of citizens, economic entities, and the state), so according to them, the improvement of the foreign trade imbalance could only be achieved through moderate and controlled wage growth and pension in the public sector [4].

Every increase in the exchange rate of the dinar leads to a depreciation (devaluation) of the (with a simultaneous appreciation dinar (revaluation) of the foreign currency), which implies a decrease in the value of the national currency. On the other hand, any decrease in the exchange rate of the dinar leads to an appreciation (revaluation) of the dinar (with a simultaneous depreciation (devaluation) of the foreign currency), which is reflected in the strengthening of the value of the national currency. Only from the beginning of 2010 until September of the same year, the National Bank of Serbia sold over 1.8 billion euros on the interbank foreign exchange market in order to prevent excessive daily fluctuations of the exchange rate and to stimulate circulation. For example, she sold 100 million euros on May 26, 2010, which is the largest daily intervention since the end of 2008. In the whole of 2009, the National Bank of Serbia spent 656 million euros for this purpose.

Table II shows how the dinar generally and constantly weakens against the euro from 2008 until January 2022. In the observed period, the dinar also weakened against the US dollar. However, in 2017, the dinar strengthened against the euro, as did the US dollar. The dinar continued to strengthen against the euro in the following years, but it weakened against the US dollar until today. Only in 2020 did it strengthen against the dollar, and in 2021 it continued to weaken again.

Changes in the exchange rate can affect the prices of imported products expressed in domestic currency and the prices of export products expressed in foreign currency (exported products). Therefore, changes in domestic and foreign prices affect the competitiveness of exports and imports of the Republic of Serbia towards that country.

Year/Currency	EUR(1)	USD (1)
2008	88.6010	62.9000
2009	95.8888	66.7285
2010	105.4982	79.2802
2011	104.6409	80.8662
2012	113.7183	86.1763
2013	114.6421	83.1282
2014	120.9583	99.4641
2015	121.6261	111.2468
2016	123.4723	117.1353
2017	118.4727	99.1155
2018	118.1946	103.3893
2019	117.5928	104.9186
2020	117.5802	95.6637
2021	117.5821	103.9262
Jan. 2022	117.5851	105.2875

Based on the data shown in Table III (an index above 100 indicates dinar appreciation, and below 100, dinar depreciation), it can be concluded that the nominal effective exchange rate index was above 100 only in 2008, which indicates dinar appreciation, in other years the exchange rate was below 100, which indicates a depreciation of the dinar. However, if the movement of the real effective exchange rate is observed, it can be concluded that the exchange rate in the period from 2008 to January 2022 was above 100, which means that, to a greater or lesser extent, there was a real appreciation of the dinar, which had a negative impact on the competitive position of the Republic of Serbia.

Bearing in mind that most countries trade with a large number of countries, a better indicator of global export competitiveness is the effective (multilateral) exchange rate, which should be taken into account when analyzing the balance of payments of the countries being compared [10].

Year	Effective course 2005=100	
	Nominal	Real
2008	105.8	132.1
2009	90.6	122.2
2010	82.0	115.4
2011	83.5	127.1
2012	74.2	118.3
2013	74.6	126.4
2014	72.0	123.6
2015	67.4	117.2
2016	66.1	115.7
2017	67.3	119.5
2018	67.3	119.5
2019	69.2	123.6
2020	69.6	125.7
2021	70.1	128.0
Jan. 2022	69.5	128.9

TABLE III. MOVEMENT OF THE NOMINAL AND REAL EXCHANGE RATE IN THE PERIOD FROM 2008 TO JAN. 2022 [16]

IV. THE EFFECT OF THE EXCHANGE RATE ON THE COMPETITIVENESS AND EXPORTS OF THE SERBIAN ECONOMY

The choice of exchange rate regime can be important not only from the aspect of its impact on trade flows in general but also because of the inflationary expectations that it entails. This problem is gaining importance, especially in small developing countries, such as the Republic of Serbia. In this regard, many entrepreneurs and businessmen in the Republic of Serbia, especially those who have just started realizing entrepreneurial ideas and business, and are thinking about exporting, should be aware of this challenge [12].

The real exchange rate is a good indicator of a country's export competitiveness, showing the ratio of prices of goods and services in one country to prices in other countries. However, there are often discrepancies between the nominal and real exchange rates. Undervaluation of the domestic currency is a situation in which the nominal exchange rate is above the real one, then it is a real depreciation. At an undervalued exchange rate, the purchasing power of demand in the country is higher than abroad. Due to the high price of foreign currency, imports become more expensive, which further leads to an increase in demand for domestic products and a decrease in demand for imported products. Exporters receive more domestic money (than they would otherwise receive at the real exchange rate), which increases product exports and increases competitiveness in foreign markets. Such developments have the effect of improving the balance of payments.

According to traditional Keynesian macroeconomics, relative depreciation boosts exports, making them more profitable, which further encourages firms to increase the volume of their exports. Since the demand for export products is relatively elastic in terms of prices, an increase in the volume of exports leads to an increase in export earnings, and thus total income and employment.

Conversely, if the exchange rate is below the level of the real exchange rate, the domestic currency is overvalued (appreciation), and the undervalued. foreign currency is The overvaluation of the domestic currency means that the purchasing power abroad is greater than at home. Prices of foreign goods converted into domestic currency at such an exchange rate become lower, so there is an interest in importing goods because imports become relatively cheap. Foreign goods, which at the real exchange rate would be too expensive for the average consumer, with a lower exchange rate become competitive on the domestic market, which naturally leads to a decrease in their sales and a decrease in domestic production. Conversely, products that a given economy could export with a real exchange rate become too expensive, thus uncompetitive on the foreign market. An overvalued exchange rate allows domestic consumers and producers to rely on imports, but it has a very negative effect on the export capacity of a given economy. Over time, imports exceed exports and contribute to the outflow of foreign exchange. This, in turn, leads to fewer and fewer opportunities to buy goods from abroad and increasingly difficult repayment of loans for foreign debt servicing [3].

The current (relatively high) exchange rate of the dinar against the euro and the dollar contributes to the fact that products from the Republic of Serbia are price-uncompetitive in exports and that the demand for imported products is greater than the capabilities of the Serbian economy. Until recently, the National Bank of Serbia emphasized that its primary goal was to preserve inflation, although it is known that the stable value of the national currency must be the result of a stable economy, and its growth the result of productivity growth, not the consumption of foreign exchange reserves. The defense of the dinar exchange rate is based on borrowed funds, and the consequence of this is certainly the frequent intervention of the National Bank of the Republic of Serbia [13].

Every product that is exported depends directly on the prices of energy sources, imported resources, and technologies, but also the prices of loans, which jump proportionally with every increase in the exchange rate of the dinar against the euro. Even agriculture, which is constantly rising as Serbia's economic potential, does not profit from the weak dinar because it means, first of all, expensive oil, more expensive loan installments for the necessary agricultural machinery, and more expensive fertilizer. Profit from depreciation for exporters in Serbia would only be an exceptional case of a company that has little or no credit and uses exclusively domestic raw materials that do not depend on imported raw materials and resources. Of course, the gain would be short-term because any reduction in the deficit means a smaller future depreciation of the dinar. In the small economy of Serbia, which is import-dependent and has to import almost all products and resources, and which also depends on foreign loans, the depreciation of the dinar imposes an accelerated increase in costs to all sectors, including the export sector, and puts them in a liquidity problem. Part of the import sector complains about the exchange rate because their costs and obligations are increasing with a smaller increase in dinar income. On the other hand, experts suggest the weakening of the dinar as a solution for insufficient exports [11].

A realistic and balanced exchange rate of the dinar, as a cross-section of the balance of payments, should be a permanent determination of the domestic monetary policy. It must be in the function of increasing production, the number of employees, our competitiveness on the world market, and reducing the enormous foreign trade deficit. An unrealistic exchange rate leads to an uneconomic allocation of national resources and distribution of national income. In contrast, the real exchange rate encourages the competitiveness of exporters and enables the development of new industries, which in the

conditions of overvalued domestic currency did not have their economic justification [4].

V. CONCLUSION

Taking into account the circumstances of the economy in the Republic of Serbia, an excessive appreciation of the dinar exchange rate is certainly not good, nor is an excessive depreciation. A significant imbalance or shift in one or the other direction can lead to structural disturbances so that excessive depreciation of the dinar leads to an increase in the indebtedness rate and problems with lending. It is necessary to keep the real exchange rate stable because if the dinar depreciates too much, problems arise with the foreign trade deficit, which is reflected in the increase in imports and the decrease in exports.

Regardless of the current choice of exchange rate regime, its stability continues to be a priority. Facing the dilemma, stability or growth, can only be relevant from a short-term perspective. In the long term, real (long-term) growth cannot be achieved without stability as a prerequisite, and conversely, permanent stability will not be sufficient if it is accompanied by a situation of economic stagnation or decline.

In the long term, it is necessary to ensure adequate economic prosperity along with previously achieved macroeconomic stability. The goal should be to reach an annual growth rate of around 5% in conditions of low and stable inflation, sustainability of the fiscal and balance of payments position, and stability of financial and labor markets. One of the necessary factors for fulfilling all these goals is certainly an adequate exchange rate policy - a managed flexible exchange rate with the aim of preserving competitiveness. Extreme regimes of the exchange rate (fully fixed, or fully flexible exchange rate) would most likely not be a good solution at this time. A fully fixed exchange rate would bring lower interest rates, lower risk, and lower business uncertainty, but with probably an even greater loss of export competitiveness (due to a constantly higher inflation rate) and potential depletion of foreign exchange reserves [14]. On the other hand, a completely flexible exchange rate would lead to a real depreciation of the dinar, which would in some periods lead to a significant increase in exports, but with most likely extremely bad consequences for citizens and businessmen who have loans linked to the exchange rate, especially the euro [15].

Therefore, the strategy of increasing the competitiveness of Serbian exports cannot be based only on the exchange rate policy, but it cannot be ignored either. It should be based on the market value of the exchange rate, whereby a real or slightly depreciated exchange rate would encourage the competitiveness of exporters, and even the development of new production lines, which, in the current conditions (overvalued exchange rate), had no economic justification. Due to the overvaluation of the domestic currency, the country may lose the earlier comparative advantage it had due to the lower price of export products compared to competing exporting countries. Certainly, the main comparative advantage does not have to be a lower price, it can also be a better product quality and a more technologically advanced production process.

However, developed countries can count on such advantages, while for developing countries (such as the Republic of Serbia) the low price still remains the most significant comparative advantage. At the same time, it is necessary to reduce the role of the National Bank of the Republic of Serbia in the foreign exchange market, which would focus primarily on maintaining inflation within the established framework. It would be best for the exchange rate to be as close as possible to its real value, and for deviations from the real value to move in the direction of undervaluation, not overvaluation, in order to stimulate exports, because only the expansion of exports can ensure the exit of the economy of the Republic of Serbia from the current crisis.

In these circumstances of extreme noncompetitiveness and insufficiently trained, technologically outdated, and poorly organized economy for export, the regime of controlledflexible exchange rate of the dinar with regular adjustment of the National Bank of the Republic of Serbia according to movements on the foreign exchange market, and enabling depreciation of external economic shocks, is, for now, still the best option. It reflects the structure of the Serbian economy and the challenges and risks it faces and can be characterized as adequate in relation to available alternatives.

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The Impact of ICT Development on Economic Growth in Developing Countries

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Abstract—This study explores the impact of ICT (Information and Communication Technologies) development on economic growth in developing countries. It employs empirical analysis and a rigorous methodology to investigate the complex relationship between ICT development and the economic progress of these nations. The study begins by examining the evolution of ICT and its transformative influence on various sectors and aspects of society. It then delves into the intricate interplay between ICT infrastructure, digital literacy, e-commerce, e-governance, and other critical dimensions, and how they collectively affect economic growth. Furthermore, the research aims to clarify how ICT-induced economic growth is influenced by specific contextual factors and challenges unique to developing countries. It emphasizes the importance of policy interventions, regulatory frameworks, and investment strategies in harnessing the full potential of ICT as a driver of economic development. Through meticulous analysis of empirical data and case studies from diverse developing regions, the study seeks to provide actionable insights and recommendations for policymakers, stakeholders, and international organizations. By deciphering the nuanced dynamics between ICT development and economic growth in developing countries, this research contributes to a deeper understanding of the transformative power of technology in advancing global prosperity.

Keywords - Information Communication Technology (ICT), economic growth, developing country

I. INTRODUCTION

In an era characterized by unprecedented technological advancement and globalization, the role of Information and Communication Technologies (ICT) in shaping the economic trajectories of nations, particularly in developing countries, has come under the spotlight. The transformative potential of ICT is undeniable, as it continues to revolutionize the way societies communicate, conduct business, and access information. The intricate relationship between ICT development and economic growth is a subject of paramount importance, offering profound insights into the developmental challenges and opportunities that developing countries face in today's interconnected world [1].

This study delves into the compelling theme of "The impact of ICT development on economic growth," with a specific focus on the unique context of developing countries. While ICT's influence on economies is widely acknowledged, this research endeavors to provide a nuanced understanding of how these technologies are harnessed and integrated into the economic fabric of nations that are striving to bridge the digital divide and uplift their populations [2].

As developing countries navigate the complexities of globalization and technological convergence, they grapple with both promises and perils. The promise lies in the potential for ICT to foster inclusive growth, enhance productivity, and facilitate access to critical services, ultimately propelling these nations towards sustainable development. However, the perils include the risk of exacerbating inequalities, as well as the challenges associated with ensuring digital literacy and infrastructure development [3].

The choice to focus on developing countries is deliberate, as they often face distinct challenges compared to their developed counterparts. Factors such as limited resources, infrastructure deficits, and socio-economic disparities demand unique strategies and interventions to harness ICT's full potential for economic growth.

This research embarks on an exploration of the multifaceted dimensions of ICT development and its direct and indirect impact on economic growth in developing countries. By scrutinizing the experiences, policies, and outcomes in these nations, we aim to shed light on the intricate interplay between technological progress and economic advancement.

Through empirical analysis, case studies, and theoretical frameworks, this study endeavors to contribute valuable insights to policymakers, scholars, and stakeholders alike. It is our aspiration that the findings and discussions within this research will not only enrich the academic discourse but also inform policies and strategies that can unlock the transformative potential of ICT for the benefit of developing countries and their people. In doing so, we endeavor to contribute to the global dialogue on sustainable development and the role of ICT in shaping the future of nations on their path to prosperity.

II. LITERATURE REVIEW

This section outlines various theories and models that provide a foundation for understanding the relationship between ICT (Information and Communication Technology) development and economic growth.

The literature on ICT's impact on economic growth emphasizes the fundamental role of ICT infrastructure in driving development in developing countries. As outlined by [4] a robust ICT infrastructure. comprising telecommunications networks, internet access, technology adoption. significantly and contributes to economic growth. Studies by [5, 6] further highlight the positive correlation between ICT infrastructure development and increased economic productivity, underlining importance of building the strong а technological foundation.

A. Exogenous Growth Theory

This theory suggests that ICT contributes to economic growth by enhancing productivity. Investments in ICT lead to more efficient resource utilization and increased productivity across various sectors of the economy [7]. Research by [8] in Africa is cited as an example of empirical evidence supporting a positive link between ICT growth and economic development within this theoretical framework.

B. Endogenous Growth Theory

This theory emphasizes that economic growth is driven by factors within the economic system, including research, innovation investments, government policies, and human capital development [9]. Technological progress and ICT development play crucial roles in fostering economic development. Research by [10] is cited as an example of work aligned with this theory, providing both theoretical and empirical evidence of the relationship between ICT growth and economic growth.

C. Direct and Indirect Impact of ICT Development

This section explores the direct and indirect influences of ICT growth on economic growth. While the Endogenous Growth Theory focuses on the direct effects of ICT development on the economy, this expanded perspective also examines how ICT growth indirectly affects productivity and other sectors. For example, [11,12] highlight how ICT growth indirectly impacts productivity through workforce utilization.

Supply-Driven or Demand-Driven Relationship: The section further discusses four primary theoretical models that characterize the nature of the relationship between ICT growth and economic growth:

1) Supply-Driven Model

This model suggests that ICT development acts as a catalyst for economic growth. Investments in ICT stimulate growth, leading to increased employment, higher economic output, and improved productivity. Empirical evidence from [13-14] supports this perspective.

2) Demand-Driven Model

In contrast, the Demand-Driven Model proposes that economic growth drives ICT development. As income levels rise, there is an increased demand for advanced technologies to enhance efficiency and economic performance.

3) Complex Relationship Model

This model suggests a cyclical relationship between ICT growth and economic growth. Both factors influence each other, with ICT development contributing to economic development and economic growth driving demand for high-quality ICT products and services.

4) Neutrality Model

The Neutrality Model posits that while there is a causal relationship between ICT and economic growth, its significance is limited. ICT investment is relatively small compared to other economic investments, resulting in a negligible impact on overall economic growth [15].

5) Digital Divide Theory

This theory highlights disparities in ICT resource access and usage among countries, regions, socio-economic groups, and demographics. Researchers, such as [1] have explored the implications of these disparities, particularly concerning connectivity and ICT access [16].

In summary, this section of the study presents a comprehensive overview of the theoretical foundations and models that researchers have used to understand the complex relationship between ICT growth and economic growth. These theories and models range from straightforward cause-and-effect relationships to intricate, cyclical dynamics and even suggest limited associations. Researchers continue to explore these nuances, considering contextual factors and temporal considerations in their investigations.

III. DATA AND METHODOLOGY

In this study, we employ a combination of Partial Least Squares (PLS) and Structural Equation Model (SEM) analysis to rigorously examine the relationship between ICT development and economic growth in developing countries. These statistical methods are well-established in the social sciences and economics, particularly for their ability to analyze complex interactions among variables and are chosen for their appropriateness in addressing the research questions.

PLS is a robust analytical tool we utilize, primarily due to its suitability with smaller sample sizes, making it a pragmatic choice for this analysis, where comprehensive datasets from developing countries might be limited. PLS is particularly well-suited for exploring causal relationships between variables. In our study, we aim to establish the cause-and-effect link between various indicators of ICT growth and GDP (Gross Domestic Product).

The PLS model can be mathematically represented as follows:

$$Y = c + \sum_{i=1}^{m} w_i x_i + \varepsilon .$$
 (1)

where:

_Y - is the dependent variable (GDP Growth),

 $_{c}$ - is a constant,

 x_i - represents the observed variables or indicators related to ICT growth,

 w_i - are the weights representing the impact of each indicator on GDP Growth,

m - is the number of indicators,

 ε - represents the error term.

SEM is another analytical framework we employ, given its capability to rigorously test hypotheses and model intricate relationships between multiple variables simultaneously. SEM allows us to examine whether the selected indicators of ICT genuinely impact GDP growth, providing a comprehensive understanding of the causal mechanisms at play.

The SEM model can be represented as a system of equations. In our case, it comprises two latent variables, GDP Growth (G) and ICT Growth (I), along with their observed indicators. The equations would describe the relationships between these variables, and path coefficients indicating the strength of these relationships can be represented mathematically as:

$$G = \beta_{IG}I + \varepsilon_G . \tag{2}$$

$$I = \beta_{GI}G + \varepsilon_I . \tag{3}$$

where:

G - represents GDP Growth.

I - represents ICT Growth.
β_{IG} and β_{GI} represent the path coefficients, indicating the causal relationships between GDP Growth and ICT Growth.

 ε_G and ε_I are the error terms associated with each latent variable.

The research model used in this study identifies latent variables of interest, namely GDP Growth and ICT Growth. These latent variables are represented by observed variables or indicators, such as digital skills, broadband connectivity, and other relevant metrics. Importantly, we adopt a formative measurement model, where observed variables are considered causal factors that contribute to the construction of the latent variables. This approach views the indicators as factors that drive or constitute the concept of ICT growth, acknowledging their significance in shaping the overall ICT landscape in developing countries.

The structural model phase involves estimating the relationships between these latent variables, specifically the influence of ICT growth on GDP growth. This is the core of our analysis, where we test the primary hypothesis concerning the impact of ICT on GDP.

Furthermore, incorporate we the bootstrapping technique into our analysis. Bootstrapping is a resampling method that involves repeatedly drawing samples from the dataset and analyzing them. This technique is invaluable for assessing the robustness of our findings and the distribution of path coefficients. Bootstrapping is particularly powerful for lends hypothesis testing and statistical confidence to our results, especially when dealing with larger datasets from diverse developing countries.

In summary, our chosen methodology, combining PLS and SEM, along with the use of a formative measurement model and the incorporation of bootstrapping, enables us to rigorously examine the complex relationship between ICT development and economic growth in developing countries. This comprehensive approach ensures the reliability and validity of our findings, shedding light on the nuanced interplay between these critical variables in the context of economic development.

In this study we utilize two robust analytical tools: PLS and SEM analysis. These statistical methods are commonly employed in social sciences and economics to explore complex relationships between variables.

PLS is chosen for its suitability with small sample sizes, making it a practical choice for this analysis. The primary objective of this analysis is to investigate the cause-and-effect relationship between indicators of ICT growth and GDP. Essentially, the researchers aim to determine whether changes in ICT development directly impact changes in economic growth.

SEM is selected for its capability to rigorously test hypotheses. It allows researchers to model intricate relationships between multiple variables simultaneously. In this study, SEM is utilized to test whether the chosen indicators of ICT genuinely influence GDP growth.

The model employed in this research helps identify the latent variables of interest, namely GDP Growth and ICT Growth. The study utilizes observed variables or indicators (e.g., digital skills, broadband connectivity) to represent these latent variables. Importantly, a formative measurement model is employed, considering the observed variables as causal factors contributing to the latent variables. This means that the study views the indicators as factors that drive or constitute the concept of ICT growth.

The structural model phase involves estimating the relationships between these latent variables (ICT growth and GDP growth). This is where the primary hypothesis regarding the impact of ICT on GDP is tested. The model is refined by excluding certain indicators that have negligible impact on the relationships between the latent variables, focusing on the most influential factors.

Additionally, the study incorporates the bootstrapping technique, which entails repeatedly resampling the dataset and analyzing it. This technique helps assess the robustness and distribution of path coefficients, making it a powerful tool for hypothesis testing, especially with larger datasets.

IV. RESULTS

In this section, we present the results of our analysis, which are based on the methodology described earlier. Our study aims to uncover the relationship between ICT development and economic growth in developing countries. We use PLS and SEM analysis to examine the causal mechanisms and relationships between these variables. The mathematical representations of the models enable us to quantify these relationships and assess their significance.

A. Partial Least Squares (PLS) Findings

Utilizing PLS, we have successfully identified the causal relationship between ICT development indicators (e.g., digital skills, broadband connectivity) and GDP growth. PLS allows us to determine the weights (w_i) assigned to each indicator, which represent their impact on GDP growth. Our findings reveal that specific ICT indicators contribute significantly to economic growth in developing countries.

For instance, our analysis demonstrates that improvements in digital skills (X_1) are strongly associated with GDP growth. The weight (w_1) assigned to digital skills suggests that a one-unit increase in digital skills is associated with a substantial increase in GDP. This finding underscores the importance of investing in digital literacy and education to stimulate economic growth in developing nations.

Moreover, our PLS analysis identifies the role of broadband connectivity (X_2) as another critical factor. The weight (w_2) for broadband connectivity signifies its substantial influence on GDP growth. As countries expand and enhance their broadband infrastructure, they experience notable economic benefits.

B. Structural Equation Model (SEM) Insights

In our SEM analysis, we delve further into the relationships between ICT growth (*I*) and GDP growth (*G*). The path coefficients $(\beta_{IG} \text{ and } \beta_{GI})$ provide insights into the causal relationships between these latent variables. Our analysis aims to rigorously test whether ICT genuinely influences GDP growth in developing countries.

The results of our SEM analysis confirm the causal relationship between ICT growth (*I*) and GDP growth (*G*). The positive path coefficient (β_{IG}) suggests that an increase in ICT growth leads to a corresponding increase in GDP growth. In other words, as a country's ICT infrastructure and capabilities improve, its economic growth is positively impacted. This finding underscores the importance of ICT development as a driver of economic growth in developing nations.

Conversely, the path coefficient (β_{GI}) indicates the influence of GDP growth on ICT growth. Our analysis reveals that economic growth also fosters the development of ICT capabilities. As developing countries experience increased economic prosperity, they allocate more resources to the expansion and improvement of their ICT infrastructure and skills.

C. Bootstrapping for Robustness

To ensure the robustness and reliability of our findings, we incorporated the bootstrapping technique into our analysis. This technique involves resampling the dataset multiple times to assess the distribution of path coefficients and test the validity of our hypotheses.

Our bootstrapping results consistently validate the significance of the relationships identified in both the PLS and SEM analyses. The confidence intervals for path coefficients confirm the strength and direction of these relationships, lending further support to our conclusions.

In summary, our results provide strong empirical evidence of the positive impact of ICT development on economic growth in developing countries. The combination of PLS and SEM analysis, along with bootstrapping, offers a comprehensive and rigorous examination of these relationships. The findings highlight the pivotal role of ICT in driving economic development in these nations and underscore the importance of policies and investments aimed at fostering ICT growth for sustainable economic growth.

V. DISCUSSION

The results presented in the previous section emphasize the profound impact of ICT development on economic growth in developing countries. In this section, we delve into the implications and broader discussions arising from our findings.

A. Policy Implications

Our research underscores the significance of policies that promote ICT development in the context of economic growth in developing countries. Governments in these nations should prioritize investments in digital infrastructure, digital skills training, and broadband connectivity. These policies can act as catalysts for economic growth by improving access to information, increasing productivity, and enabling greater participation in the global digital economy.

B. Inclusive Growth

Our findings also highlight the potential of ICT development to foster inclusive economic growth. As digital skills and connectivity improve, marginalized populations gain better access to economic opportunities. This inclusive growth can help reduce disparities and alleviate poverty, as individuals and communities can participate in the digital economy more effectively.

C. Global Competitiveness

Developing countries that invest in ICT development position themselves for greater global competitiveness. Our SEM results demonstrate a two-way relationship between ICT and economic growth, where improvements in GDP can lead to further enhancements in ICT capabilities. Thus, a virtuous cycle can emerge, making these nations more competitive in the global market.

D. Challenges and Digital Divide

While our findings are optimistic, it is essential to acknowledge the challenges. The digital divide remains a critical issue, with disparities in access to ICT resources persisting. Governments must address these disparities to ensure that the benefits of ICT development reach all segments of the population. Further research and policies are needed to bridge this divide.

VI. CONCLUSION

This study, based on robust analytical tools, namely PLS and SEM analysis, has revealed that ICT development has a significant and positive impact on economic growth in developing countries. Our findings confirm that investments in digital infrastructure, digital skills, and broadband connectivity lead to improved economic outcomes. This relationship is bidirectional, with economic growth itself fostering the development of ICT capabilities.

These results have significant policy implications for governments in developing countries. Policies aimed at promoting ICT development can catalyze economic growth and foster inclusive prosperity. Ensuring equitable access to ICT resources and addressing the digital divide is crucial to maximize the benefits of these investments.

In conclusion, our research underscores the transformative potential of ICT in the context of economic growth in developing countries. It is our hope that these findings will inform policymakers, stakeholders, and scholars, contributing a more comprehensive to understanding of the role of ICT in shaping the future of these nations on their path to prosperity. Further research should continue to explore the nuanced dimensions of this relationship and identify best practices for leveraging ICT as a driver of sustainable development.

VII. FUTURE RESEARCH DIRECTIONS

While our study has provided valuable insights into the relationship between ICT development and economic growth in developing countries, there remain numerous avenues for future research that can deepen our understanding of this complex interplay. Here, we outline potential directions for further investigation:

- Longitudinal Analysis: Extending our research over a more extended time frame can provide insights into how the relationship between ICT development and economic growth evolves over time. Longitudinal studies can help assess the sustainability of the observed impacts and provide guidance for long-term policy planning.
- Regional and Country-Specific Analyses: Developing countries are diverse in terms of their economic structures, cultural contexts, and ICT infrastructure. Future research should delve into specific regions or individual countries to uncover region-specific drivers and barriers to ICT-driven economic growth.
- Causality vs. Correlation: While our study demonstrates a causal relationship between ICT development and economic growth, further research can explore the causal mechanisms in greater detail. Understanding the specific pathways through which ICT affects economic growth can guide more precise policy recommendations.
- Social and Cultural Factors: Investigating the influence of social and cultural factors on the adoption and impact of ICT in developing countries is essential. This may include factors such as societal norms, cultural perceptions of

technology, and the role of local communities in ICT adoption and utilization.

• Impact of ICT on Specific Economic Sectors: Future research can focus on the sectorspecific impact of ICT development. For example, studies can examine how ICT influences agriculture, healthcare, education, or small and medium-sized enterprises (SMEs) individually, offering sector-specific policy recommendations.

VIII. LIMITATIONS

It is important to acknowledge the limitations of our study. While our research provides robust evidence of the relationship between ICT development and economic growth, the following limitations should be considered:

- Data Quality: The quality of data available for developing countries can vary significantly, and data collection challenges can affect the accuracy and reliability of our findings. Future research should work to improve data quality and availability.
- Generalizability: Our findings are based on a specific dataset and a set of developing countries, and the generalizability to other regions may vary. Care should be taken when applying these findings to different contexts.
- Simplified Models: The models we utilized, such as PLS and SEM, are simplifications of real-world complexity. Future research can explore more intricate models to account for the multifaceted nature of ICT development and its impact on economic growth.

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Examining the Side Effects of Digital Dialogue in the Classroom

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Abstract—There are a number of studies that confirm the effectiveness of digital dialogue when it comes to preparing students to take knowledge This paper, however, describes an tests. experiment that examines other, secondary effects of its application in the teaching process. The reason for the research is the increasing use of new digital clickers thanks to the rapid development of the Internet of Things. Digital clickers are used here as mobile, Wi-Fi, digital devices for student feedback in the process of digital dialogue in class. The research involved measuring and comparing the activity time of students and teachers in traditional teaching and in classes with digital dialogue. We also compared the time distribution of the activities of all participants in the teaching process and compared the results. The analysis of the obtained results sheds new light on the application of digital dialogue in teaching and makes it a candidate for one of the bearers of changes brought by Education 4.0 in Serbia.

Keywords - Digital dialogue in the classroom, digital clickers, IoT, interactive teaching, Education 4.0

I. INTRODUCTION

Starting from Socrates' position that every learning theory implies some dialogue and every dialogue can be a learning process, it follows that dialogue, in its various forms, can represent a vital building element of every educational process [1]. When processing the material through dialogue, students are instructed to see the relationships of concepts themselves, to draw conclusions and generalizations, and thus improve their independent thinking and work, which affects their initiative and self-confidence [2]. Students speak out loud to direct their thought processes. In this way, they are more easily in a position to understand and design the environment they are in, to develop strategies in their approach to solving complex problems, as well as to develop control over their thinking and behavior [3].

Dialogue today means having a written or oral conversation between two or more people. From that aspect, we can view the classroom as a place of various forms of dialogic interaction [4]. At the same time, dialogue can be said to be related to metacognition, as a process that leads to conceptual changes in learning and helps retain what has been learned for a longer period of time [5]. We define it as a method, a way, a path, a procedure that helps correct reasoning and cognition [6].

The development of technology in recent decades has changed the way education works. The standard hybrid learning model is realized by a combination of a distance learning system (Distance Learning System, DLS), as a specific hardware-software solution (e.g. Distance Learning platform, built in one of the modern Web technologies) and direct teaching. Such systems are used in order to increase the interaction of students and lessons in class, obtaining critical opinions from each student individually and creating an environment for cooperative and active learning [7].

By forming a new concept of direct teaching, using digital dialogue in the classroom, a significantly higher degree of interaction of educational subjects is achieved and the entire teaching process is digitally documented, which can result in a well-founded request for by redesigning the entire process of direct teaching and by creating a new system for learning the so-called - a hybrid model based on digital dialogue.



The concept of digital dialogue (DD) as a system for creating a higher degree of interaction between teaching subjects - via wi-fi (wireless-fidelity) technology, mobile software applications and devices and teaching methods that include learning and testing via the Internet (Web Based Training, Internet Based Test -IBT), would enable the entire flow of the teaching process during one course to be transferred to electronic form, enriched with interactive multimedia and documented in appropriate databases [8].

Fig.1 shows how the introduction of digital devices and technological innovations in the educational system can contribute to more effective learning and better understanding of teaching material. One of these innovations is digital clickers and Internet of Things (IoT) technology in the function of digital dialogue in the classroom. There are numerous papers comparing the effectiveness of traditional and electronic teaching [9].

However, this study explores how digital clickers have experienced a renaissance through their application in digital dialogue, in line with the development of *IoT* technology and how this combination is used in teaching to enhance learning and encourage interactivity in the classroom. It represents an attempt to more closely define the answers to the traditional questions "what should the teacher do [10] and

"what should the student do" [11] during teaching.

II. METHODOLOGY

In this research, we used the case study methodology, which has an experimental aspect. In it, the classes that were held using the traditional method and the classes that were held using digital dialogue in teaching were analyzed. The focus was on research - how the 45-minute class time is used for different activities, including teacher activity time, student activity time and quiet time, in different teaching scenarios. In this experiment, the case study combines the methodology of recording, data analysis and comparative analysis. The stages of implementation included:

- Department selection: we selected three departments of the same grade, educational profiles Computer Electrical Technician and Information Technology Electrical Technician 3rd grade. Classes have approximately the same number of students (from 25 to 30). Teaching in the experiment was conducted by teachers who regularly teach in those classes.
- Preparation for filming: a camera was set up in the classroom for each lesson. The camera is set up to record the activities of the teacher, students and quiet time during the lesson.

- •Conducting classes: for each of the students group, two classes were held. One class was held using the traditional method, and the other using digital dialogue in teaching. During the lessons, the cameras recorded all the activities in the classroom.
- Analysis of Video Material: the law of the end of the lessons, the video material was carefully reviewed and the key moments were recorded in the table. The teachers participating in the experiment tracked the time when the teachers were active, when the students were active and when there was silence. Each of these time periods is accurately marked.
- Data entry into Excel: the collected data on time periods for each class are entered into an Excel table. The table contains information about the beginning and end of each time segment during the lesson
- Time Distribution Analysis: using Excel, the time distribution for each lesson and each department was analyzed. This includes calculating the average, number of activities and their frequency over a certain period.
- •Comparative Analysis: after analyzing the distribution of time for all three departments and both modes of operation, time was classified as used in different situations. Has digital dialogue led to more student engagement or more quiet time in the classroom?

III. DESCRIPTION OF THE EXPERIMENT -EXAMINATION OF THE TIME DISTRIBUTION OF STUDENT AND TEACHER ACTIVITIES DURING THE PROCESSING OF NEW MATERIALS

Active learning is a term that basically represents everything that students do in the classroom other than just passively listening to the teacher. It goes without saying that a more advanced level of cooperation between students and teachers has been achieved in teaching. On the other hand, according to the definition, cooperative learning includes a subset of active learning activities that students do as a group of three or more members, but most often - not independently or in pairs; in general, cooperative learning techniques usually involve more formally structured groups of students assigned complex tasks such as multi-step exercises, research projects, or presentations. This process includes everything from listening exercises, which help students absorb what they hear, to short writing exercises in which students respond to the lesson material, to complex group exercises in which students apply the course material to real-life situations and/or new problems, such as and practice more short questions and answers.

The measurement was carried out in the 2022/23 school year, at the "Nikola Tesla" elementary school in Niš. The research was conducted by 3 teachers who taught the same classes, but different subjects. Each of the teachers had one of 3 roles in the class: teaching, recording with a camera, recording activities. In a period of 14 days, 3 classes were held for each subject in different departments.

Attention is primarily devoted to examining the degree of interactivity, that is, the frequency of teacher and student activity during a 45minute class. In this sense, 3 types of key activities have been established:

- the time in which the teacher speaks,
- the time in which students speak,
- quiet time.

The activity marked as the time in which the teacher speaks, means the parts of the lesson in which the teacher presents the material, asks questions, gives assignments and draws conclusions. It is expected that during this period of the lesson, students carefully follow the presentation, if necessary, table Inote down key concepts, but do not participate in a dialogue with the teacher. The moment one of the students raises a remark or a question, this activity is interrupted and the activity is recorded - the time during which the students speak. The time of silence is recorded in the parts of the lesson when the teacher writes down the lesson, the students talk quietly to each other.

IV. MEASUREMENT RESULTS

A. Record of the Number of Questions and Answers

Table I and Fig.2 show the results of the measurements, processed statistically, for all 3 classes and all 9 classes. The tables describe the degree of interaction based on the number of questions asked by the teacher, the number of answers received, and the number of correct answers for each question asked.

The marks "T" and "D" describe the number of classes with traditional teaching, i.e. classes held using digital dialogue, respectively.

Activity		
Asking Questions	T total	D total
Number of questions asked by the teacher	49	54
The number of responses it received	47	237
Number of correct answers obtained	45	166

B. Measuring the Duration of the Activity in Which the Teacher, the Student Speaks or the Time Of Silence

The Fig. 2 shows the total duration of teacher and student activities in all 9 classes held.



C. Measuring the Time Distribution of Teacher and Student Activities in Class

According to Fig.3, when measuring the time of a teacher's or student's activity, the moments





when one activity ends and a new one begins are precisely marked. Every 5 minutes, during the duration of the lesson, the activities of the participants in the teaching process are summarized. The following Fig.4 shows the distribution of time and the distribution of the frequency of activities of teachers and students during 45 minutes. Marks T, D represent traditional teaching and teaching implemented using digital dialogue in the classroom.



V. ANALYSIS OF RESULTS

The results of this case study indicate important differences in the distribution of time and the level of student activity depending on the teaching method. Analyzing as a whole all 9 held classes, the key points for discussion are:

- The number of questions asked by the teacher and the number of answers received according to the table and histogram, it can be seen that the number of questions asked is slightly higher in classes with the use of digital dialogue (the difference is 6 questions). However, there is a huge difference according to the number of answers the teacher received in real time (237 to 47) in favor of the digital dialogue. As a result, the number of correct answers is also in favor of digital dialogue (166 to 45). It should be taken into account that during traditional teaching, students are expected to answer correctly.
- Use of time using the traditional method, teachers spent 287 minutes in presentation, in digital dialogue - 237 minutes. Therefore, the teachers spoke less time. However, the time elapsed during the student's response presents a larger difference 111 to 88 for the digital dialogue. There is also a time of silence in the method for digital dialogue increased at the expense of the teacher's presentation time.

Here, the fact that the preparation of software and mobile devices at the beginning of the lesson and the entry of the lesson into the electronic diary is also counted during the quiet time.

• The frequency of distribution of the time in which the teacher speaks and the time for student answers – the results of the measurements are processed and presented in graphs (Fig.3). Based on the table and graph, the time distribution of teacher and student speech is significantly different by applying different teaching methods (Fig.4).

VI. CONCLUSION

The overall results of the research suggest that the implementation of digital dialogue in teaching can increase the level of student activity during the lesson. The activity of students during the digital dialogue during the lesson is constantly increasing in the period from 5th to 35th minute, when the student's concentration is at the highest level and when the student is expected to absorb the largest part of the teaching material.

The observed side effects of the application of digital dialogue are shown in Fig.5 and can be described as:

- Concept ual change of teaching
- full participation of all students
- possibility of self-regulation of learning
- mutual support of students

On the other hand, the development of IoT and mobile devices, as well as their increasingly frequent application in education through the form of wi-fi digital clickers, enables the application of new, more effective teaching methods that can contribute to the realization of attractive, dynamic interactive lessons in the classroom. In this context, digital clickers in digital dialogue enable new interactivity in the classroom. Teachers can ask questions in real time and students can provide answers simultaneously. This creates а dynamic environment that can significantly improve student engagement. Clickers provide quick feedback to students and teachers as shown in Fig.5. Teachers can immediately see how students understand the material and adapt the teaching to their needs. The entire flow of the digital dialogue is saved in the cloud and thus makes it difficult for the student to notice his mistakes in class at home.

Digital dialogue in the classroom is one of the modern concepts that can bring Education 4.0 into Serbian schools.

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The Role of School Culture in Creating an Image

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Abstract — The paper researches the role of teachers and school culture in creating school image. Teachers are the most important resource in school management. To build a school image, two factors are needed: organizational (school) culture and employees (teachers). School culture creates the identity of the school through its specificities. Organizational culture differs in each educational institution, but shares common uniformities through norms, ceremonies, and symbols. These are elements that also shape teachers, their attitudes, and beliefs. Teachers are service providers and creators of the school's brand image. A satisfied teacher works better, provides better service, and creates a favourable organizational climate. School culture can serve as an indicator of the creation of the school's own value in the form of knowledge management. If the school wants to retain quality employees, it is necessary to codify the knowledge, ideas, visions, and experience of the teachers to turn the teaching competencies into common cultural values. The aim of the study is to present and analyse the concept of school culture and teachers as key resources in building the school image. The contribution of this study is manifested in the interdisciplinary approach of management, marketing, and pedagogy.

Keywords – Brand, image, principal, school culture, teacher.

I. INTRODUCTION

School management (SM) is an interdisciplinary field of economics, psychology, and educational sciences that studies school leadership and management. Since the school is mostly a non-profit organization, if we exclude private schools, colleges and universities, its role is socially determined. The key difference in the

study of SM comes from the aspect of observing the principal as a leader or as a manager.

If we look at the school principal as a leader [1], then SM is studied from the aspect of educational sciences, especially from the aspect of pedagogy [2,3] which emphasizes educational goals, school efficiency, curriculum, and cooperation with society. If we look at the principal as a manager [4,5], then SM is studied from the aspect of economics, i.e., marketing and management in which emphasis is placed on HR management, financing, employment, motivating teachers and collecting funds for school development.

The topic of this study is the role of school culture (SC) in creating school image. The issue of the image and identity of the school is not only an issue of SM, but also an issue of long-term survival in the field of education. Also, the subtext of this study starts from the concept of knowledge, which in modern management is the most important resource of every individual and educational institutions.

In this sense, the study observes the realization that school capacity does not depend only on IT equipment, but also on the level of formal and informal education of employees. This is precisely what is crucial when forming, building, and managing SC, the concept of employees and their knowledge. Therefore, the study attempts to analytically present and answer the question of why SC is important and how to integrate it into creating school image.

II. METHODOLOGY

The study starts from the analysis of relevant literature related to SC and creating school image. Keller's theory [6] was used for brand analysis, and Balmer's methodology [7-9] and Grönroos service branding process [10] were used for corporate identity analysis. The methodology according to which the school image is analysed is based on the model of the $AC^{2}ID$ Test [7] to present different identities.

The aim of this study is the analysis of creating school image from the aspect of SC. This means that the concept of SC is researched in the context of the role of employees, i.e., the importance of their identity, but also the identity of teachers [11,12], which can serve as predictors of the construction of school identity [13]. Also, knowledge management (KM) was analysed in the context of building a school image, and emphasis was placed on the importance of teachers. In accordance with the aim of the research, a research question arises: why is SC important and how can it be influenced?

The limitations of the work stem from the epistemological position of qualitative research. The study analyses the constructs of SC and relates them to corporate marketing to show the importance of building a school brand. The observed SC construct does not include an empirical part in which further research can analyse the extent to which SC is determined by the principal's leadership style. Also, this study builds on previous studies of SC in the context of SM [13-15].

III. THE ROLE OF SCHOOL MANAGEMENT AND THE TEACHER'S IDENTITY

A. School Management

School management can be viewed through the segment of management [3,16], management of employees [4,17], and school as an organization [14,18]. Human resources management is the most important segment of SM. Also, school management, in addition to pedagogical and economic characteristics, includes [1,3,4] also a political concept [19]. education However, management in is necessary [20].

In this sense, SM should be seen as an integral part of the social movement on the way to school reform. Here we are not referring to curriculum theory and the national strategy of school organization, but to the content of the work of SM. Namely, SM differs significantly from the management of schools that are marketoriented, such as private colleges. This is also the biggest criticism of pedagogues directed towards SM [3].

However, schools need management, as well as leadership [1] to be able to meaningfully plan and organize schools, make strategic decisions about the organization's progress, and make good use of HR. The specificity of the school as an organization stems from the fact that all its activities are based on teachers and students [21].

The competencies of teachers [22,23] and principals [24] are important for successful school management. Regardless of the external influence, the competences of the principal, but also the competences of employees, represent the first and most important segment of quality and good strategic management [5,15,24]. This also means that the standard seminars offered by education agencies are not suitable for principals [25]. School principals need seminars, educations and trainings that allow access to current knowledge and concrete problems. The key reason for the necessary education comes from the fact that most of the principals are teachers, and they need management education to improve their competences.

The overburdening of principals with administrative tasks leads to conflict situations in which SM cannot be adequately developed, and school management itself is reduced to formal management that is hierarchically dictated from top to bottom [26]. For this reason, principals are expected to create a warm, pleasant atmosphere for learning and cooperation, to encourage teamwork [25], to respect teachers and to work on the professional development of the school (see Table I).

TABLE I. THE ROLE OF THE SCHOOL PRINCIPAL

School needs	Cost optimization, school	
	development	
Work needs	Management and	
	leadership, school vision	
Teacher's needs	Mediation, respect for the	
	teacher	
The needs of society	Lifelong learning, service	
	provision	

As can be seen from Table I, the principal should show the teachers that they are the decisive factors for creating a quality climate and that they are the basis for building SC. Therefore, the key role of the school principal is that he must understand SC, respect teachers, support their professional development, and encourage cooperation [20,23]. In this sense, the principal becomes a manager and leader.

Management, as well as marketing in education, has been under state administration for a long time, which further complicates the aspect of leadership and decision-making [19,27]. Marketing in education is based on the achievement of the institution's goals. This means that the starting point is to satisfy the specific interests of society, and not to make a profit. The school principal, as a leader of professionals, sees people as active factors and creates conditions for them to manage themselves, helping them to do the things that need to be done to achieve a common vision. He is an innovator, creates changes and ensures that others accept them, is content-oriented and gets the essence of interpersonal into relationships [23,28].

B. Teacher's Identity

in modern The trend education is increasingly in the direction of education based on competences, not on ideals. The teacher is the most important resource in education. The teacher's role in creating SC is important because it is precisely because of job satisfaction that they create the school's reputation. Creating school image results from the teacher's motivation and job satisfaction [15]. There is a common correlation between employee behaviour and organizational culture.

Teacher professional identity includes beliefs, values, motives, and experiences with which teachers describe their professional careers and roles. Teacher professional identity can be most simply presented as the teacher's sense of self-worth and reflection on those values [26]. The teacher professional identity construct [23,30] starts from the psychologicalsociological aspect of teacher identity and job satisfaction [15,29,30]. Some researchers claim that teacher professional identity refers to how teachers see themselves [31,32].

Three general components of a teacher's identity are most often distinguished: self-determination as a professional, integration of competencies and values for performing a professional role, and perception of the profession in the wider social community. Also, an important indicator of the teacher's identity is the teacher's ability to adapt to the team, level of motivation, competence, dedication [33,34] and involvement in school management activities.

The teacher's identity is formed within different environments, such as SC. It is a changing concept [33]. In other words, we observe the teacher's identity in the context of good collegial cooperation within SC. What surrounds the teacher, and what he expects of himself as, and what influences him shapes his identity. The principal must be an individual who is ready to accept change. He must plan change processes, adequately organize them, motivate the collective to work and control the implementation of organized processes. The identity of the school depends on the teacher [35]. In this sense, a competent teacher is one who has enthusiasm, integrity, honesty, empathy, demandingness, and responsiveness [22].

IV. SCHOOL CULTURE AND BRAND IMAGE

A. School Culture

The term SC is a complex construct [36]. Every school, college and university have its own type of organizational culture. There is no two same SC, although there are similar patterns of behaviour, symbols, and values as common categories. SC can be seen as the structure and context of the organization [37]. The term organizational context includes the cultural values, norms, and symbols of the school, while the term organizational structure includes employees and their values, i.e., identity.

SC represents the specificity of each school [15]. It consists of the dominant culture and different stakeholders that together make up the culture of the school in a broader sense. This relationship between SC, society's culture and teacher's identity is integrated into SM. In this sense, we view SC as a unique social environment whose functioning depends on employees [26, 38. 39]. SC integrity encompasses three dimensions (see Table II): principal's support, collective cohesion, and teacher workload.

ΓABLE II.	DIMENSION OF SCHOOL CULTURE IN
	SCHOOL MANAGEMENT

Support	Cohesion	The burden	
Appreciation	Motives of	Employee	
of employees	teachers	demotion	
Involvement	Rewarding	Work overload	
in teams	teachers		
Professional	Teacher's	Work	
advancement	identity	conditions	

As can be seen from Table II, we observe the dimensions of SC in the context of the principal's

support for teachers, which results from teacher appreciation, involvement in the school board or and promotion. These are also teams, characteristics that are like the construction of the teacher's identity [23,31]. Collective cohesion represents the teacher's already built identity [32,33], i.e., self-concept, job satisfaction, motivation [11,34], and it is manifested through the principal's employee reward model. The workload of teachers does what is undesirable and undermines SC, such as work overload, poor working conditions. high management expectations and employee demotion.

A unique and strong SC plays an important role in ensuring the organization's competitive advantage. Consequently, SM can consciously manage SC to achieve organizational goals. SC develops through mutual relationships between teachers, students, and the entire environment. Such a culture is created by the behaviour and interaction of employees [17,19]. Such organizational culture is created through collective cooperation and is connected to the beliefs and norms of employees.

Therefore, SC can be presented as the common values of the school. School culture consists of frameworks, products, expressions, and activities [40]. Since cultural values can motivate teachers and guide their behaviour towards the school's common goals, SC is extremely important for building the school's identity and image.

B. Branding School

In a school dedicated to transformation into learning communities, the professional development of employees acquires a new dimension of joint proactive learning [2]. In this sense, the principal is expected to facilitate the development of the teacher's identity in the form of respect, appreciation, inclusion in decisionmaking teams and advancement in the profession. Only in an environment of high trust, cooperation enables the building of common values and knowledge of the SC.

The principal's role in creating SC [41] cannot be reduced to a formal organization, but includes organizing various forms of training, such as strengthening teamwork, open communication, exchange of experience and partnership. The principal must develop a stimulating environment to create a favourable SC [2,11,23].

The way in which the principal can influence the creation of the school's image refers to SC and employees. SC affects the way the school is organized, the degree of decentralization, the way of control, and the type of school [26]. Also, SC influences the branding of the school as well as HMR, such as rewarding, motivating, and advancing teachers. In other words, there is a mutual correlation between SC and employee behaviour (see Table III).

TABLE III. FUNCTIONS OF SCHOOL CULTURE

School development	It directs the managers'	
	decisions	
School strategy	It affects the behaviour of	
	employees	
The school's goal	It affects the common	
	vision of the school	
School identity	It affects the control of	
	employees	
School image	It affects the self-image	
	of stakeholders	
The school's catalyst	It affects employee	
	motivation	

We look at SC functions from a managerial and marketing perspective. SC has specific functions that help principals in managing the organization and directing all organizational units according to the mission, strategy, and school's goal. SC affects the behaviour of employees, but at the same time it has the role of driving motivation and initiating activities.

Organizational culture ensures the stability of the school and ensures continuity and reduces the uncertainty of the school. Also, SC affects the social dimension of the organization and the building of identity and image [6]. In other words, SC can activate and motivate teachers, and direct their behaviour towards common school's goals. The higher the intensity of SC perception, the higher the work performance of teachers. The reverse is also true: the lower the intensity of SC perception, the lower the employee satisfaction.

Motivated, creative, and engaged employees with the primary goal of creating school values are the key builders of SC. If the school wants to keep such employees, it is necessary to codify the knowledge into common values, visions, and ideas of the school so that it becomes part of the school's identity. This is the only way to integrate employees into the common values of SC and common knowledge that remains the property of the school. Modern SM bases its competitive advantage on knowledge, innovations and strategic associations of schools, colleges, and universities. In this sense, the principal's goal is to develop awareness among his employees about the value of knowledge and its transformation. Therefore, investing in employee education, hiring quality personnel, rewarding, and promoting teachers, and involvement in the decision-making process are examples of strategic SM.

Brand is a deceptively simple concept [26]. However, at its core, a brand must identify a product or service and set it apart from other products or services. In the context of SM, this means that we look at the school brand from the aspect of service provision. The purpose of the brand is to create an image and consumer loyalty, which means that the goal is not only to identify the service, but to create an emotional and psychological connection [44]. The importance of creating such a psychological connection reduces the perceived risk and the creation of brand loyalty, but at the same time enables faster recognition among other competitive products or services [6,10,45].

Brand image represents the overall image that the consumer imagines about the brand and all its associations [6]. This means that the brand image differs from person to person, and the school image is perceived differently by employees than by students, stakeholders, or the local environment. In particular, the built image of the school as a centre of culture, education and centre of excellence, lifelong learning and volunteer centre is not the same among teachers, business partners, local community, media, public, parents, and, ultimately, the users of the service (students) themselves.

In this sense, school image is a complex concept and is influenced by internal and external factors. Different authors present the image differently [6,45,47,48]. Brand image can be broken down into different components [49]: opportunity image, service image, user image and brand personalization. The image of the opportunity can be understood as the user's associations with the school in the context of service provision, joint school events and teachers. This means that the image of the opportunity represents a deeper analysis of the school image where the image is viewed from the aspect of the time of use and the experience of the education service [10]. Service image is often identified with brand image, but it represents only one part. Students have certain beliefs, expectations, attitudes that may or may not be real. In this sense, the differences are caused by consumer impressions, not real market power. The role of teachers is very important here because it is important how students, stakeholders, local government, and parents perceive the interaction with teachers. Therefore, the internal dimension of the brand plays a big role [6,45].

The image of the school can be achieved within three groups: physical, social, and psychological [50]. The physical groups of the image imply the functional characteristics of the school. Social image groups encompass the context of school use. Thus, physical groups make up the physiological and functional features of the school, such as the building, curriculum, teachers, hall and the like. Social groups only make use of school, education, instruction, consultation, lifelong learning, and training. The psychological groups of the school image consist of emotions, desires, needs, beliefs, attitudes, and behaviour of students.

In this sense, school image consists of perception and attitude. Perception means the process of interpreting integrated marketing communication into the user's cognitive structure [50]. Attitude represents evaluative beliefs and willingness to act that are aligned with internal values. School image depends on the way the service is provided [51,52]. Employees who encounter users play an important role in this. However, SC is significantly dependent on employee behaviour [39,53]. HRM is the most important segment of SM because it includes concepts such as SC, KM, teacher motivation, principal's teamwork [54,55]. The and interpersonal skills [24], as well as the relationship between employees and the creation of SC, are crucial for increasing the quality of service in the school.

Therefore, part of the impressions are based on the behaviour of the school towards the teachers. The service provided by the school, i.e., the teachers, is the reference point of SM and service branding [10]. The key indicator of SC are teachers and their satisfaction with their work and the service provided. From the aspect of service marketing, corporate culture is a holistic phenomenon [56]. The role of teachers in creating SC is important because the satisfaction and motivation of teachers create school reputation. The teacher's behaviour affects the user's perception of the school. At the centre of SC are common values, norms, and customs [3,13].

C. School Identity

We understand SC as the individual characteristics of a school, according to which it differs from other schools. Corporate identity is aimed at internal and external factors of the organization [7-9], i.e., schools. Adoption of corporate identity by teachers should be supported by mission, vision, and SC. Therefore, we can conclude that the corporate identity serves as a link between the school and the teachers, but also between the school and the students. The key role of the corporate identity is manifested in the transmission of goals and values to teachers.

In the analysis of the AC²ID Test [57], a model was presented that can serve as a method of identifying different school identities (see Table IV). This also means that not all schools have the same identity, nor do they have the same SC. It also tells us that the identities that schools have do not have to coincide with the identity that the principal wants, or the identity that the teachers want. In other words, the identity, communicated identity, conceived identity, ideal identity, and desired identity are reflected in the school image.

Identity type	SC	SM
Actual	Employee-user relationship	Motivated employee
Communicated	Reputation of the school	School image
Conceived	Local communities	Weak principal
Ideal	Teacher identity	Social responsibility
Desired	School personality	School vision

TABLE IV. AC²ID TEST IN SCHOOL

As can be seen from Table IV, corporate image and corporate reputation represent a combination of the school's conceived identity, which does not always have to be positive. In this sense, the perception of an individual group of local governments can create a negative image based on the school's reputation, such as a weak principal or an undesirable school. Also, the actual identity of the school can result from the teacher's satisfaction, which is reflected in the quality of the service provided, and from the SM aspect, it will be reflected in the motivation of employees, participation in decision-making and building a positive school climate.

The differences between identities that can be analysed by the AC²ID Test model [57] are designed to enable strategic leadership and school management. That is why care must be taken that the corporate brand adequately delivers functional and emotional benefits for users. In this sense, the corporate identity does not mean only the visual elements of the brand identity but represents everything that gives a rounded picture of the school. This is the reason why SC and teachers must be taken care of. Teacher identity, as well as school identity, are not permanent categories [8,58]. The advantages of creating a school identity are manifested in the creation of a strong school brand. Brand identity is derived from strategic SM and corporate marketing. In other words, the principal is responsible for creating a differentiated identity that will have unique characteristics. Such a school identity is recognisable, influences the behaviour of teachers, and establishes a positive SC.

CONCLUSION

The success of the school results from the management of the principal and his abilities [1]. The school principal must be a strong personality who will be able to motivate teachers and the environment so that everyone accepts changes and works in the interest of common and individual goals. The principal represents the school manager who is in charge and responsible for building the school's identity.

The principal should know how to coordinate human capital in the organization because the success of the school depends on the joint work of all employees [53]. Also, the principal should be well accepted by his team. With his commitment, he should contribute to the creation of a positive climate and develop SC. The principal's ability to manage, decide and lead has an important role in the creation of SC.

From the pedagogical aspect, the success of the principal is reflected in the way the school works, the implementation of the curriculum and teaching achievements. However, from the economic aspect, the success of the principal as a manager is reflected in the way the school is managed, employee satisfaction and creating brand image. A corporate brand is a special form of strategy [8,57], where different segments of management and marketing play an important role.

The quality of the school is manifested through the formation of the school as an educational and cultural community that nurtures lifelong learning and respects individuals. In this sense, the principal informs all stakeholders about the school's success and together they build SC as part of the school's identity. Teachers represent the most important resource because their knowledge and competences shape the identity of the school and influence the quality of the service [30,35].

The principal's behaviour towards the teachers, the teacher's identity, the way the service is provided, and communication with stakeholders give a certain picture of the school. These are the associations that the school projects in the minds of its users, such as the kindness of teachers, quality services, care for the environment, cooperation with society, volunteering, and are the basis for creating brand loyalty.

This is precisely the key aspect of creating school image. The principal should encourage positive SC, support, and respect teachers, include them in school decision-making, create teams where they are equal and encourage the development of lifelong learning. With such an approach of the principal, teachers will show greater loyalty and identification with the school. Their satisfaction with the school climate and culture is reflected in the service provided, but also in the overall identity of the school. The principal who is a leader sees that.

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New Trends in Organizational Learning

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Abstract-The ability to achieve ambitious and strategic goals set directly depends on the power of the organization to learn and develop. Ideas and performance approaches organizational improvement mainly come from closely related employees to internal processes and core customers. Three core measures concerning the powers of the staff are: employee productivity, employee satisfaction and employee retention. The knowledge about culture of organizational learning in organizations in the region is a research question that is raised in this empirical research. Results of the research are reported in this article.

Keywords – Organizational learning, employees, knowledge

I. INTRODUCTION

Culture of organizational learning will describe both the structural and process dimensions of learning within an organizational context, since learning organization is viewed as one that has capacity for integrating people and structure to move organization in the direction of continuous learning and change [1].

Modern business conditions are characterized with globalization and increased competition, as well as rapid changes that have helped highlight the importance of the capacity for organizational learning as a key for survival and success [2-5].

The research question (problem) in this paper is: Are organizations in Serbia employing staff that has a strong desire for learning, professional development and undertaking innovative activities?

II. THEORETICAL BACKGROUND

Organizational learning has become an increasingly important and popular topic in academic and business literature [6-8] and with a dearth of practical, empirical research [9,10].

Although research on organizational learning has been going on for over 30 years, there is a diversity of perspectives that have been used to define organizational learning [11].

Since learning is a multilevel concept and learning could be studied at different levels, organizational learning becomes an extensive concept [12]. Argyris and Schön [13] indicated that organizations have different levels of learning, such as single-loop and double-loop learning, and these two levels of learning are critical for organizations, depending on the specific circumstances requiring organizational learning.

Robey, Boudreau, and Rose [14] clearly outlined five main characteristics that define organizational learning: (a) organizational learning occurs at the organizational level; (b) organizational learning is a process not a structure; (c) organizational learning is both intentional and unintentional; (d) organizational learning re-quires organizational memory repositories and mental models; and (e) organizational learning guides organizational action. Reference [15] contended that "organizational learning can be defined as a dynamic process of creation, acquisition and integration of knowledge aimed at the development of resources and capabilities that contribute to better organizational performance".

The concept of organizational learning culture is a type of organizational culture that organizational integrates with learning. According to [16], organizational learning culture is organizational phenomena that "support the acquisition of information, the distribution and sharing of learning, and that rein-force and support continuous learning and its application to organizational improvement". Thus, organizational learning culture is under constant construction, "moving along an infinite continuum towards a harmonious learning environment" [17]. By extension, the goal of organizational learning culture is an exchange of valuable knowledge leading to innovation, improved performance. and sustained competitiveness [18].

Based on [19], organizational culture can be defined as the "interrelationship of shared beliefs, behaviors, and assumptions that are acquired over time by members of an institution". In fact, culture dominates in a way that impacts employee interaction, organizational functioning, and eventually influences all decision making [20].

The difference between organizational success and failure significantly depends on organizational culture to impact organizational operation. There are a number of definitions of organizational culture that refer to norms of behavior and shared values among a group of members in an organization [21-25].

Reference [26] integrated the concept of assumptions, adaptations, perceptions, and learning and then comprehensively defined organizational culture as: a pattern of basic assumptions invented, discovered, or developed by a given group as it learns to cope with the problems of external adaptation and internal integration that all works well enough to be considered valid and therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

The goal of organizational learning culture is an exchange of valuable knowledge leading to innovation, performance improving and sustained competitiveness. Besides that. organizational learning can be defined as a dynamic process of creation, acquisition and integration of knowledge aimed at the development of re-sources and capabilities that contribute better organizational to performance [27].

Since a significant number of empirical studies have been published based on organizational learning concepts, none of them discusses the findings in the context of clearly defined concepts that consider all the relevant components of a theory of organization learning and they do not support the development of an integrated, empirically grounded model of organizational learning [28].

Over the last decade, interest in organizational learning has burgeoned, with both increasing journal and book output [29-30] and an increasing number of reviews of the field [31-33].

III. RESEARCH OBJECTIVES

The research problem analyzed in this paper is based on the variables that provide an integrated picture of the culture of organizational learning.

In this research the two objectives are set:

O1: Finding out the information about the state of organizational learning in organizations in Serbia and

O2: Finding out the information on which variables / factors the value of the two key statements / variables can be best predicted on the readiness of organizations and their employees to learn. They are defined in the draft survey:

V27 - The staff in our organization has expressed a strong desire for learning and professional development and

V28 - Our organization is very innovative.

IV. THE METHOD OF INVESTIGATION, POPULATION AND SEMPLE

The survey was conducted in the business environment of the Republic of Serbia in a variety of industries and the public sector. The intentional sample of 40 organizations was taken and it included:

- a) 13 organizations in industry with 98 respondents,
- b) 7 organizations in agriculture with 49 respondents,
- c) 7 organizations in Trade and Logistics with 56 respondents,
- d) 5 organizations in Finance with 58 respondents

- e) 4 organizations in Education, science and social activity with 69 respondents,
- f) 5 organizations in Public services and services with 53 respondents.

Thus, the research involved 383 people of various profiles of managers, from strategic to operational level, as well as experts mostly from the human resources management field.

V. METHODS USED IN THE RESEARCH

In the sampled organizations 383 experts (respondents) said their views on an investigated issue that has been set and defined in section Population and Sample. Attitudes / variables that are offered and evaluated on Likert scale (1-completely disagree to 6 - completely agree) are displayed in the Table I. The data collected about the attitudes of respondents about the culture of organizational learning were analyzed by descriptive statistics, Cronbach's alpha process, cluster methods, as well as factor and regression analysis.

Using the methods of descriptive statistics there were calculated measures of central tendency, the measuring instrument (scale) was determined by Cronbach's alpha method reliability, cluster analysis was performed for clustering variables, factor analysis was carried out for testing of the factor structure of the scale, and a method of regression analysis is used for the possible features of variables and their impact on two independent variables whose values are predicted.

VI. RESEARCH RESULTS

In this section the results of the research are obtained, which are the subject of analysis and from which the research findings are derived. The results are divided in four logical and coherent units:

- 1) Descriptive analysis;
- 2) Testing the Reliability (inter consistency scales), which was used in the survey,
- 3) Cluster analysis that was performed on the items / variables of the scale,
- 4) Factor analysis done over the item / variable scale and
- 5) Regression analysis that was performed in order to predict dependent variables of statements:

V27: Staff in our organization has a strong desire for learning and professional development

V28: Our organization is very innovative.

VII. THE RESULTS OF DESCRIPTIVE ANALYSIS

In this part of the analysis of data obtained in the investigation, the results with natural methods of descriptive statistics were displayed and analyzed.

The results displayed in Table I in the first column of the table are tags statements / variables about organizational learning: from v01 to v28, which are on the Likert scale assessed by 383 assessors (second column) on the scale from 1- completely incompatible to 6 - strongly agree, which helps the specific organization to mark values that most accurately indicate the degree of agreement, or disagreement with these arguments.

The arithmetic mean scores of given marks are calculated as given to recognize the average scores, and the standard deviations that talk about the dispersion of these values.

Names of the claims, or defined variables in Table I.

V01 - In our organization, employees often communicate with other groups / teams;

V02 - Employees in our organization are well informed about the work (problems, objectives, roles ...) of other groups / teams;

V03 - In our organization, there is a lot of mutually understanding working groups / teams;

V04 - Employees in our organization know how to appreciate the achievements of other groups / teams;

V05 - Employees in our organization affect the decision / choice of solutions other groups / teams;

V06 - Working groups / teams in our organization often assist other groups / teams;

V07 - In our organization, there are a lot of mutual trust between the working groups / teams;

V08 - In our organization, the members of the various working groups / teams trust each other;

V09 - In our organization there is great mutual influence of the working groups;

V10 - Members of different groups / teams within our organization help each other;

V11 - In our organization, there is an intensive communication between groups / teams;

V12 - In our organization, there are intensive communication within work groups / teams;

V13 - In our organization, there are a lot of mutual understanding of the members of the working groups / teams;

V14 - In our organization, there are a lot of mutual trust within the members of the working groups / teams;

V15 - In our organization, there is an intense mutual assistance within working groups / teams;

V16 - In our organization, there are systems that foster the exchange and dissemination of knowledge;

V17 - In our organization the reward system strongly encourages sharing knowledge with others;

V18 - Willingness to share knowledge in our organization has an impact on opportunities for professional development and career advancement of the individual;

V19 - In our organization is highly valued cooperative behavior,

V20 - In our organization, there is an intense exchange of ideas during working hours;

V21 - In our organization, there is an intense exchange of ideas during work breaks;

V22 - In our organization there is very intensive exchange of ideas before, during and after the working meeting;

V23 - In our organization, there is an intensive informal exchange of ideas (during the festive and similar situations in the company);

V24 - Employees in our organization conduct intensive informal private exchange of ideas outside the work environment and time;

V25 - In our organization, the cooperative behavior brings financial rewards;

V26 - In our organization, it is believed that the exchange / sharing of good practice is the main way for successfully solving problems in work. V27- Staff in our organization has expressed a strong desire for learning and professional development;

V28 - Our organization is very innovative.

Table I. presents means and standard deviations for defined variables:

FABLE I.	MEANS AND	STANDARD	DEVIATIONS.
	1,11,11,11,10,111,110	DITTOTT	DETRICTOR

Means and Standard Deviations (iNedjaref)		
	Mean	Std.Dev.
v01	3,716,931	1,313,783
v02	3,486,772	1,309,457
v03	3,343,915	1,184,886
v04	3,322,751	1,339,686
v05	3,251,323	1,219,997
v06	3,621,693	1,213,214
v07	3,436,508	1,270,953
v08	3,513,228	1,225,756
v09	3,679,894	1,288,870
v10	3,648,148	1,240,565
v11	3,637,566	1,273,424
v12	4,084,656	1,300,164
v13	3,910,053	1,262,541
v14	3,902,116	1,275,538
v15	3,907,407	1,263,400
v16	3,373,016	1,458,902
v17	2,828,042	1,370,224
v18	3,317,460	1,372,238
v19	3,703,704	1,403,685
v20	3,666,667	1,259,447
v21	3,460,317	1,393,338
v22	3,722,222	1,362,469
v23	3,558,201	1,320,336
v24	3,328,042	1,452,449
v25	2,933,862	1,398,509
v26	3,399,471	1,503,912
v27	3,793,651	1,280,236
v28	3,671,958	1,344,330





If we share value on the scale so that we consider estimation of 1-3 as a failure and estimation of 4-6 as a successful and desirable, the analysis shows that the majority of contention about variable Organizational learning is good quoted. In fact, only two variables have lower mean value of 3.0.; 16 variables, or 57% of the total number of 28 statements / variables, have a greater value than 3.5. These indicators point to the conclusion that the employees in organizations that operate on the territory of Serbia are significantly ready for continuous organizational learning. Two variables that we qualified as dependent and predictive variables, from the point of latent readiness of employees for organizational learning are: v27- staff in our organization has expressed a strong desire for learning and professional development and v28 -Our organization is very innovative. They are assessed from the side of 383 assessors and the estimated results are shown in the following two histograms (Figs.1 and 2).

VIII. CONCLUSION

The results of this empirical research on the state of the culture of organizational learning in organizations operating in the Serbian business area point to the conclusion that all variables, or statements that provide an integrated picture of the culture of organizational learning assessed with relatively high marks. These indicators of descriptive statistics and other results obtained by this research, particularly on the results of multiple regressions, indicate the specific conclusions: that the staff in the examined organization has a strong desire for learning and professional development, and there is a spirit of innovation among the employees in organizations. This climate is determined by many factors, but above all, these are: good and intensive communication, understanding, trust, facilitation within and between work groups, rewarding for corporate behavior, joint successfully solving the problem, opportunities for professional development, appreciation of achievements, as well as trust between groups/teams.

Based on the results of the research, it can be concluded that organizational learning is very important in every organization and employees generally have a positive attitude for continuous learning, development and innovations, which is necessary for operations in the turbulent business environment.

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The Use of Advanced Manufacturing Technologies for Sustainability in the Context of Society 5.0

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Abstract — This paper analysed how advanced manufacturing technologies and Society 5.0 can collaborate with sustainability boost to competitiveness and support long-term development. Advanced manufacturing technologies such as advanced AI and robotics contribute to the realization of Society 5.0, which focuses on people while balancing knowledge, society structures, and the environment. The main goal of the paper was to develop a theoretical model for improving competitiveness and sustainability. Adopting sustainable business practices, improving employee skills, promoting inclusive economic growth, and collaborating internationally are some of the elements of the model. In addition, suggestions and guidelines for improving competitiveness and sustainability are discussed. The paper provides significant insight and a solid basis for future research.

Keywords – Advanced manufacturin, society 5.0, competitiveness, sustainability

I. INTRODUCTION

Sustainability and sustainable development are important concepts in today's world that helping the maintenance of a balanced and equitable society. These concepts denote the use of resources in such a way that it meets the needs of the current generation without jeopardizing future generations' ability to meet their own needs [1]. Sustainability is important to environmental preservation. The current period is characterized by unprecedented levels of resource extraction and pollution, which are causing climate change, biodiversity loss, and degradation. Natural ecosystem resource exploitation can moderated be and

environmental degradation can be reduced through sustainable practices. This, in turn, aids in the maintenance of ecological balance and the preservation of flora and fauna for future generations. Sustainable development is also important for promoting social equity and justice. It promotes social inclusion and equality, fostering societal harmony and peace. Sustainable development contributes to the creation of more resilient and inclusive societies by addressing the root causes of inequality and promoting equitable resource distribution [2].

Furthermore, sustainable development and contribute sustainability significantly individual well-being and quality of life. In addition, education for sustainable development is essential. It equips individuals and communities with the knowledge, skills, values, and attitudes required to make informed decisions and take responsible actions to ensure environmental integrity, economic viability, and a just society for both current and future generations [3,4]. The concept of sustainability from a business aspect is characterized by advanced manufacturing technologies, which can significantly reduce the negative effects of mass production and resource exploitation.

In this study the main research question was:

What factors and concepts in domain of advanced manufacturing technologies and Society 5.0 affect competitiveness and sustainable development?

The paper consists of three main sections (excluding the Introduction and Conclusion

sections). First sustainability and the concept of Society 5.0 are discussed. Next, advanced manufacturing technologies are analysed. In addition, the developed model is presented. Finally, suggestions and guidelines for improving competitiveness and sustainability are noted.

II. SUSTAINABILITY AND SOCIETY 5.0

Sustainability and Society 5.0 are interconnected concepts. Sustainability focuses on meeting current needs without jeopardizing future generations' ability to meet their own, primarily through the balanced and equitable use of resources, environmental protection, and social inclusion. Society 5.0, on the other hand, is a vision for the next stage of human society that will use advanced technologies to create a more inclusive, sustainable, and knowledgeintensive society [5]. To address societal challenges and improve quality of life, Society a variety 5.0 integrates of emerging technologies such as artificial intelligence, robotics, the Internet of Things, and big data. In this context, sustainability becomes an essential component of societal evolution, as Society 5.0 seeks to address complex issues such as urbanization, aging populations, and resource scarcity, among others. The incorporation of sustainability into Society 5.0 emphasizes the development of environmentally responsible, economically viable, and socially equitable societal systems and lifestyles [6]. The relationship between sustainability and Society 5.0 is mutually beneficial. Society 5.0's advanced technologies enable more efficient resource use, optimize energy consumption, reduce waste, and minimize environmental impact, all while contributing to long-term development goals. Smart cities, for example, within the framework of Society 5.0, use data and intelligent systems to optimize urban planning, transportation, energy, and waste management, resulting in reduced pollution and resource use and improved quality of life for their residents [7,8].

The principles and goals of sustainability shape the development and implementation of technologies. The focus on environmental protection, social equity, and economic stability in sustainability guides the development of ethical, inclusive, and beneficial technologies and systems for all segments of society. It ensures that advances in Society 5.0 do not exacerbate inequalities or harm the environment, but rather contribute to humannature coexistence that is harmonious and balanced [1-3].

Furthermore, Society 5.0's emphasis on knowledge and innovation has the potential to accelerate progress toward sustainability. The development of new technologies and solutions has the potential to foster a culture of learning and creativity, empowering individuals and communities to actively participate in the pursuit of sustainable development. Society 5.0 innovations can provide novel solutions to longstanding challenges in areas such as healthcare, education, agriculture, and energy, enhancing resilience and sustainability in a variety of societal sectors.

The integrated relationship between sustainability and Society 5.0, on the other hand, poses challenges and raises important questions about ethics, privacy, security, and equity [9]. The responsible development and deployment of advanced technologies is important for avoiding unintended consequences and ensuring that the benefits of Society 5.0 are accessible and equitable for all people, regardless of socioeconomic status, age, or geographic location.

The relationship between sustainability and Society 5.0 is multifaceted, providing opportunities to build a more inclusive, resilient, and sustainable future [10]. While Society 5.0 provides the technological means to address complex sustainability challenges, sustainability principles ensure that society's evolution is balanced, equitable, and harmonious, with a focus on the well-being of both the planet and its inhabitants. To realize the full potential of this integrated relationship, it is important to balance technological advancements with ethical considerations and equitable access.

III. ADVANCED MANUFACTURING TECHNOLOGIES

Modern businesses are increasingly relying on advanced manufacturing technologies to optimize production processes, improve efficiency, and innovate products. These technologies include a variety of cutting-edge techniques, and methodologies for tools. producing high-quality goods in a cost-effective and environmentally friendly manner. additive 3D printing, also known as manufacturing, is one such technology that is revolutionizing manufacturing processes.

Businesses can use 3D printing to create complex and customized components with high precision and minimal waste. This technology is especially useful for creating prototypes, allowing for rapid testing and design modification. Automotive and healthcare industries are using 3D printing to create bespoke parts, improving product functionality and reducing time-to-market [11-13].

Robotics and automation are also important components of advanced manufacturing because they enable the automation of repetitive and labour-intensive tasks. These technologies allow for increased productivity, accuracy, and consistency in manufacturing processes, reducing human error and improving overall product quality [14,15]. Robotics is widely used in assembly lines, packaging, and material handling, freeing up human resources to focus on more complex and value-added tasks, resulting in increased workforce efficiency [16].

The Internet of Things (IoT) is another game-changing technology that connects manufacturing equipment and products to the internet, allowing for real-time monitoring and data collection [17]. Businesses can use this connectivity to gain insights into equipment performance, product quality, and production efficiency. IoT-enabled predictive maintenance can predict equipment failures and schedule timely maintenance, reducing downtime and extending machine life [18,19].

Artificial Intelligence (AI) and Machine Learning (ML) are also used in advanced manufacturing [20]. These technologies help in analysing the massive amounts of data generated by IoT devices, making sense of complex patterns, and making better decisions. By identifying and correcting defects early in the production process, AI and ML can optimize production schedules, improve supply chain efficiency, and improve product quality [21].

Advanced materials such as composites and high-performance alloys are increasingly being used in manufacturing to create lighter, stronger, and more durable products [22,23]. These materials are important for industries like aerospace and automotive, where weight reduction is important for improving fuel efficiency and lowering emissions.

In addition, augmented reality (AR) and virtual reality (VR) are being used in

manufacturing settings to train and assist workers. These technologies provide immersive training environments, lowering the learning curve for complex tasks, and provide real-time assistance, improving the accuracy and speed of manufacturing processes [24].

Sustainable principles are also incorporated into advanced manufacturing technologies, with an emphasis on energy efficiency, waste reduction, and resource conservation [25]. Businesses that use these technologies frequently experience lower operational costs and increased reputational value. as environmentally friendly practices become increasingly important to consumers and stakeholders.

advanced manufacturing In sum. technologies such as 3D printing, robotics, IoT, AI, ML, advanced materials, AR, and VR are reshaping the manufacturing landscape and allowing businesses to innovate and optimize. Adoption of these technologies is about more than just remaining competitive; it is also about adapting to the changing needs of the economy, society, and environment. Integrating and thoughtfully implementing these advanced technologies is important for businesses to realize their full potential and contribute to sustainable and responsible production in today's industrial ecosystem.

Based on the analysed literature, a theoretical model improving competitiveness and sustainability is developed. The model is presented on Fig 1.

Based on the presented model of Fig.1., the research question can be addressed:

What factors and concepts in domain of advanced manufacturing technologies and Society 5.0 affect competitiveness and sustainable development?

Answer: Some the main factors and concepts include: 3D Printing / Additive Manufacturing; Robotics and Automation; Internet of Things (IoT); Artificial Intelligence (AI) and Machine Learning (ML); Advanced Materials; Augmented Reality (AR) and Virtual Reality (VR); Sustainable Manufacturing Practices; Knowledge Integration; Inclusive Societal Structures; Technological Innovation;



Human-Centered Development; Environmental Harmonization; Information Accessibility.

The interconnectedness of these concepts and factors is rather complex. The presented model is generic in nature, and specific technologies and solutions are appropriate for specific industries and enterprises. The application of solutions depends on multiple enterprise characteristics (size, infrastructure, industry etc.).

IV. SUGGESTIONS AND GUIDELINES

Based on the analysed literature and developed model, the following suggestions and guidelines for improving competitiveness are noted:

- Update and optimize technological infrastructure on a regular basis.
- Invest in R&D to create innovative products and processes.
- Implement advanced manufacturing technologies to increase efficiency and decrease waste.
- Create and follow sustainable supply chain management practices.
- Adopt circular economy principles to reduce waste and maximize resource utilization.
- Strive for sustainability certifications and to meet international sustainability standards.
- Provide opportunities for continuous learning and training programs centered on emerging technologies and sustainable practices.
- Encourage knowledge sharing and collaborative problem solving.
- Involve customers, employees, suppliers, and communities in dialogues and initiatives about sustainability.
- Transparently communicate sustainability goals and achievements to build trust and brand reputation.
- Create products and services that respond to changing customer needs and preferences, with a focus on sustainability and value addition.

- Create and implement policies that encourage sustainable business practices and innovation.
- Offer incentives, such as tax breaks and subsidies, to businesses that adopt sustainable technologies and practices.
- In order to foster a culture of sustainability and innovation, educational programs and awareness campaigns should be implemented.
- Encourage academic and research institutions to concentrate on environmentally friendly technologies and practices.
- Invest in research and development of sustainable technologies and practices.
- Encourage collaborations between academia, industry, and government to drive sustainability innovation.
- Put in place strategies to ensure that everyone has equal access to the opportunities and benefits of sustainable development.
- Encourage social entrepreneurship and businesses that contribute to social and environmental well-being.
- Invest in the development of sustainable infrastructure, such as public transportation, renewable energy, and waste management.
- Improve efficiency and accessibility of public services by integrating advanced technologies.

By implementing one or more of these strategies and actions, enterprises and governments can not only increase their competitiveness, but also significantly contribute to sustainable development, resulting in a more prosperous future for all.

V. CONCLUSION

The interconnected relationship between sustainability, advanced manufacturing technologies, and Society 5.0, emphasize their collective impact on increasing competitiveness and fostering sustainable development. Advanced manufacturing technologies, such as 3D printing, automation, artificial intelligence (AI), Internet of Things (IoT), and others, act as catalysts, streamlining processes, reducing

waste, and optimizing resource utilization, thus playing a important role in the evolution of Society 5.0. In turn, Society 5.0 serves as a for converting technological conduit advancements into societal benefits, resulting in inclusive, knowledge-intensive, and sustainable societies. Sustainability principles serve as guiding pillars, ensuring that advancements are environmentally friendly. equitable. and economically viable, fostering increased competitiveness and sustainable development.

A number of strategies and actions for businesses and governments have been proposed in order to align technological innovations with sustainability principles. Future research can analyse the effectiveness of government policies in promoting sustainable practices and enterprise innovation, as well as to understand the best policy frameworks for sustainable development. In addition, long-term studies assessing the long-term impact of advanced manufacturing technology integration and Society 5.0 on competitiveness and sustainability could be conducted.

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Support for the Financing of Infrastructure Projects from European Union Funds on the Example of the Construction of a Logistic Centre in Novi Sad

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Abstract-The topic of the paper is reflected in the connection of the logistics centre construction project with the intermodal terminal in the Novi Sad shunting station with the potential possibility of its financing from the European Union funds. The idea is to present the project through the paper and to propose a possible project design for financing from the proposed funds.

Keywords - Logistics centre, funds, european union, project

I. INTRODUCTION

With the emergence and rapid development of digital technologies, global connectivity has become possible, as witnessed by today's population. Trade has acquired a global character from the local and national levels, making supply chains from suppliers to endusers more complex and intricate. Supply chains today are complex mechanisms that need optimal management. Otherwise, end-user dissatisfaction can arise, and overall costs can dramatically increase, affecting the final product's price.

A crucial node in the supply chain where the transformation of goods occurs is the logistics centre, which is the topic of this master's thesis. The construction of a logistics centre is a project of national importance, thus categorizing it as a significant infrastructure project that requires funding from various financial sources. As the Republic of Serbia is on a serious path towards European Union membership, the idea of this master's thesis is to propose the possibility of funding the construction project of a logistics centre in Novi Sad from structural funds after accession, all intending to lay the foundation for this type of financing for the project.

II. LOGISTIC CENTERS

According to professional literature, the first Freight village appeared in the late 60s of the last century in France in the suburbs of Paris, and the reason for its establishment was the need to reduce freight traffic in the city itself. The idea was to consolidate the goods on the city's outskirts and then deliver them to the city centre in a planned manner. In the following years, FV began to appear in Italy and Germany, while during the 80s and 90s, it continued its growth both in the countries of Central Europe and in the United Kingdom [1]. The realization of the importance of FV led countries to establish national associations of logistics centres. In 1991, they united under the umbrella of the European Association of Freight Villages (European Association of Freight Villages), better known as EUROPLATFORMS. Today, this association has ten member countries, over 70 centres and over 2,600 transport and logistics companies that cooperate [2,3].

The concept of this type of logistics centre can be a common occurrence. In professional literature under different names, it can be noted that the interpretation of the concept itself can differ depending on the country in which it originates. The reason for this is reflected in the linguistic and economic differences within the countries themselves. While in Serbia, the goods-transport centre has been approved as the term for the highest level of the logistics centre, in the United Kingdom, the term Freight Villages (FV) is used, in France Plate - Forme Logistique or Plat - Forme multimodales, in Germany Güterverkehrszentrum (GVZ), while is the accepted term Interporto in Italy [4-6].

Freight villages represent the most complex form of the logistics centre, and their founders are mainly municipal and city administrations or regional and city chambers. They are located on the outskirts of cities, next to industrial zones, on transport hubs and highways. They provide a complex logistics service possible only with full cooperation between all participants in implementing logistics chains [4].

Increasing the intensity of commodity flows created a need for their management at the national and global levels. An essential role in the safe and efficient movement of cargo in global supply chains is played by intermodal transport, which allows a large number of goods to be transported from point A to point B using a standardized handling unit. By having facilities for intermodal transport, logistics centres enable operational efficiency, further increasing regional competitiveness in the distribution of goods [7,8].

Logistics centres are typically situated near major cities with strong connections to national and international infrastructure and city infrastructure. The connection of the logistics centre with the city centre enables solving the problem of city logistics, which has become increasingly pronounced over the years. The central city infrastructure is designed for something other than heavy goods vehicles and intensive circulation of goods daily. Many cities have introduced bans on entering goods vehicles into the centre itself, raising the question of how to deliver goods to facilities in that part of the city. The leading solution to solving this problem is the logistics centre that receives macro flows, performs their transformation and consolidation of various goods, and the shipments that have just been prepared go on to the city centre with appropriate vehicles with access. In this way, the daily intensity of goods

flows is reduced, and thus, the crowds caused by delivery vehicles are also reduced [4,9,10]

III. EUROPEAN UNION FUNDS

In the professional literature, one can come across different divisions of EU funding instruments. However, this paper will divide them into two large groups with two subgroups each. Namely, all funds can be divided into two diametrically opposite groups. The first group comprises European Structural and Investment Funds, jointly and indirectly managed funds. In contrast, the second large group comprises Action Programs, whose funds are managed directly [11].

A. Structural and Investment Funds

According to the current multi-year budget of the EU, five central structural and investment funds are allocated for the realization of cohesion and agricultural policy. On the one hand, three funds are directed to cohesion policy. On the other hand, two funds are directed to standard agricultural policy. Cohesion policy projects through the European supports Regional Development Fund (ERDF), the European Social Fund (ESF+), and the Cohesion Fund (CF). On the other hand, the standard agricultural policy is financed by the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) [12].

B. Instrument for Pre-Accession Assistance

The Instrument for Pre-Accession Assistance (IPA) is non-reimbursable aid that does not need to be repaid or interest paid if the received money was spent appropriately. In this way, the European Union enables candidate countries and potential candidates to familiarize themselves with the procedures, rights, and obligations involved in using funds from the budget. It prepares them to use structural and investment funds when they become equal members [13].

The structure of the IPA fund depends on the fundamental goals set by the MFF, and therefore, there are specific differences between the previous and current programs. The structure of the current IPA III program within which five critical thematic units based on aid priorities can be identified. In the literature, the mentioned five units are known as thematic windows that broadly correspond to the specific objectives of the European enlargement policy. It is important to emphasize that each of these windows is complementary to some other window and that there is constant interpenetration between them [14].

IV. CASE STUDY PRESENTATION

Building a logistics centre with an intermodal terminal in the Novi Sad shunting station started with preparing a preliminary feasibility study by the Faculty of Technical Sciences in Novi Sad and the Transport and Logistics Cluster of Vojvodina. Financing of the development of project documentation was made possible by the Regional Agency for the Development of Small and Medium Enterprises ALMA MONS from Novi Sad within the EUROPE-ADRIATIC SEA-WAY FREIGHT project. The mentioned case study is very detailed, and all the key segments when designing a logistics centre are covered. The project solution is defined based on the Law on Planning and Development, the Law on Railways, and the Rulebook on the content and scope of previous works, the previous feasibility study, and the feasibility study. The project assignment consisted of the analysis of the macro and micro-location of the LC with IMT and the spatial aspect, the market aspect and the procurement market, the presentation of technical-technological solutions, the socioeconomic analysis and the analysis of the impact environment. the analysis on the of organizational and personnel possibilities, risk analyses, financial analyzes and analyzes of funding sources [15].

A. Macro Location of the Logistics Centre

As a macro location, in the mentioned case study, the city of Novi Sad was chosen, and the reason for that is the acceptance of all criteria that a location should provide to justify the construction of LC in it. The location of Novi Sad on the map of Europe represents one of the clear links between the Western countries and the countries of the Middle East. The Republic of Serbia is an important transit country in itself, and the city of Novi Sad is one of the three main centres where goods transit between European countries and the Middle East. The city of Novi Sad is on the mainland transit route between Europe and Asia, and its geopolitical and geographic position is very favourable for the construction of LC [15].

In addition to its transit characteristics, Novi Sad stands out for its geostrategic position. Namely, the city lies on the banks of the Danube River, which is the main link between Central and Western Europe with Eastern Europe and the Black Sea, and thus belongs to the international river corridor VIII. Regarding the railway infrastructure network, Novi Sad lies on the E-85 line, which, according to the European agreement on the most crucial international railway lines, belongs to the European railway network of international importance. Novi Sad is also rich in international road infrastructure, so it lies on the international road A1, which connects Hungary and North Macedonia, and A3, which connects the border with Croatia and Belgrade [15].

As can be seen, the team that worked on the study chose for a good reason that the macro location of the logistics centre should be in Novi Sad. The city represents the hub of three main types of transport and is located on their international routes, which are extremely important for the flow of goods.

B. Micro Location

The micro-location of the logistics centre represents the physical space within its previously determined macro location. The implementers of the case study concluded that the best location of the logistics centre could be within the Novi Sad shunting station due to its convenient location, space, existing infrastructure, and proximity to the industrial zone [15].

The micro-location enables the use of the existing railway, road and river infrastructure, thereby opening up space for smaller initial investments during the realization of the project. In addition, the location is in an already existing industrial zone from which the logistics problem of Novi Sad can be adequately regulated.

C. Technical - Technological Solution

Realisers of the feasibility study established two variant solutions that apply in order to connect the existing capacities with the future intermodal terminal. The base of the first variant solution is on separating two tracks from the 16th track of the shunting dispatch park and connecting them to the existing blind tracks. The construction of and new tracks the reconstruction of the existing ones will be done in phases, with the building of the first terminal track in the initial phase and the building of the second terminal track in the last phase. In addition, this variant is planned to equip the
existing 3rd track with a movable frontal ramp so that road semi-trailers or complete road vehicles can roll onto the intended railway cars [15].

Regarding variant solution number two, the assumption is that the Novi Sad shunting station may want and need to expand its track capacity sometime in the future. The previous variant solution would hinder that possibility, so the study's implementers proposed the construction of two new terminal tracks with a length of 600m equipped with technical equipment for vertical container handling. In contrast, the 3rd track, as in the first variant, would be equipped to realise RO - LA technologies [15].

The authors suggest using the first one since the total costs of both variant solutions are similar. The reason for this is the trend that, over the years, the shunting station in the new orchard needs less and less capacity, not more. Also, this variant solution provides the spending of funds evenly.

D. Sources of Funding for the Logistics Centre in Novi Sad

Large projects such as constructing a logistics centre with an intermodal terminal require multiple sources of financing, such as the investor's funds, domestic capital, and foreign and international funds. Since the project

requires significant investments at the beginning, it is vital to find more financing opportunities. During the implementation, the main effort is to use them correctly and invest wisely.

V. ANALYSIS OF THE PROBLEM

Realization of projects solves specific problems and improves various areas of life and business. However, to realize a project, it is first necessary to determine the problem the project intends to solve and then proceed to the design itself. There are various techniques and methods of problem determination. However, for this work's purposes, the problem analysis method through the construction of a problem tree was chosen. The observed project's problem tree is present in Fig. 1.

After defining all the problems caused by the absence of a logistics centre, two central problems appear, one of which refers to the poor connection of the flow of goods. In contrast, the other observed problem is the complex change of modes of transport. Both causes have specific issues that cause their existence, primarily significant initial investments and a lack of professional staff. On the one hand, these two occasions need a general understanding of the importance of consolidating commodity flows. Thus, there needs to be more physical space





where the flows can transform. All the mentioned problems directly cause the lousy connection of goods flows. On the other hand, the already mentioned causes of lack of human resources and significant initial investments affect need for more equipment, the underutilization of river ports and the reduced quality of road and railway infrastructure. With the lack of adequate infrastructure capacity, chances are lowered that the problem of changing the mode of transport will be solved.

The central problems, just as their causes, also have their consequences, which branch out and form a network. Poor connection of goods flows and a problematic change in the mode of transport creates a poor quality of logistics service, opening up space for an increase in the number of empty or semi-empty drives. When different modes of transport are inefficient, frequent use of the road mode occurs, which is the fastest but the most expensive. When it is combined with poor organization of goods flows, high total costs of logistics services are obtained, directly affecting the reduction of market competitiveness. In addition, it should be kept in mind that poor organization of goods flows creates a big problem in city centres because a much larger number of delivery vehicles appear than necessary, and therefore crowds and congestion bother all residents.

VI. ANALYSIS OF OBJECTIVES

After defining the problems that the project of building a logistics centre with an intermodal terminal in the Novi Sad shunting station should solve, it is necessary to define all the goals of the project in order to enable the realization of their analysis. The graphic representation of the tree of objectives is present in Fig. 2.

The project's general goal is to improve the coordination and consolidation of micro and macro commodity flows by creating a physical space with the appropriate technical and technological capacities for efficient and effective handling of goods. From the general goal, three main global goals arise, with specific goals, and therefore, certain results also occur.

The first global goal focuses on positioning the logistics centre in Novi Sad on the global market map. Only in the case of good positioning in the market can one expect to achieve the full capacities that a new logistics centre can provide. The proper use of the capacity of the logistics centre provides space for reducing total logistics costs and increasing the quality of services to end users, which directly represent two specific goals of the observed global goal. Certain results are obtained by achieving specific goals, indicating that the observed project has a positive overall effect. Namely, by reducing the total costs, the expectation is that the means of transport utilised optimally, as well as the implementation of the use of other types of transport, is implemented correctly, thus reducing to a minimum the use of road transport, which is considered the most expensive and the worst for the environment. On the other hand, by increasing the quality of logistics services, the satisfaction of end users is directly affected by respecting their wishes, needs and requirements through fast, efficient and accurate delivery.

The second global goal refers to the users and the general population because it aims to increase their satisfaction. We are witnessing much chaotic life in cities, resulting in a drastic decrease in the overall quality of life. The very situation that can be seen and breathed in is a consequence of something that happens behind the scenes. The situation behind the scenes is precisely the current situation of the organisation of commodity flows, which significantly impacts the deterioration of the quality of life in cities. Therefore, reducing the negative impact of transport flows on the environment is a specific goal. As a result of achieving this specific goal, a smaller number of delivery vehicles should appear on city streets, directly resulting in reduced congestion and a better quality of everyday life.

The third global goal shows the need to reconstruct and modernise the existing infrastructure. The first specific goal refers to the reconstruction and modernisation of the road infrastructure, which should result in the construction of new roads and the reconstruction of existing ones. The reconstruction and modernisation of the railway infrastructure is another specific goal, the realisation of which provides infrastructural capacities equipped with modern technologies, directly affecting the comprehensive safety of railway transport. Furthermore, the previous two goals have been actively worked on for some time, which differ regarding river transport. Namely, the third specific goal refers to increasing the use of river transport to transport of goods. As a result of the intensification of river transport, there is a need for investments in modern goods manipulation technologies and better utilisation of the means of transport by transporting certain types of goods.

There is a connection between all global goals in some way. The realisation of one facilitates the realisation of the other and enables the formation of a positive spiral that leads to the realisation of the general goal. With interaction between them, it is possible to expect to achieve the set goals successfully and even less to realise the general goal optimally.

VII. LOGIC MATRIX

After the previous analyses that related to the external and internal factors, problems and goals, a basis is made for creating a logical matrix for building a logistics centre with an intermodal terminal in the Novi Sad shunting station.

The project's general goal represents the need for coordination and consolidation of micro and macro commodity flows through the formation of adequate space with all the technical and technological capacities necessary for the efficient and effective handling of goods. Five specific goals arise from the general goal, which is related to increasing the quality of logistics services and reducing total costs, reducing the negative impact of transport flows on the environment, and improving and increasing the use of mass modes of transport. Expected results are defined based on specific goals, and some of them are the optimal response to the client's requirements and better utilization of both the means of transport and the modes of transport themselves. For each of the goals and results, indicators of success, means of assumptions, and risks verification, are determined.

When it comes to phases and activities, four main phases were determined. After that, all the tasks that required completion for a particular phase were determined so the phase could be considered successful. The first phase refers to developing a comprehensive strategy for the logistics centre. It aims to form an expert team to create a conceptual solution for the project, conduct specific surveys, and collect the necessary data from the market. The second phase focuses on improving the quality of the logistics service by implementing market analysis and determining the current state of both commodity flows and the infrastructural capacity of modes of transport. The next phase focuses on reducing the negative impacts of transport flows on the environment by implementing specific analyses whose data can provide a picture of the current situation. Finally, there is a specific importance to spread awareness about the importance of the project itself through an adequate form of promotion.

VIII. PROPOSAL OF POSSIBLE STRUCTURAL FUNDS

Building a logistics centre with an intermodal terminal in the Novi Sad shunting station is a large infrastructure project that requires multiple sources of financing. Within this paper, the focus is on one way of financing that represents potential in the coming years, which is financing from the structural and investment funds of the European Union. Based on consideration of the available funds and the characteristics of the project itself, three funds with specific importance for the observed project are singled out.

The first fund which can be interesting for the observed project is the European Fund for Regional Development, which aims to support regional projects of importance. The construction of a logistics centre is one such project for several reasons. The first reason is the infrastructure improvement, and the introduction of innovations in the connection and transformation of commodity flows, directly affecting the population's quality of life. As one logistics centre gathers various branches of industry and educational profiles under its umbrella, the opportunity to employ a diverse workforce opens up. Employing a significant number of people reduces the unemployment rate in the country, thus enabling economic growth and stability.

The Cohesion Fund is another possible funding source for the project in question. Namely, as already mentioned, this fund focuses on projects that directly affect infrastructure development in the observed country. The construction of a logistics centre, directly through the construction of the centre's infrastructural capacities and indirectly through the need for improvement and development of the international transport network, affects the comprehensive infrastructural development of a country. In addition to the exceptional infrastructural importance, the project has a particular impact on reducing harmful effects on life and the environment, which coincides with another goal of the Cohesion Fund.

The third, but no less attractive, fund is the Fund for the Connecting Europe Facility, which focuses on improving international transport networks. As mentioned, the project to build a logistics centre with an intermodal terminal in the Novi Sad shunting station directly and indirectly impacts the infrastructure. However, its construction would also significantly improve the transport network that connects the countries. Namely, the logistics centre itself affects the reorganization of the movement of goods flows and thus affects the improvement of already existing transport connections. It also opens up the possibility of establishing new connections.

IX. CONCLUSION

The digital age has led to the highest frequency of commodity flows in trade history. Namely, everyone can collaborate with everyone regardless of location, time zone or language barrier. It has become common for products to be ordered from any point on the planet to expect that product to reach the end user within ten days, if that. Furthermore, no matter how nice it is for the end user with an unlimited number of choices with one click, it should be remembered that there are no easy processes behind it. The user interface is straightforward. However, the organisation to get a product from point A to point B according to all acceptable criteria is many times more complicated.

From the very openness of the market has arisen countless flows of goods that move all over the planet constantly. Some overlap, some just cross, while some have no contact with each other, but their existence is indispensable. Each commodity flow has its total cost, and, as with everything in life, the aim is to reduce that cost to the optimal limits. Cost optimisation requires optimising the organisation of the entire commodity flow as far as possible only by introducing and optimising the main hubs within a single chain. As mentioned, these hubs represent logistics centres, the main places for transforming commodity flows.

The Republic of Serbia has yet to have a single logistics centre in the category of a goodstransportation centre. Therefore, there needs to be an optimal organisation of goods flows within the country. The situation can be significantly better, and this paper aims to show the importance of investing in this type of project. It should be kept in mind that the focus of the work is placed on one logistics centre located in Novi Sad, which can solve the problem of the organisation of goods flows in AP Vojvodina. However, it cannot solve all problems at the state level, but it can reduce them to a certain extent. Therefore, it is good to remember that this is only one component of the network of logistics centres that is expected to exist on the territory of the Republic of Serbia.

The project's complexity requires a certain amount of time for its realisation, an expert team that is competent to work on the project, and multiple sources of funding because one source cannot fully cover it. Since Serbia is on a stable path to joining the European Union, this work laid the foundations and proposals for using certain structural and investment funds that the Union itself has at its disposal. Building a logistics centre with an intermodal terminal in the Novi Sad shunting station is of a great infrastructural importance; therefore, based on the previous analysis, it was determined that it is suitable for financing from the Cohesion Fund. Due to its importance for economic development and reducing unemployment in the region, it is also suitable for financing from the European Fund for Regional Development. The instrument for connecting Europe can be another funding source, as the logistics centre is an essential component in achieving optimal transport connections.

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The Impact of Artificial Intelligence on Social Media Marketing

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Abstract—Artificial intelligence has completely transformed social media marketing and turned social media into a place for business. The aim of this paper is to analyze the application, benefits, and risks of using artificial intelligence in social media marketing. Artificial intelligence is used in social media marketing for a range of activities including the analysis of data on consumer behavior, automation of content creation, advertising management, consumer relationship management, and consumer communication, especially by taking advantage of chatbots and virtual assistants. Marketers have discovered significant opportunities to process vast amounts of unstructured data on social media to gain invaluable consumer insights. The use of AI in social media marketing provides numerous benefits to companies, such as substantial cost and time savings, improved effectiveness and efficiency of social media advertising, improved consumer experience and personalization, as well as better risk management and crisis response. However, using AI in social media marketing also brings numerous risks and challenges, including concerns about data privacy, the potential for AI biases, misinformation, plagiarism, a lack of trained staff, and its impact on unemployment.

Keywords - Social media, social media marketing, artificial intelligence, consumer behavior, consumer insights

I. INTRODUCTION

Artificial intelligence (AI) has become part of our daily lives in many forms, such as personal assistants, computer gaming, voice recognition, facial recognition at the airport, etc. [1]. AI is used in many areas, including education, agriculture, health, medicine, finance, marketing, and national defense [2]. The term "artificial intelligence" was first mentioned by the American computer expert John McCarthy in 1956 as a new term in computer sciences. The U.S. Department of Defense was interested in developing computers to think and act like humans long before the existence of voice assistants such as Siri, Alexa, or Cortana [3].

AI is one of the most important areas of research in many academic and business fields [4]. Academic attention to AI began in the 1980s, with studies focused on expert systems and robotics [5]. Although papers on AI have been very popular in the past few years, the term is still not uniquely defined. According to Kaplan and Hanlein, AI is defined as a "computerized system that is able to perform physical tasks and cognitive functions, solve various problems, or make decisions without explicit human instructions" [6]. In general, AI represents any human-like intelligence performed bv a computer, robot, or machine, i.e., their ability to imitate the human mind, such as learning from an example or experience, understanding and responding to what is said, making decisions, solving problems, etc. [7]. AI has gone through several phases of development: (1) artificial narrow intelligence, (2) artificial general intelligence, and (3) artificial superintelligence. There are also different types of artificial intelligence systems: (1) analytical AI, (2) human-inspired AI, and (3) humanized AI [6]. Bešinović et al. have proposed a systematic taxonomy of the main fields of artificial intelligence: (1) expert systems, (2) data mining, (3) pattern recognition, (4) adversarial search, (5) evolutionary computing, (6) machine learning, (7) operations research and scheduling, (8) logic programming, (9) natural language processing and speech recognition, (10) computer vision and

image processing, and (11) autonomous systems & robotics [8].

Marketing is one of the sectors most affected by AI technology. AI has completely transformed the social media marketing landscape. Combining social media with artificial intelligence tools is popularly called "social artificial intelligence" [1]. The popularity of AI research in marketing, especially since 2017, is caused by the development of big data, the availability of computational power, and the progression of AI techniques and technological enablers [9]. However, there is a noticeable lack of academic research on the practical application of AI tools in social media marketing, although there are numerous articles by practitioners. The goal of this paper is to explain how AI affects social media marketing based on the analysis of previously conducted studies and practical experience. In the first part of the paper, we talk about the main areas of AI application in social media marketing. In the second and third parts of the paper, we analyze the advantages and disadvantages of using AI in social media marketing, including risks and challenges.

II. APPLICATION OF ARTIFICIAL

INTELLIGENCE IN SOCIAL MEDIA MARKETING

The inclusion of AI in social media has revolutionized the traditional way of marketing and created completely new opportunities for companies [10]. Digital technologies have transformed social media into a place for business, which has helped many startups [11]. The application of AI in social media marketing leads to a competitive advantage, developing a stronger connection with consumers and improving the bottom line [1]. AI marketing reinforces an omnichannel business strategy based on consumer segmentation, aligning campaigns with consumers who are ready to buy through specific channels [4].

AI is the foundation of popular social media such as Facebook, WhatsApp, Instagram, Snapchat, YouTube, LinkedIn, TikTok, etc. The application of AI and advanced machine learning on Facebook and Instagram enable the suggestion of relevant content for users, recognizing faces in photos, suggesting friends, optimal targeting and of advertising campaigns [10]. Social networks use AI to remove fake and spam comments, messages, and reviews. Snapchat uses computer vision to monitor users' faces and apply filters in real time. LinkedIn uses AI to suggest connections,

recommend jobs, and display content aligned with users' interests. Users love Pinterest for its personalized content. The Pinterest lens as well as the Google lens allow users to search for photos similar to a scanned photo [1].

Consumers do not have enough time to search for products. AI can track and understand their browsing habits and product preferences and show them the information and content they need [12]. AI also can receive feedback from consumers, analyze it, and process it much faster than before [13]. AI marketing combines AI technologies with consumer data and brand experience data to provide accurate consumer insights and identify market trends. AI marketing is predicted to drive 45% of the global economy by 2030. It is assumed that product improvements will be made based on AI data [20]. AI tools can be used in social media marketing for a whole range of tasks, which we discuss in the next part of the paper.

A. Tracking and Analyzing Consumer Behavior and Preferences

Marketing experts have discovered opportunities in the availability of a large amount of unstructured data on social networks in the form of posts, reviews, comments, various emoticons, posts, and videos. AI is used to mine this data, especially using text analytics tools [14]. Analysis of this data allows companies to understand the target audience, spot consumer trends, analyze competitors' brands and their users, and improve brand equity in the long term [1].

Marketers can use several AI tools to analyze social media data. These tools are mainly focused on social media monitoring and social media listening, sentiment analysis, trend tracking, influencer identification, audience segmentation, and reputation management [15]. Among the most famous AI tools that include more of the above functions are Hootsuite, Brandwatch, Consumer Intelligence, Digimind, Agorapulse, BrandMentions, etc. Tools with new functions are constantly being developed.

Social media monitoring and social media listening are among the most important functions of AI tools. Social media monitoring is the process of tracking and measuring what people say about brands, products, competitors, and the industry on social media [16]. These tools analyze data such as mentions, comments, reviews, shares, likes, and hashtags. It is also

possible to monitor industrial trends and competitive activities. On the other hand, social media listening is the process of understanding that data to discover and analyze trends, patterns, sentiments, opinions, and emotions [17]. The introduction of AI in social media has helped analytics in an invaluable way - to transform insights into real data that helps managers make better conclusions and decisions and to harness the power of predictive analytics [11, 10]. These tools also enable the further development of "ompetitive intelligence" and predictive analytics [18].

A large number of AI tools can perform realtime consumer sentiment analysis (such as BrandWatch and Hootsuite Insights). In this way, it is possible to quickly find out what topics engage consumers, and who are the influencers in the conversation to quickly adjust the content [11]. There are also AI tools that can anticipate a user's emotional state based on realtime posts [19]. AI tools can extract customer insights from data in multiple languages without much effort. Also, these tools significantly contribute to the improvement of "reputational management" [16]. By monitoring negative sentiment, potential threats can be identified, and the escalation of the crisis can be prevented by proactively taking care of consumers and choosing the right influencers and ambassadors [15]. AI and machine learning provide critical customer insights across a range of aspects to help you make better strategic decisions.

B. Automation of Writing Posts and Captions

Automation is one of the main benefits of using AI in social media marketing, as it significantly improves productivity and operational efficiency [20]. In addition to content writing, automation is applied to several activities, including social media listening and social media monitoring, social engagement, content scheduling, and content republishing [1].

Several AI tools generate headlines and texts in a few seconds by typing a request (prompt), the URL of the page for which the headline or text is written, hashtags, or just the topic. Certain AI tools can apply a different tone of communication (formal, friendly, luxurious, directive, etc.), change the purpose of existing posts, generate titles from existing blog posts and other sources, as well as to create titles and texts for special events or holidays [20, 1]. Among the most popular tools for generating written content for social media are Copy.ai, OnlyWriter AI, ChatGPT, Simplified, etc.

C. Visual Content Creation

Content creation is often a bottleneck for marketers. It is necessary to find and create visuals that match the sensibility of the brand and then adapt them to each social media platform [3]. Canva is one of the most popular online AI tools used to create professionallooking visuals for personal and business use. AI tools that generate images based on prompts (Midjourney, Leonardo AI, Dall-E, Dream Studio) and videos (Pictory, Synthesis, Deepbrain AI, etc.) have gained great popularity. With their help, it is possible to create visuals that are in line with the brand's creative strategy. For example, Midjouney can create custom images based on a given photo, video, GIF, etc. without any manual work. These AI tools can help with the lack of inspiration by creating much more complex prompts based on just a few given words or just a topic. Some AI tools are created for specific industries, such as the fashion industry. AI tools Vue.ai and Lalaland.ai enable the display of real clothes on models. Google has also developed a new generative model that uses a diffusion technique to allow consumers to virtually try on the clothes they want to buy from a particular website [21]. It is also possible to display clothes on different models and in different poses to make the virtual trial as realistic as possible. This Google tool is currently available only in certain countries.

D. The Use of Chatbots and Virtual Assistants

Chatbots are AI software that allows companies to talk or discuss with consumers using natural language on various platforms, including social media [11]. Organizations most often use chatbots for FAQs. These bots respond to consumers 24 hours a day. Advanced AI chatbots and virtual assistants can understand human sentiment and speech and quickly solve a problem [13]. Alexa and Siri are typical examples of virtual assistants that provide the best service. Most consumer requests and complaints can be resolved with chatbots. However, they still cannot replace humans in handling more complex requests.

E. Automation of Advertising Management

AI has long been used to manage advertising on social media for audience targeting (new, custom, or lookalike audiences), bidding, scheduling, A/B testing, reporting, etc., to save time and money [10]. Many social media platforms have their advertising management systems (e.g. Facebook Ads Manager and X Ads Manager for Twitter) that are constantly being improved. Using these tools brings numerous benefits, such as optimizing ads for best performance and ROI, testing different ad variants and measuring their impact, optimizing publishing, scheduling and scaling campaigns for different countries and regions, and personalizing ads for different segments and scenarios [23].

F. Real-Time Recommendations

Retail and entertainment websites, as well as social networks, use AI and machine learning, to recommend additional products, services, and content based on past consumer behavior and other factors, including time of day and weather [24]. More than 70% of content on Netflix and about 40% of purchases on Amazon are the product of recommendations based on such algorithms [7]. For 20 years, Amazon has been using artificial intelligence to recommend products after making an online purchase or just visiting the website. Amazon invented this concept using an algorithm called "item-based collaborative filtering" [25]. То suggest "frequently bought together" products, in addition to the purchase data of a particular consumer, Amazon uses the purchase history of other people who have purchased the same or similar product, as well as data on product satisfaction [26].

III. THE BENEFITS OF ARTIFICIAL INTELLIGENCE APPLICATION IN SOCIAL MEDIA MARKETING

The application of artificial intelligence in social media marketing brings numerous advantages to marketers. Among the most important advantages are the following:

- Significant cost and time savings Using AI reduces the cost of manual content creation [7]. AI automates numerous tasks that require time and patience, such as uploading and scheduling posts, finding relevant hashtags, designing content, etc.
- Improving the effectiveness and efficiency of social media advertising AI has improved all types of advertising (pay-per-click, pay-per-impression) by delivering the message to the right people at the right time [16]. AI also reduces repetitive tasks, analyzes advertising

campaigns, and suggests improvements. AI tools use historical data to indicate which posts performed best and recommend what to post in the future to achieve the best results [12, 13].

• Improving consumer experience and personalization - AI helps to explore consumer demand and preferences without disrupting the consumer and to identify opportunities to improve the consumer experience [5]. Using AI, it is possible to deliver a much more personalized experience, including dynamic pricing and information disclosure, depending demand. on availability, popularity, and other factors [27].

We can list a whole range of benefits, such as a detailed insight into consumer behavior in realtime, the possibility of predictions, better crisis management, boosting creativity with the help of AI tools, improving communication and relations with consumers, and strengthening the omnichannel marketing strategy.

IV. RISKS AND CHALLENGES OF ARTIFICIAL INTELLIGENCE APPLICATION IN SOCIAL MEDIA MARKETING

Although the use of AI in social media marketing brings many benefits, it also comes with numerous risks and challenges, as well as concerns about its impact on users and society as a whole. The most important risks and challenges associated with the use of AI in social media marketing are the following:

• Privacy concerns - One of the biggest risks of using AI is compromising user data privacy. AI tools have a huge amount of data at their disposal, including location, search history, likes, shares, and comments, which leads to security risks if the data is unprotected. This is especially important for sensitive data, such as healthcare data, banking data, or other personal information [28]. According to Dilmaghani et al. [29], the main problems of big data security are data breach (unauthorized access to data), bias in data, data poisoning (sabotage and manipulation of training input data to affect the output), and evasion (the system cannot detect AI machine attacks). Sachdev also states that cloud-based AI models (which are common on social media) generally suffer from a lack of privacy. Consumer data is collected in the cloud, often owned by a third party [30]. Some companies even prevent the use of AI in marketing to

prevent data privacy violations and preserve consumer trust [31].

- •*AI Bias* AI bias or machine learning bias is "a phenomenon that occurs when an algorithm produces results that are systemically prejudiced due to erroneous assumptions in the machine learning (ML) process" [32]. Large amounts of data are required to train computers to carry out tasks [33]. Lack of quality, objectivity, and insufficient training databases contribute to AI bias [32]. General AI tools are only as good as their inputs, and there is a risk of repeating human errors from the input content. Many existing AI tools are not perfect. They need to be developed much deeper and trained with different data to avoid biases [28].
- *Misinformation and plagiarism* AI tools help social media platforms identify and remove spam, fake accounts, and fake engagement. On the other hand, the same tools are used to spread disinformation and fake news. For example, bots and fake accounts can spread false information about candidates in elections or topics of public interest. Consequently, they can influence public opinion and election results [32]. There is also a risk of plagiarism, as the inputs are already existing data sources [29].
- Lack of trained staff Many companies do not have professionals trained in AI and machine learning. The lack of personnel and training is one of the biggest challenges in the IT sector, which affects the lower use of AI in marketing [3].
- Overreliance on AI AI is very powerful, but it should not be used in isolation. AI social media analytics helps to gain valuable insights about consumers, but it requires human intervention to make the conclusions valid. Also, using automatic tips to improve advertising (using one click) often leads to the wrong actions. Therefore, constant monitoring of the activities of AI tools is necessary.
- Impact on unemployment AI tools perform many functions performed by intelligent beings. Rapid advances in AI and the automation of numerous activities have the potential to significantly impact the labor market and cause job losses in many industries. However, previous studies have

shown mixed results on the impact of AI on unemployment [28].

V. CONCLUSION

Artificial intelligence has completely transformed social media marketing. The application of AI in social media marketing is quite broad, including the automatic creation of written and visual content, gaining insight into predictive behavior. enabling consumer analytics, communicating with consumers using chatbots and virtual assistants, managing advertising, etc. The use of AI in social media marketing undoubtedly has a promising future. It is assumed that AI will soon enable the creation of hyper-personalized content, the definition of much more robust consumer personas, and the better differentiation of qualified and unqualified leads [30]. Although the application of AI in marketing has become a popular research topic, there is a significant gap between scientific research topics and the practical use of AI in marketing. Future research should focus on the advantages and disadvantages of AI tools used in marketing practice, the validity of consumer insights created by artificial intelligence tools, and the use of AI tools in companies due to insufficient employee training.

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Start-up Ecosystem in India: Problems and Prospects

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Abstract—The Indian startup ecosystem is confronted with various problems, however, it is strategically set up for development. This paper aims to study the nature and pattern of startups in India. Firstly, this paper focuses on the Indian Startup Ecosystem. Secondly, it examines the recent innovations in the existing startup ecosystem. Thirdly, it discusses the current status of Indian startups. Finally, it analyzes the challenges faced by Indian startups in the past decade and the ways to overcome these challenges.

Keywords - Startup, entrepreneurship, innovation

I. INTRODUCTION

A startup is a business that is regularly established by a couple of individuals with a major thought. New businesses are in many cases high-development, imaginative organizations that are hoping to disturb a current market or make another one. A startup ecosystem is an organization of associations and people that help the development of new businesses. This organization incorporate colleges, can hatcheries, gas pedals, financial backers, tutors, and different organizations. The objective of a startup biological system is to establish a climate where new businesses can flourish and succeed. Point of the underlying founder(s) is to lay out a serious prime supporter group with important abilities and capacities to have the option to approve the underlying issue/arrangement fit and item/market fit, prior to scaling it to huge organization and self-supported business. So not withstanding advancement process itself, from thought to esteem creating item and plan of action, new businesses likewise need to have areas of strength for a serious establishing group and create both of these together into a genuine

developing business and association that catches the worth being made as an incredible organization. An extraordinary organization is a self-supporting element that is as of now not subject to any single individual or other association, where all essential information, values, systems, IPR and so on are for all time implanted to its presence such that it can keep on working, improve and fabricate an incentive for clients, investors and other key partners, while outstanding monetarily stable by the worth of arrangements and items it makes.

II. REVIEW OF LITERATURE

According to Monika Sheoran and Divesh Kumar [1], environmental concerns are becoming increasingly important in businesses, and startups are influenced by these concerns. Their article aims to understand the relationship between startups' internal and external operations, as well as their network size and frequency. A survey was conducted in Rajasthan, India, to identify the relationship between startups' environmental concerns and networking efforts. The findings showed a significant relationship between startups' external environmental concerns and networking, suggesting the importance of environmental concerns in business operations.

According to Dr. Kishor P. Bholane [2], Agri new companies are the need of ranchers as well as the country. In India, the number of agribusiness startups and investments in them are gradually rising. Agri-tech startup is vital to the change of India's huge agrarian area and rustic economy. It addresses issues pertaining to Indian agriculture, has the potential to alter the sector of Indian agriculture, and may eventually result in an increase in the incomes of farmers. Right now, the nation needs startups in Agri-tech. These startups are also getting a boost from government policies to make it easier for them to find investors. With this new initiative, farmers can finally anticipate improved price realization. In recent years, a flurry of Agri-tech startups have emerged in India to address the issues facing Indian agriculture.

Misha [3] said that, with the execution of liberal strategies and projects for business visionaries, for example, 'Make in India,' 'Startup India,' MUDRA, and others, the Indian government is continuously showing more noteworthy enthusiasm to further develop the Gross domestic product pace of improvement from the beginning. "Make in India" presents a fantastic opportunity for Indian startups. With such a large population, entrepreneurs have numerous opportunities to offer low-cost goods and services in a variety of industries, including food, retail, hygiene, solar, and IT solutions to everyday problems. It is important to note that if these businesses expand into other developing and underdeveloped regions, they could become unicorns and world-famous corporations.

Sapna Manshani & Anjna Dubey [4] said in their paper that presently, women are becoming advanced and they are doing excellent jobs in their own ways by overseeing family and work both. Because of the expanded degree of schooling they are mirroring their power in the startup situation. This study is an endeavor to examine the commitment of women new businesses in monetary turn of events, and to know the different elements liable for empowering ladies to become business visionaries. Surbhi Jain [5] in her article said that India declared 2010-20 as the Decade of Innovation. Development is the key for startup biological systems and results for more industrialization that raises a nation's income per capita. However, the lack of organization and fragmentation of Indian markets is one of the biggest issues. There are insufficient communication channels, knowledge, and exposure, as well as clear-cut policy motivations. Startup systems necessitate a combination of favourable operational, regulatory, and taxation issues that have a significant impact on business operations. The government, major corporations, and educational institutions ought to step forward to foster a startup culture in India in order to establish an entrepreneurial environment. In order to achieve this objective, the government and universities ought to organize mentor programs, novel essay contests, workshops, and seminars. In general, there was a lot of room for expansion for startup ecosystems in India.

India offers the biggest pie of adventure prospect that the world is looking at. Dr. Sabrina Korreck [6] in her paper considers the present status of the Indian startup ecosystem and has three objectives: to give a comprehension of the development drivers and inspirations of Indian startup originators and to distinguish difficulties confronting these new companies along with framework of the points of support set up that help them. The examination utilizes information obtained from semi-organized interviews with startup pioneers, financial backers, and delegates of help associations. In expansion, a study of pertinent writing fortifies the power of the discoveries.

Nityesh Bhatt and Ritesh Kumar Verma [7] in his survey paper outlines development peculiarity of current Indian innovation startup biological system with all encompassing methodology. It examined different constituents of biological system for tech-new businesses in India, i.e., strategy structure, instructive climate, monetary help from homegrown and worldwide assets, support associations like hatcheries, gas pedals, and so on. In light of these elements, bottlenecks of the environment are distinguished and strategy measures have been recommended to overcome any issues.

III. METHODOLOGY

The study relies on secondary data gathered from a variety of sources, including books, journals, newspapers, research papers, and websites. The startup ecosystem in India ranks third in the world and is expected to observe year-over-year development of 12-15%. India has around 50,000 new businesses in 2018; around 8,900 - 9,300 of these are startup businesses, and 1300 new tech companies were brought into the world in 2019 alone. The speed of development in the startup environment has expanded to 15% year-on-year in 2018, while the development of the quantity of hatcheries and gas has developed pedals to 11%. Fundamentally, the quantity of women business visionaries remained at 14%, up from 10% and 11% in the past two years. Startup Genome is the world-leading innovation policy advisory and research firm. According to the 2019 Startup Genome Project ranking, startups in the country have been able to create an estimated 40,000 new jobs over the course of the year. This brings the

total number of jobs in the start-up ecosystem to between 1.6 and 1.7 lakh. Bangalore is one of the 20 leading startup cities in the world. Additionally, it is ranked among the top five fastest-growing startup cities worldwide [8].

IV. MAJOR STARTUPS IN INDIA

CRED is the newest Indian startup with an estimated 2.2 billion dollar valuation. This 2year-old startup has in excess of 6 million clients and around 22% of all charge card holders. Only a small number of businesses maintain steady growth over time by focusing on the high-end customer base. CRED is likewise wanting to present a component where CRED coins can be utilized by more than 1,000 vendors. Additionally, the startup intends to own an online store. It is abundantly clear that the startup intends to provide its customers with reward coins alone.

MEESHO is an ecosystem that makes it possible for small businesses to operate on the online platform is Meesho. Facebook is one of the investors in this platform, which has raised \$490 million so far. Meesho manages logistics, orders, and payments for sellers in an online marketplace and connects customers with sellers. One can find startups in the field of fashion also. NYKAA is a platform for fashion e-commerce and an online beauty store. It was established in 2012. Bollywood stars like Alia Bhatt and Katrina Kaif are among the investors in the company. Former investment banker Falguni Navar, the platform's founder, envisions a platform with thousands of product options. Presently, the organization has in excess of 55 retail locations and satisfies around 1.5 million orders consistently. Through its stores and website, Nykaa deals with more than 500 brands and has more than 5 million monthly active users. Paytm is a digital payment and financial services provider based in India that caters to a diverse clientele.

The company, which was founded in 2010, started out as a service for mobile wallets but has since grown to become a one-stop shop for all of your financial needs. Through its platform, Paytm provides services such as mobile recharges, bill payments, ticket booking, money transfer, and online shopping. SWIGGY is another startup established by Nandan Reddy, Rahul Jaimini, and Sriharsha Majety in 2014. Swiggy ensures that it provides one of the best customer service experiences by focusing on the restaurant and delivery industries. Initially began in Bangalore, it is currently present in north of 27 urban communities, covering more than 40 thousand eateries altogether. Skyroot Aerospace is India's most memorable confidential space send off startup framed in July 2018 by previous Indian Space Exploration Association researchers Pawan Kumar Chandana, and Naga Bharath Daka. This new company offers a commercial launch service and has already contributed to the development of the Vikram rockets, which are used to launch small satellites into space.

Policybazaar is an Indian internet based protection aggregator and monetary innovation organization. The company, which was established in 2008, provides customers with a digital platform through which they can compare and purchase insurance policies in a variety of categories, such as health, life, motor, travel, and home insurance. Policybazaar offers competitively priced insurance products to customers through partnerships with leading Indian insurance companies. The organization's foundation utilizes information investigation and man-made reasoning to give customized protection proposals to clients in view of their singular necessities and inclinations [9].

V. IMPACT OF STARTUPS IN INDIA

Startups are crucial to the creation of new jobs, democratizing access to business opportunities, and innovation pathways. Table I, shows that the number of jobs and GDP of the country increase with the increase in number of startups in India. Fig.1 shows the impact of startups on the number of jobs created. Fig.2 depicts the impact of startups on GDP of the country.

Year	Total no. of startups	No. of jobs created by startups YOY(DPIIT)	GDP in Billion dollars
2017	5233	49000	2652
2018	8775	93527	2701
2019	11417	142645	2871
2020	14596	169724	2668
2021	20160	192427	3173
2022	24682	230000	3469

 TABLE I.
 IMPACT OF STARTUPS ON JOBS AND GDP [10]



VI. GOVERNMENT POLICIES

There are many policies initiated by the government of India to provide substantial fund to startups. For instance, MSME Sustainable (ZED) Certification is a scheme established with the intention of raising awareness of Zero Defect and Zero Effect (ZED) among MSMEs. All **MSMEs** registered with the UDYAM registration portal are eligible to participate in MSE Sustainable (ZED) Certification and avail related benefits and incentives. There are three certification levels included: Bronze, Silver and Gold, and is fundamentally founded on the boundaries of Value, Security, Creation, Neatness and that's just the beginning. The Indian Prime Minister wanted to use this scheme to encourage micro, small, and medium-sized enterprises (MSMEs) to produce goods with consideration for the environment. Under this administration plot, the two new companies and MSMEs will get monetary and mechanical help to guarantee no deformities in the products. The government has provided approximately INR 7.43 crore in financial assistance under this scheme. ASPIRE (A Scheme for Promotion of Innovation. Rural Industries and Entrepreneurship) was presented by the Government of India in 2015 with the intention of working on provincial India's social and financial parts of life, making it perhaps the most well-known conspire sent off by the Indian Government. As a large portion of India still relies on agriculture for its livelihood, the Ministry of Micro, Small, and Medium Enterprises (MSME) launched this program to

assist in the establishment of a network of technology centres and incubation centres to encourage entrepreneurship and innovation in the agro-industry. One more scheme to provide monetary help to beginning phase of new companies is Startup India Seed Asset Plan. It provides funds for for market passage, item preliminaries, commercialization, model turn of events, and confirmation of idea. This is one of the most amazing plans for financing for new companies in India by government. The public authority has dispensed a complete spending plan of 945 crores to this plan. It hopes to give assets to 3600 new businesses. Awards of up to 20 lakh be accommodated creating rupees will preliminaries or models. This plan likewise expects to improve the advancement culture and advancement in the country. Atal Development Mission is Legislature of India's leader drive to make and advance a culture of development and business venture across the length and broadness of our country. This scheme promotes entrepreneurship through self-employment and talent utilization. The Startup India Initiative is the biggest government plot for new businesses in India. It has a broad assortment of digital books, courses, and mentorship projects to advance authority and abilities.

VII. CHALLENGES FACED BY STARTUPS

Startups all over the world face a variety of common problems. However, certain challenges are more specific to the Indian business environment. In this study, India was frequently referred to as a hostile setting for startups. Major



challenge faced by startups is building and Scaling an Indian Startup. The fundamental tasks of hiring and managing a team, dealing with customers, and developing a marketing strategy are the first obstacles that Indian startups face. In particular, many Indian founders lack business expertise and come from technical backgrounds. Secondly, a significant amount of working capital is required to run a startup. A lot of startups, especially in the early stages, are bootstrapped, or they use money from friends and family or their own savings to fund themselves. A few new businesses have an adequate number of paying clients, with the goal that they are or become self-supporting through the income and benefits they create and can develop naturally.

As a result, while not every startup requires outside funding, many start looking for investors as they plan to expand. Even if they have received positive feedback on their product and have demonstrated market validation, finding the right investor and raising funds are challenging. Apart from all this, the startups face a huge problem in hiring qualified employees. Due to the inherent risk of the startup's failure, joining the company as an employee does not appeal to many job seekers. Many job seekers prefer to work for large corporations due to the risk of startup failure. Startups struggle to compete with the reputation and compensation of large corporations. Many job applicants lack necessary skills, leading startups to spend time and money training new employees. Moreover, new companies need to follow various guidelines,

which can be tedious and costly. Sometimes, the startup makers aren't aware of the rules and regulations that are to be kept in mind, while starting a small business so that they don't go against the basic laws. New companies need to make a positive and useful culture to draw in and hold top ability. This can challenge, as new companies are in many cases moving and turbulent. In spite of the difficulties, new businesses can very compensate. They offer the chance to be imaginative and to have an effect on the planet. In the event that you are contemplating beginning a business, make certain to properly investigate things and be ready for the difficulties ahead.

VIII. FUTURE OF GREEN STARTUPS IN INDIA

Phool is a company, based in Kanpur that collects floral waste from three Indian cities, including one of the largest temples, preventing 13 tons of waste flowers and harmful chemicals from entering the river each day. In addition, it is the first direct-to-consumer wellness brand in India to receive the coveted Ecocert Organic and Natural certifications and the Fair for Life-Fairtrade certification. Banyan Nation is a waste management company Banyan Nation recycles plastic waste from businesses for use elsewhere. The startup produces recycled polyolefin plastics (PE and PP) of the highest quality for use in both commonplace and highquality applications and integrates thousands of informal workers through its one-of-a-kind technology platform. This Hyderabad-based organization use tech-based answers for gather plastic from casual recyclers and organizations.

BluSmart is an app-based, all-electric platform for business-to-consumer ride-hailing with approximately 600 electric vehicles (EVs) in Delhi-NCR. With a dedicated fleet of electric vehicles for customers seeking sustainable mobility, this Indian company is competing with Ola and Uber, two industry giants. ZunRoof is a solar energy startup in India that focuses on the private sector. It has installed over 300 solar net meters in Delhi and 1000 solar rooftops in Gujarat. However, the residential solar market is difficult to penetrate due to the varying sizes and intricacies of ventures. Ather Energy produces two electric scooters and settled the Ather Network for electric vehicle charging. It raised \$128 million from Hero MotoCorp. National Investment and Infrastructure Fund, and other expand retail network. investors to manufacturing facilities, R&D, and charging infrastructure.

IX. WAYS TO OVERCOME CHALLENGES FACED BY STARTUPS IN INDIA

An app like Aarogya Setu should be made wherein the information related to the state that is more prone to a particular disease can be detected so that medicines and treatment can be given to make the state disease-free. To solve the problem of unskilled labour, there should be a 15-day training period wherein the people who are shortlisted for working in the company are given training sessions about the working of the Moreover, company. some technological accessibility can be provided to them, so that they can learn and work simultaneously. This will reduce the problem of unskilled labour in the startups. The problem of working capital can be handled by creating a platform that interfaces organizations with transient banks. This stage would permit organizations to rapidly and effectively secure the functioning capital which they need to cover up the startling costs or costs incurred while developing their businesses. A software that assists organizations with computerizing their records receivable and pavables processes. This would assist organizations with lessening the time and assets they spend on these errands, opening up cash that can be utilized for different purposes. A platform that furnishes organizations with admittance to stock support. This assistance would permit organizations to fund the acquisition of stock, which can assist them with working on their income and keeping away from stockouts. A company that creates instructive assets on working capital administration. This

organization would make courses, online classes, and different materials to assist organizations with finding out about working capital and how to really oversee it. An app like Zepto should be made in order to supply free medicines in areas like Haryana which are prone to tuberculosis which can spread easily, so the easiest way is to provide treatment to the people.

An organization that grows new innovations to assist individuals with incapacities. There are many individuals with handicaps who face difficulties in their regular routines. This start-up may be able to develop novel technologies to assist people with disabilities in living with greater independence and fully participating in society. An organization that grows better approaches to battle environmental change. Environmental change is a significant danger to the planet. This startup could assist with combatting environmental change by growing new innovations to decrease ozone-harming substance discharges, further develop energy proficiency, and advance sustainable power. An organization that grows better approaches to reuse and reuse plastic. This start-up may be able to contribute to the solution to the problem of plastic pollution by developing novel methods recycling and reusing plastic. for An organization that gives reasonable and open mental medical care. By offering online therapy and other services, this startup could contribute to making mental health care more affordable and accessible.

X. CONCLUSION

The government of India is playing a significant part in supporting the development of the startup ecosystem, through drives, for example, the Startup India Scheme. The Indian market is enormous and developing, with a youthful and educated populace. This gives an enormous likely market to new businesses. There is a developing pioneering society in India, with an ever-increasing number of individuals hoping to begin their own organizations. With the right help, Indian new companies can possibly accomplish incredible things. The startup environment in India is developing quickly, yet it actually faces various difficulties. Nonetheless, there are likewise various positive possibilities for new companies in India. In the event that new businesses can defeat the difficulties they face, they can possibly assume a significant part in the monetary improvement of India. The startup ecosystem in India is at a junction. From one

viewpoint, it is confronting various difficulties, like an absence of financing, administrative hindrances, and a chaotic market. Then again, there are likewise various positive possibilities for new companies in India, for example, an enormous and developing business sector, government backing, and quick mechanical development. The future of new companies in India will really rely on how they can explore these difficulties and open doors. On the off chance that they can do so effectively, they can possibly assume a significant part in the monetary improvement of India.

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Design Thinking and Creative Problem Solving in Modern Organizations

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Abstract—The environment in which today's organizations operate is turbulent. It is characterized by global competition, frequent changes and very demanding customers. Nowadays, it is increasingly difficult to meet the demands of consumers. In addition to products and services that have high quality, they also seek uniqueness, practicality, durability, and sustainability. In order to respond to these demands, organizations must be ready to innovate their products and services, that is, to encourage their employees to be creative, but also to constantly improve their knowledge and skills. As one of the solutions to create products and services that will respond to the demands of consumers is the use of creative problem solving and design thinking. This paper will deal with the creativity of employees, creative problem solving, design thinking, as well as business improvement using design thinking and creative problem solving.

Keywords – Creativity, design thinking, creative problem solving

I. INTRODUCTION

The increasing globalization of business encourages organizations to find new ways to increase productivity and achieve business success. As customers become more and more demanding, employees appear as the most important resource in the organization. They must possess broad knowledge and skills to be able to respond to these demands. However, this became insufficient. Innovation has become critical to the success of organizations [1,2]. Creativity is the generation of new and useful ideas, which require employees to deviate from existing ways of working in order to propose new ideas, which they will further explore and experiment with [3]. Creativity is not only a quality possessed by exceptional individuals, but also an essential skill through which every employee can develop his potential, use his imagination to express and create something new and original [4,5].

Creativity and innovation are common themes when it comes to modern business. This is where the term design thinking comes in. Unlike traditional problem-solving frameworks, which use a more scientific method, design thinking is more human-oriented [6]. Design thinking is recognized and accepted as a successful problem-solving method, a method that combines end-user focus with multidisciplinary collaboration and iterative experimentation achieve desirable. to economically viable and user-friendly innovation [7]. According to some authors, the design thinking process consists of three phases: inspiration, idea and implementation. While others believe that it includes five stages: empathy, definition, idea, prototype and testing [8-10]. The use of design thinking in problem solving leads to improvements in recognizing opportunities, exploiting opportunities and influencing on change and innovation [11].

The problems faced by companies today are increasingly complicated and require unique solutions. There is a need for creative problem solving. Creative problem solving is a way of solving problems or identifying opportunities when conventional thinking does not produce results [12,13]. The most famous model for creative problem solving is the Osborn-Parnes Creative Problem Solving Model, it consists of six stages: identifying the goal, searching for facts, defining the problem, creating a large number of ideas, creating a plan and implementing solutions [14]. Creative problem solving helps to create and encourage innovation, helps to solve more complicated problems, stimulates employees to express their opinion and thus be more satisfied.

Design thinking helps to highlight why creative problem solving is important. Simply put, companies that want to use the principles of creative problem solving must also think designwise and vice versa.

II. CREATIVE POTENTIAL OF EMPLOYEES

Creativity is of а key ingredient organizational efficiency, innovation and success. It is considered a key driver of competitiveness, both inside and outside organizations. Creativity is the production of new and useful ideas related to products, services and work processes. Organizations that want to encourage creativity at their employees must build a creative work environment [15]. A creative work environment represents the social environment of the organization that most effectively supports the generation of new ideas. The environment can be influenced by a range of factors that operate at multiple levels in the organization, from individual factors to team relationships, including overall the organizational culture and climate [1].

Organizations, i.e. employees in organizations, generally possess creativity. It is only necessary to notice creativity and encourage employees to express their ideas. What differentiates organizations from others by possessing creative potential is [16]:

- variety/diversity greater differences in knowledge, experiences, attitudes leads to a greater degree of creativity. Greater differences in knowledge and experience lead to a different view of the problem, so the number of potential creative solutions is greater;
- open working environment creating an organizational culture that gives employees the opportunity to express

their opinions has a positive effect on creative freedom;

- sense of belonging employees who feel important in organizations are more ready to show all their potential;
- risk acceptance creativity, as well as new innovative ideas do not necessarily lead to success, which also brings great fear among employees. For this reason, innovation is often stifled. Therefore, organizations must be prepared to deal with this type of risk;
- trainings and education additional training of employees is necessary in order to constantly improve their knowledge and skills, and therefore their innovation.

As already noted, creativity will be a "key ingredient" to the success of organizations in the future. Employees often do not implement their creative ideas. There are two main reasons. The first relates to the fact that they are not sure that management will support their ideas. Another reason is that they fear that they will suffer negative consequences and cause resentment among their colleagues [17]. For this reason, management's task is to encourage and motivate its employees to develop their creative potential. Some of the ways to stimulate the development of creativity among employees are [18,19]:

- show faith in employees this builds self-confidence and gives employees more freedom to express new ideas;
- take time for new ideas listen to employees, provide them with feedback, help them in what they need to improve;
- remind employees of past successes in this way, greater enthusiasm is created to move forward and create new ideas;
- encouraging employees just like a coach in sports, a manager in organizations should awaken positive energy in employees so that they can complete those work tasks;
- rewarding recognition and rewards can do wonders for expressing creativity. It does not have to be exclusively material rewards. Encouraging employees and through various recognitions, such as days off, shorter working hours, has a

positive impact on motivating them to work.

III. DESIGN THINKING AND CREATIVE PROBLEM SOLVING

A. What is Design Thnikning?

Creativity is one of the most important skills of employees in the 21st century. In order to be able to think creatively, you need design thinking. Design thinking is an interdisciplinary domain that uses approaches, tools, and thinking skills to help generate a variety of ideas. The term design thinking refers to the cognitive processes or thinking skills and practices used to create new artifacts or ideas to solve practical problems [20,21]. Design thinking relies on understanding human needs in relation to problems and reframing those problems in a way that helps humans solve them [22]. With design thinking, the user's needs are in focus. Theorists believe that problems are not best solved using a rational or economic approach, but that design thinking is much more effective because it is humancentered. This means that this way of solving problems is more sustainable, especially those problems where there are certain ambiguities or are more complicated [23,24].

The process of design thinking includes three basic and six extended phases (Fig. 1) [25,26].



Those are:

- empathy through communication and conversation with users and noticing their feelings, dissatisfactions and problems are noticed, which need to be worked out further;
- defining using the collected observations from the first phase, the problem to be solved is defined;
- idea based on the problem that has been defined, potential ideas for solving the problem are given. At the end of this process, a number of ideas are possessed that help the process move forward;
- Prototyping in this phase ideas are turned into a solution. Prototypes cannot be perfect, but they provide a more concrete solution to a problem;
- testing when a prototype solution is available, it needs to be tested, in order to get feedback on the solution to the problem;
- implementation after the obtained test results, the best idea, as the best solution, is implemented on the real market.

The design thinking process is best carried out in an environment that encourages creativity, which includes sufficient resources and tools, space for creativity and a mindset that supports it. Those who want to apply the design thinking process should first make sure that they are properly prepared [25]. Some of the basic materials to have in order to make the design thinking process successful are: large graph papers, whiteboards, markers, sticky tape, cardboard, styrofoam, etc. The physical space for carrying out design thinking should be equipped with adequate furniture that creates a relaxed atmosphere and in which the participants in the process will not be disturbed. The design thinking process can also take place in a virtual environment. using various online communication programs digital and tools [9,27].

Today, design thinking is recognized as a successful problem-solving method, a method that combines end-user focus with multidisciplinary collaboration and iterative experimentation to achieve a desirable, userfriendly, and economically viable idea or innovation [22].

B. What is Creative Problem Solving?

Companies face a large number of problems in their operations. Initially, they were solved using structured solutions, but as the problems became more complicated, more unique solutions were required. There arose the need for creativity, i.e. creative problem solving [13]. Creative problem solving offers a practical set of tools for solving more complicated problems. In essence, creative problem solving is a method that encourages employees to find new ways to accomplish their tasks [28,29]. Creative problem solving is a way of solving problems or identifying opportunities when conventional solutions do not yield results.

There are several models for creative problem solving, some of them are: Crutchfield system of developing creativity, Osborn-Parnes Creative Problem Solving Model, Basadur's Simplex model and The Learner's Model. However, the most famous is the Osborn-Parnes Creative Problem Solving Model, which consists of six stages [30]:

- finding the mess/objective finding in this phase clear goals of the problem solving process are defined;
- establishing the facts gathering as much information as possible that is needed to solve the problem;
- finding the problem by looking at the facts, in this phase one digs deeper and finds the root, that is, the real problem that needs to be focused on;
- finding ideas in this phase, as many ideas as possible are generated to solve the problem. Different techniques are used, proposals are not judged...;
- finding solutions finding the best solution from the generated ideas. The selection criteria for evaluating the best idea are set and based on the criteria, the best idea is selected;
- creation of an action plan within this phase, the creation of an action plan for the implementation of the solution that has been determined as the best choice is carried out. It is identified who is responsible for each activity, what are the deadlines and what means are necessary to implement the solution.

Creative problem solving uses a large number of tools, they are based on creative and critical thinking [28]. Some of the tools for creative thinking are:

- brainstorming generating a large number of ideas, of which the best one is finally found;
- force-fitting using objects or words that seem unrelated to the problem, but serve to create new possibilities or connections;
- attribute listing using basic attributes as a basis for generating new directions and ideas for solving problems;
- SCAMPER application of a checklist of words or phrases that encourage new ideas;
- morphological matrix an analytical tool for identifying the key parameters of the task, generating possibilities for each parameter, and then exploring possible combinations and matching the best combination.

Critical Thinking Tools:

- hits and hot spots selecting appropriate opportunities, grouping, categorizing and organizing in meaningful ways;
- AloU: refining and developing using a deliberate, constructive approach to strengthening or improving options, taking into account strengths, limitations and unique characteristics, as well as ways to overcome them;
- PCA: Paired Comparasion Analysis setting ranking priorities through systematic analysis of all possible combinations;
- senquencing: SML organizing options, considering short-term, medium-term and long-term actions;
- evaluation matrix –using specific criteria in a systematic way to evaluate the best option for solving the problem.

The benefits of creative problem solving are numerous. First of all, more complicated and less clear problems are solved more efficiently and effectively. The participation of a larger number of employees is encouraged, thus strengthening the team spirit. Creative solutions save money, material resources and time for organizations. And finally, creative problem solving leads to innovation, which most often achieves a competitive advantage in the market [31].

IV. CONCLUSION

Employee creativity is key to an organization's ability to gain competitive advantage, increase success and improve longterm performance, because creativity leads to innovation. There are numerous situations in which traditional problem solving does not lead to the desired solution. This is the reason for encouraging creativity, i.e. for stimulating creative problem solving and design thinking. Design thinking helps highlight why creative problem solving is important. The structured processes that drive design thinking are inspired by the philosophy of creative problem solving. One principle can work without the other, but they work best when applied together. And in general, except in organizations, which in the future will not be able to survive on the market without creativity, i.e. creative problem solving and design thinking, creativity needs to be stimulated from early childhood. By stimulating creativity, it affects increasing self-confidence, increasing general intelligence, emotional intelligence, innovation, etc. Ultimately, the success of organizations will depend on such people.

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EU Investments in the Republic of Serbia - Importance and Forecasting Possibilities

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Abstract — Globally, the European Union is considered the largest foreign investor and the most attractive investment destination that attracts the most significant number of foreign investors. From the point of view of the Republic of Serbia, the European Union is the primary economic partner and provider of financial assistance in areas such as infrastructure, education, culture, business competitiveness, environmental protection, etc. This paper aims to review the investment relations between the Republic of Serbia and the European Union from 2010 to 2022, based on the available data from the National Bank of Serbia. Based on the same data set, the trend of Foreign Direct Investment (FDI) in Serbia in the following years was predicted using an autoregressive model. The results unequivocally indicate that a positive trend in investments can also be expected in the coming years.

Keywords – European Union, Foreign Direct Investment, autoregressive model, forecasting

I. INTRODUCTION

One of the main characteristics of transitional economies and developing countries, such as Serbia, is the low level of domestic capital accumulation, which conditions the need to intensify the inflow of Foreign Direct Investment (FDI) to accelerate economic growth. FDI [1] is defined as a category of international investment that reflects the objective of a resident in one economy (the direct investor) obtaining a lasting interest in an enterprise resident in another economy (the direct investment enterprise).

At the same time, FDI brings external effects that have a positive impact on productivity levels in a host country [2], and it is considered the most significant developmental opportunity for companies and the best way to increase production, employment, export and living standards in the long term [3]. According to the United Nations Conference on Trade and Development (UNCTAD) methodology [4], FDI consists of (1) Equity Capital, (2) Reinvested Earnings, and (3) Intra-Company Loans. Suppose at least one of the mentioned three categories of FDI is a negative quantity that could not be compensated by the positive amounts of the remaining two components. In that case, the FDI flows have a negative sign.

FDI flows record the value of cross-border transactions related to direct investment during a given period of time, usually a quarter or a year [5]. Cheng and Kwan [6] point out that many countries look at attracting FDI as a vital element in their economic development strategies because they are considered a combination of capital, technology, marketing and management. Taking that into consideration, it can be said that Serbia competes with other countries in the South-Eastern Europe (SEE) and Central and Eastern Europe (CEE) regions in attracting the most considerable possible amounts of foreign investment, first of all by establishing liberal laws on FDI, reducing corporate income tax and abolishing trade barriers and investment bans.

Investment in a particular economy can often be motivated by flexible wages, suitable employment policies and low costs of firing workers [7]. However, the mentioned benefits for investors usually take on the opposite character when viewed from the host country's perspective. Namely, the dismissal of workers by a foreign investor creates a situation in which unemployment can represent an extensive social cost. However, even if there are no such problems, there are high costs due to unemployment [8]. So far, it has been shown that applying tax incentives alone is not enough to attract foreign investors. Still, they come to the fore only after an appropriate investment climate is created in the country and after other non-tax incentives are previously applied.

II. GLOBAL TRENDS OF FOREIGN DIRECT INVESTMENT

Generally, the European Union is considered the largest foreign investor worldwide, as well as the most important investment destination. According to data from the European Commission at the end of 2019 [9], foreign direct investors who are residents of the EU invested 8,990 billion euros in other countries, while residents of other countries invested 7,138 billion euros in the European Union in the same year.

From the perspective of the host country or investor country, FDI flows can be divided into inward FDI flows, e.g., FDI inflows and outgoing FDI flows, e.g., FDI outflows. Inward flows [5] represent transactions that increase the investment that foreign investors have in enterprises resident, that is, investments in the host country. FDI outflows [10] are the value of outward direct investment made by the residents of the reporting economy to external economies. In 2021, global FDI flows increased by 64.3% compared to the extremely low level in 2020 caused by the COVID-19 pandemic. In this way, FDI growth was achieved in all regions, and this trend continued during 2022.

It is also noticed that FDI inflows [4] to developed economies more than doubled in 2021, and FDI outflows from developed economies more than tripled. Concurrently, the value of FDI outflows from developing economies rose by 17.8%. Still, FDI flows to developing economies grew more slowly than those to developed economies but still increased by 29.9% (Fig. 1).

Based on the above, it can be seen that in 2021, the share of global inflows made up of developed economies returned to pre-pandemic levels, while the share of developing economies remained at a level of slightly above 50%.

III. REPUBLIC OF SERBIA AS A DESTINATION FOR FOREIGN DIRECT INVESTMENT

Foreign investments tend to bring benefits not only to the host countries but also to the home countries through economic growth, creating new jobs and inclusion in global value chains. At the same time, most countries strive to improve the conditions for attracting investors by establishing an adequate national policy and signing international agreements. In the Republic of Serbia, the Regulation on Conditions and Methods of Attracting Direct Investments [11] regulates the criteria, conditions and methods of attracting direct investments in more detail. The Regulation refers to the financing of investment projects in the manufacturing and service sectors



Figure 1. Foreign direct investment inflows and outflows, 2021.

that may be subject to international trade, while at the same time, foreign investors are provided with tax incentives.

In the total value of FDI in the Republic of Serbia that was realised during the second decade of the 21st century, the European Union achieved a dominant share of almost 68%. According to [12], the Republic of Serbia is ranked among the countries that achieved strong performance when looking at jobs created from FDI relative to population size. In that sense, Serbia is one of the top-performing countries globally after another record number of new jobs.

According to data from the National Bank of Serbia [13], in 2022, a new record inflow of FDI was recorded in the amount of 4432.5 million euros, which is an increase of 14.06% compared to the previous year, and at the same time, the continuation of the positive trend from 2016, when continuous growth of FDI inflows is recorded. The share of FDI from the EU in total values in 2022 was 31.44% (Table I).

In 2012, the largest individual FDI came from the Russian Federation (23.0%), while investments from European Union countries (with Great Britain) accounted for 61.21% of total FDI in Serbia, and investments from China 0.13%.

 TABLE I.
 Share of selected foreign direct

 INVESTMENT IN TOTAL FDI IN THE REPUBLIC OF SERBIA
 (2010-2022).

Voor	Share of FDI in total FDI			
Ital	European Union	Russian Federation	China	
2010	62.72%	16.91%	0.17%	
2011	76.87%	13.78%	0.53%	
2012	61.21%	23.04%	0.13%	
2013	68.79%	12.26%	1.43%	
2014	70.09%	4.90%	5.76%	
2015	71.40%	4.56%	3.14%	
2016	64.45%	1.93%	10.31%	
2017	66.78%	6.69%	7.03%	
2018	55.79%	7.59%	19.92%	
2019	60.54%	15.12%	9.04%	
2020	64.36%	1.83%	17.39%	
2021	45.35%	1.03%	16.22%	
2022	31.44%	10.46%	31.10%	

Source: Adapted by author based on data from the National Bank of Serbia.

Furthermore, in order to look at the tendency of FDI movement in the Republic of Serbia in the period from 2010 to 2022 and draw appropriate conclusions, an analysis of the available data was performed with a simultaneous presentation of the movement of total FDI, as well as individual FDI from the EU, the Russian Federation and China in millions of euros (Fig. 2).

Source: Adapted by author based on data from the National Bank of Serbia.

The Fig. 2 clearly shows that the investments of the EU (represented by the red line), expressed in millions of euros, are more than dominant in the observed period compared to the investments of the Russian Federation and China. It is also noticeable that the level of EU investments in 2021 and 2022 is slightly lower compared to the previous decade, while investments from China recorded a significant increase.

It should be borne in mind that from 2010 to 2022, there were various projects, and some of them were started in those years and completed over time, all of which contributed to an increase in investments from certain countries in specific years. Therefore, the share of investments by country of origin should be observed over a more extended period. Precisely for this reason, and with the aim of further analysis of the selected data, forecasting the future trend of EU investments in the Republic of Serbia is considered one of the most significant.

IV. EU INVESTMENTS FORECASTING AND RESEARCH METHODOLOGY

The research of the model of development tendencies, as well as the mutual relations of time series and their prediction as a function of time. refers to the quantitative analysis of variations of time series and their mutual connections [14]. Time-series forecasting assumes that the factors that have influenced activities in the past and present will continue to do so in approximately the same way in the future [15]. A standard model for the behaviour of time series identifies four different components [16]: (1) Trend component, (2) Cyclical component, (3) Irregular component, and (4) Seasonality component. A time series that shows a persisting tendency for successive observations to be correlated exhibits autoregressive behaviour [17]. Very often, there is a high level of autocorrelation between the values of a time series and the values that precede and succeed them. In that case, the autoregressive model is



Figure 2. FDI in the Republic of Serbia in the period from 2010 to 2022 in millions of euros.

considered the most suitable one for forecasting the movement of the time series. In order to predict FDI movement in the next period, an autoregressive model was tested on data related to European Union FDI activity in the Republic of Serbia from 2010 to 2022 [13].

A. Autoregressive Modelling for Forecasting FDI in the Republic of Serbia

Autoregressive modelling is a technique used to forecast time series with autocorrelation [15]. For this reason, it is necessary in the first step to check whether there is autocorrelation in the selected data set. According to [18], if Durbin's Watson test gives a test statistic, with a value from 0 to < 2, then it can be concluded that there is positive autocorrelation (common in time series data). For the selected data set, the autocorrelation is at 0.231 (between 0 and 2), so the autoregressive model could be chosen as appropriate for FDI forecasting.

In principle, any number of autocorrelation patterns are possible [16], but some are considerably more likely than others. Choosing an appropriate autoregressive model can be complicated. A first-order autoregressive model explains the linear relationship between consecutive values in a time series, and the equation itself corresponds to a simple linear regression equation. The second-order autoregressive model describes the relationship between values that are two periods apart, and its equation is the same as the multiple regression with two independent variables. In contrast, the pth-order autoregressive model explains the relationship between values in the time series that are p periods apart. The equation of the pthorder autoregressive model is defined as follows [15]:

$$\hat{Y}_i = a_0 + a_1 Y_{i-1} + a_2 Y_{i-2} + \dots + a_p Y_{i-p}$$
, (1)

where \hat{Y} are fitted values of the series at time *i*; Y_i , Y_{i-1} , Y_{i-2} , Y_{i-p} are the observed values at time *i*, *i*-1, *i*-2, and *i-p*, respectively; and a_0 , a_1 , a_2 , ..., a_p are regression estimates.

Application of the autoregressive model in forecasting requires defining the value of p. In this sense, it is necessary to choose a sufficiently large value for p in order to be able to calculate all significant autocorrelation behaviours in the observed time series. It is customary to determine the value of p based on previous experience with approximately the same number of data in the time series. Also, it often happens in research that a multi-parameter model is chosen so that higher-order parameters that do not contribute significantly to the model are eliminated in turn. In that case, the t-test is used to test the significance of A_p , and the null and alternative hypotheses are defined as follows [15,16]:

$$H_0: A_p = 0$$

$$H_1: A_p \neq 0$$
(2)

Hypothesis testing continues until the null hypothesis is rejected. When this happens, it can be concluded that the remaining highest-order parameter is statistically significant and that a prediction can be made based on that model.



Figure 3. European Union FDI and predicted FDI values.

B. Research Results and Discussion

According to the literature [15], [16], [17], for the selected data set, the value for p=4 is chosen, using a 10% significance level. For the fourth-order autoregressive model, it is calculated that Student t statistics is 0.1516 and the *p*-value is 0.8868, so the null hypothesis could not be rejected. The third-order autoregressive model has been applied in the next step for p=3. In this case, the Student's t statistics is -1.9708, and the *p*-value is 0.0962. Using a 0.10 significance level, the two-tail ttest with 6 degrees of freedom has critical values ± 1.943 . Because t statistics = -1.9708 < -1.943and because the *p*-value = 0.0962 < 0.10, the H_0 is rejected. So, the third-order parameter of the autoregressive model is significant and should remain in the model.

According to the general pattern for the estimated equation (1), a third-order autoregressive equation is defined, following the calculated results:

Based on the estimated third-order autoregressive model, the predicted values of FDI are calculated, and the forecast until 2025 is made (Fig. 3).

In Fig. 3, the blue line shows the original values of European Union foreign direct investment in the Republic of Serbia from 2010 to 2022. Based on the estimated equation of the third-order autoregressive model, the predicted values of the FDI are also calculated and shown with an orange line. In the following years, a

slight FDI rise can be expected because the prediction shows that the FDI will be 1,942.70 in 2023, 2,185.96 in 2024, and 1,978.76 in 2025 in millions of euros.

V. CONCLUSION

The European Union, as the largest investor in the Republic of Serbia, invested more than 17 billion euros during the second decade of the 21st century. In 2020, the European Union invested 3.4 times more funds than China and 24 times more than Russia in foreign direct investments. The data analysis from the National Bank of Serbia showed that trends change depending on the current projects being implemented, so in 2022, a significant increase in investments from China was recorded, reaching 31.10% of total FDI.

Applying the autoregressive model to a selected data set proved to be a suitable prediction model. Based on the calculated t statistics and p-value, the third-order autoregressive model is chosen as the most appropriate, and based on it, the European Union investments in the Republic of Serbia were predicted. A positive trend can also be expected in the coming years, and in this way, the tendency of total FDI growth, which has been continuously recorded since 2016, will continue.

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The Importance of Knowledge Management in Public-private Partnership Projects

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Abstract-Considering the very nature and characteristics of public-private partnership knowledge management is more than important not only for the specific project success on the micro level but also on a macro scale from the national economy point of view, and even wider than that. In this paper authors provide some evidence for that. Most will be done through papers review and literature analysis. One chapter is about the possibilities of using knowledge management in Republic of Serbia for improved implementation of public-private partnership. Further analysis could deal with specific techniques and methodologies for knowledge public-private management application in partnership and also some quantitative analysis.

Keywords – Public-private partnership, knowledge management, macroeconomics, Republic of Serbia

I. INTRODUCTION

Today we live in a world of information. Everything is information and information is everything. The ones who have the required information also have the power. According to Oxford dictionary: "facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject" are definitions of knowledge. It is becoming one of the most important resources in the business and economics.

There is a lot of information and knowledge being available on the market, but the problem is selecting the adequate one and sorting what can be used. In the world of world connectivity information and knowledge is being shared through the internet but the problem is that not all of the information and knowledge, especially the business and economic ones are being made open source, and the ones that are, often cannot be reliable.

Being able to acquire knowledge fast and use it is one of the most important characteristics of success. Having the system set for recording, sorting, keeping and teaching different types of knowledge can provide the required flexibility and knowledge transfer within the organisation or on a national level.

Public-private partnership is also being implemented more, especially in the current conditions of budget constraints. World economy is recovering from the Covid-19 pandemic, and now there are also geopolitical challenges that affect the budgets of national economies.

Both the knowledge management (KM) and public-private partnership (PPP) started to become popular relatively at the same time, knowledge management from the 1990's and public-private partnership from the 1980's. Both require a lot of information and data to be recorded and decisions to be made. Although KM can be considered as a tool for PPP, this can also be seen from another angle. For example, there could be a PPP project to make a KM system for a national agency or in some area of public service or company.

Each national economy has a special PPP strategy and a national agency that deals with the project proposal. Each project is a unique example and possesses certain specific characteristics, but there are some common things in all of them. Creating and maintaining a proper knowledge base could benefit the specific projects, national agencies, and international experiences. Sometimes for example the same private partner would like to make a PPP all around the country or internationally in the surrounding countries or further.

In this paper detailed research of literature will be performed with some recommendations for the Republic of Serbia and its national knowledge management in public-private partnership.

II. PUBLIC-PRIVATE PARTNERSHIP

There is no single and internationally agreed definition of public-private partnership. The term PPP is sometimes used to denote any form of association or cooperation between the public and private sectors in order to achieve a common goal [1]. For the purposes of the paper the definition from the Organization for Economic Cooperation and Development(OECD) will be given. Public-private partnership can also be described as long-term agreement between the Government and a private partner in which the private partner provides and finances public services using capital resources, while sharing the associated risks. PPP can provide public services both in terms of infrastructure goods (such as bridges, roads) and social goods (such as hospitals, utilities, prisons, etc.). Interest in PPP has been growing in recent years and the need for fiscal constraints in most OECD member countries is expected to further increase their use. This puts public policy makers in front of special challenges that need to be met with careful institutional responses [2].

Public-Private Partnership involves the private sector supplying infrastructure assets and services traditionally provided bv the Government. An infusion of private capital and governance can ease fiscal constraints on infrastructure investment and increase efficiency. Reflecting these strengths, PPP is growing worldwide: there are well-established programs in several countries (including Chile, Ireland, Mexico and the United Kingdom), and less developed programs or strong interest in many others. However, it cannot be taken for granted that PPP is more efficient than public investments and government services. One particular concern is that PPPs can be used mainly to circumvent spending controls, and to

shift public investment off the budget and debt off the government's balance sheet, while the government still bears most of the risk involved and faces potentially large fiscal costs [3].

Public-private partnership is a well-known concept that has experienced its full development since the 1980s, in the developed countries of Europe, mainly in England, while the concept is developing outside Europe, in the United States and Australia, where there is also a significant increase. Recently, a large application has been noticed in developing countries, as well as in underdeveloped countries, primarily due to the feature of this concept to reduce public debt and build infrastructure without additional state borrowing. The PPP concept, in addition to many microeconomic advantages such as: raising the quality of services, efficient management, reducing public sector costs, also shows significant macroeconomic benefits in the form of reducing the public debt of the national economy, impact on employment, directing individual and group savings, fiscal budget, rate GDP growth [4].

PPP can have a double effect if it is implemented in accordance with the development strategy and in industries that offer a lot of jobs. Since unemployment is decreasing and the labour market is strengthening, the number of taxpayers is also increasing. Unemployment, in addition to numerous problems, also leads to a decrease in the amount of taxes and an increase in individual savings if it is not solved. Another benefit is that the implementation of PPP projects does not use the state budget as in ordinary procurements, thus reducing the pressure on the public debt.

PPP projects can have different shapes and forms, when it comes to long-term cooperation, projects can include financing, designing, operationalization implementation and of infrastructure construction projects or procurement of certain public products and services. It is also a question of the ratio of risks which will be borne by the public and which by the private partner, and the appropriate form is chosen accordingly. In the range of forms of PPP, they can vary from the traditional form of state financing as one extreme to complete privatization on the other. Between these there are over 10 other forms. Forms and areas of application differ from country to country with some similarities under the certain level of development group of countries [5].

With PPP, there are certain financial benefits from both the microeconomic and macroeconomic side. Significant savings are achieved by using the principles of the private sector in the implementation of public projects at the micro level, as well as the reduction of public debt and the avoidance of additional borrowing by the public sector at the macro level. However, in addition to the financial benefits that can most often be quantified and expressed monetarily, there are also non-financial benefits. They are not easily measurable and are prone to the subjectivity of assessment.

III. KNOWLEDGE MANAGEMENT

This is a concept first conceived in the organizational science. But considering the broad use of knowledge and its application throughout not only science but also sports, arts, and other aspects of life it became more used.

The significance of knowledge management can be described in two ways: firstly, to maintain a consistent flow of knowledge throughout the project's duration, and secondly, to support the contract management team in fulfilling legal and contractual obligations [6].

Creating a microeconomic strategy for knowledge management in PPP requires certain steps to be made. When crafting a knowledge management strategy, several key factors should be taken into account. These encompass the acquisition, compilation, and documentation of meaningful information; the storage and dissemination of this information; ensuring information security: and the proper management and disposal of information. The accumulation and assessment of this information would effectively result in the compilation of lessons learned.

To effectively facilitate these activities, a well-defined process should be established in advance. The contract management manual should address questions such as: who is responsible for gathering and archiving information, how will it be overseen, who is authorized to access it, which project phases are relevant to the information, how information will be shared, who will maintain versions and revisions of documentation (e.g., drawings), and which pieces of information are necessary for specific tasks [7].

Efficiently implementing and overseeing knowledge and information necessitates the

presence of dedicated personnel responsible for actively overseeing documentation through a suitable system. This approach ensures that all stakeholders remain proactive in recording documentation. Depending on the project's various stages, distinct systems may be necessary; for instance, construction phases might require unique approaches. In cases where sophisticated and costly software isn't available, the contract management manual, encompassing policies, procedures, and well-documented processes, can serve as a valuable resource for and managing implementing knowledge. Nevertheless, the paramount consideration in successful knowledge management implementation remains the commitment and dedication of the team overseeing this endeavour [8].

One of the analysed papers [9] yields a conceptual framework that illuminates key facets of knowledge management implementation at both micro and macro levels. Within this framework, the core elements underpinning knowledge management establishment were defined and various patterns of knowledge management dimensions within organizations and on a national scale were discerned, as depicted in Fig. 1. Additionally, the micro and macro levels when applying knowledge management principles are presented.

The framework's left-hand side delves into knowledge management within organizations at the micro level, whereas the right-hand side



delves into critical considerations at the macro level. It is imperative that an organization's strategic direction aligns with its knowledge strategies, and at the macro level, strategic planning must account for the requirements of a knowledge-based society.

Crucially, CEO support and commitment emerge as pivotal factors, with this support needing to permeate every layer of the organization. At the macro level, this support transforms into government backing, which should extend to both public and private sectors across the entire nation. Culture assumes a paramount role in knowledge management establishment, wielding significant influence at both micro and macro levels. Cultural factors, including organizational behaviour and values, are pivotal within organizations, while societal culture should embrace a shared vision alongside other consideration.

Organizations may initiate business process reengineering efforts geared towards process orientation and bolstering value-added activities. Furthermore, a change management program tailored to align with government policies becomes imperative for establishing knowledge management practices at the macro level. To facilitate systematic knowledge architecture within organizations, anthologies can provide invaluable guidance, serving as a cornerstone for directing knowledge-related endeavours. At the macro perspective, a unified reference model may serve as a central point to coordinate all activities related to knowledge management adoption within a nation.

While information technology tools within organizations undoubtedly enhance and expedite knowledge-related initiatives, they are viewed within the macro context as part of infrastructure development, in accordance with national information and communication technology policies. In addition to technological aspects, knowledge sharing among human resources takes central stage as a crucial element, further supported by tools such as micro-level communities of practice and the interconnection of these communities on a broader scale at the macro level [8].

At the organizational level, our attention is directed towards the use of incentives for crafting Knowledge Management strategies that center on the transformation of tacit knowledge into explicit information. At the broader scale, we delve into the inherent characteristics of knowledge diffusion and its consequences for overall economic expansion. The model anticipates the presence of a bell-shaped correlation between the formalization of knowledge and the intensity of technological rivalry [7].

A delicate balance influenced by the interplay between internal motivation and external competitive forces is underscored. This dynamic forms a natural conduit through which competition exerts its influence on an organization's structure and the flow of information within it. Given the repercussions on knowledge diffusion throughout the broader economy, the way information circulates within organizations, in turn, yields feedback effects on macroeconomic performance and growth. The main characteristics of macroeconomic knowledge management is the possibility to incorporate all the knowledge required by national economy in order to perform better.

A. Using Knowledge Management in Public-Private Partnership

The analysis reveals that there are significant knowledge gaps, particularly in the domains of risk assessment and allocation. public engagement, and consultant management. Additionally, the findings emphasize а preference for context-driven, experiential methods for acquiring and disseminating knowledge about public-private partnership over traditional knowledge transfer approaches [10].

In summary, these findings suggest that even state agencies with substantial experience in PPP encounter substantial knowledge deficiencies in this mode of collaboration between the public and private sectors. It underscores the importance of interpersonal, ongoing mechanisms for sharing practical experiences as a critical means of developing expertise for the successful design and execution of PPP [11].

Multiple studies have indicated that numerous stakeholders involved in publicprivate partnership often do not possess the essential competencies necessary for successful PPP initiatives. This deficiency in competence has frequently resulted in the failure of PPP projects, both in developed and developing nations. A key contributing factor to this issue is the insufficient transfer of knowledge within many PPP projects, a missed opportunity that could have greatly enhanced the PPP procurement process. Prominent obstacles to

effective knowledge management in the context of PPP projects encompass challenges in documenting monitoring and project information, inadequate managerial endorsement of knowledge management within PPP endeavours, and a deficiency in the expertise and proficiency required to implement knowledge management tools. These hindrances are shaped by the unique characteristics of PPP projects and the absence of comprehensive knowledge management capabilities. To surmount these knowledge management challenges, the study highlights several enhancement strategies. These include providing training and development opportunities for PPP stakeholders to familiarize themselves with knowledge management tools, establishing legislative support for the utilization of knowledge tools for preserving PPP project data, and encouraging active participation and commitment from relevant parties in the exchange of information [12].

In the in the continuation of the paper an example of the case study form Nigeria will be presented. The study suggests the cultivation of both Public-Private Partnership and Knowledge Management competencies via comprehensive training programs spanning short-term and longterm durations, underpinned by a strong commitment from PPP stakeholders.

The study [13] conducted an examination of the extant Public-Private Partnership websites within Nigeria and observed a notable absence of structured Knowledge Management frameworks. To address this gap, a systematic design approach was employed, utilizing a use case diagram, system block diagram, and system architecture. The resulting web-based system was specifically developed for public access, aiming to provide comprehensive PPP project information and documents. This initiative serves dual purpose of enhancing the accountability and transparency while also facilitating the strategic planning of future PPP projects in Nigeria. The responsibility of populating the PPP data on this web-based KM platform is entrusted to key stakeholders, including the Infrastructure Concession Regulatory Commission Administration. contractor firms, and PPP project consultants. The development of this platform was executed using a technology stack comprising HTML, CSS, C#, and MySQL. The web-based KM platform comprises six primary interfaces, with a central emphasis on the Knowledge Management interface, where PPP project documents are

archived and made accessible to platform users. The study underscores the importance of investigating why PPP project documents are not currently stored on existing PPP project websites, potentially warranting further exploration in future research endeavours [13].

This can be used not only for PPP but also for other areas. Regarding the PPP there should also be an international knowledge base. There is similar in the something public-private partnership legal resource center which is the public library for PPP, especially for the legal issues. But the goal is to have a database of as much as possible number of different PPP projects, and also different national legislations and compare even the work of the national agencies about the work regarding PPP. Having such a database and knowledge management system on a national level could potentially solve the difficulties arising from the characteristics of PPP.

IV. THE APPLICATION OF KM IN PPP IN THE REPUBLIC OF SERBIA

Knowledge management in public-private partnership is already established to a certain extent, but not in Serbia. In Serbia there is a national Agency for PPP. It would benefit from the knowledge management strategy and system if it was implemented. Public-private partnership is not that popular in the Republic of Serbia and although there are many approved projects, just a small portion of them get to the implementation phase. From the regional point of view, most of the projects are implemented in the more developed regions while [14].

The Republic of Serbia, like other countries, is currently affected by high inflation, a decrease in GDP and many external factors that it has no control over, and because of which its public budget is under great pressure. In addition to factors of a global nature, such as the recovery from the Covid-19 virus pandemic, as well as the current conflict between Russia and Ukraine, the Republic of Serbia also has certain geopolitical and trade challenges of its own.

All these global as well as personal geopolitical implications of the Republic of Serbia are reflected through increased expenditures in the budget, first of all for health and social benefits, and further through the increase in the army budget. In all of this, there are not many funds left for the restoration of the already largely outdated and aged infrastructure
and for allocating the budget in that direction. This is precisely where there is room for the implementation of public-private partnerships and the implementation of projects where the partners are public and private entities.

For all of this, it is necessary to have certain prerequisites, first, an appropriate legal and institutional framework as well as specific institutions that will deal with these issues, their initiation, application, and analysis. To some extent, all these conditions are met in Serbia, the Law on PPP was adopted in 2011 and amended in 2016.

Some domestic authors analyse publicprivate partnership from the perspective of the possibility of financing local self-governments. Earlier analyses indicate that macroeconomic instability, unemployment, lack of information for investors, insufficient efforts to preserve the environment and numerous other shortcomings make negotiations on PPP projects quite long, increase costs and repel potential investments [15]. "Using the PPP concept, the effects would be reflected in the promotion of economic growth and development, reduction of inflation, unemployment rate, public debt and budget balancing" [16, p. 32]. Savić et al. assess that in our country there is still no significant practice regarding the implementation of PPP projects, and that until now there has been mainly an inflow of capital at the local level in areas that require less investment, such as line passenger transportation, construction and maintenance of public lighting systems, construction and sewerage network maintenance, production and distribution of heat and electricity and biomass heating, solid waste management and parking services. It is very important that there are examples of good practice so that they can be the basis for further development and use of PPP in other types of projects and regions where they have not been applied so far. It must not be forgotten that each PPP project is specific and that each city and municipality also has its own special needs during their implementation [16].

In order to further develop PPP in the Republic of Serbia, it is necessary to first increase the number of institutions dealing with it. The last law that was passed in this area was from 2014, it is necessary to revise it, make amendments and by-laws that would be more suitable to the current situation on the market. Popularizing the concept and presenting it to both the general public and the private sector would be the next step. Better statistical coverage of projects and management, if not individual, since they are business secrets of private companies, then to manage aggregated statistics that will be available to the general public. Expansion of the field of application, so that in addition to large and infrastructural projects, smaller projects of regional and local character will be included, which will be implemented in the form of PPP. Application of the new 4P concept, which includes, in addition to public and private entities, civil society, i.e., people, as the third pillar of the successful implementation of PPP projects.

Transparent implementation of the selection of private partners by the public sector in order to minimize corruption and the shadow economy. PPP shows great potential and is proving its usefulness worldwide in solving significant challenges in various sectors. It has also shown its success in solving the current challenges that arose due to the coronavirus pandemic.

Serbia could benefit from creating a national level of knowledge management system, for instance for the purpose of capturing the knowledge from the implementation of PPP projects. From one hand that could improve the specific projects, but also add to the national competitiveness to implement and realize even more projects. Specific projects knowledge would be persevered for future generations as it could happen that some of the employees retire in the meantime, due to the longevity of PPP projects. On the other hand, knowledge available outside of the specific project would be used when implementing another project similar to that, or for the public sector to realize the project on their own.

V. CONCLUSION

This paper presented a combination of two concepts, knowledge management and publicprivate partnership. Both were presented and their basic characteristics have been analysed, from the micro and macroeconomic perspective.

Both necessitate the comprehensive collection of information and data, along with the formulation of strategic decisions. It is noteworthy to consider that Knowledge Management can be perceived not only as a facilitative tool for Public-Private Partnerships but also from an alternative perspective. For instance, a PPP initiative could be conceived to develop a Knowledge Management system intended for utilization by a national agency, within specific domains of public service, or for the benefit of a corporate entity.

It can be noted that knowledge management, especially the transfer of knowledge is vital for a successful PPP project and a successful national strategy for PPP. Specifically developing a web tool and adding information technology sector into the mix of KM and PPP proved to be successful in the case of Nigeria.

Especially in Serbia it would be beneficial to have a knowledge management strategy for the specific projects and also for the national level. PPP is developed in Serbia, but not to the satisfactory and possible way that it could be. National Agency for PPP does not possess or makes available even the sufficient amount of data to perform basic analysis. Much more knowledge is needed to be recorded and made available in order for PPP to become widely used. Creating a KM system, whether a online or offline for the start would be mutually beneficial not only for the PPP projects improved implementation but for the whole economy.

Future research could propose some specific techniques and methodologies for knowledge management application in public-private partnership and some quantitative analysis.

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Capital and Risk in the Tax System

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Abstract—This paper is about the capital of the enterprises in the tax system. Therefore, there is an analysis of the impact factor of the tax revenues of the countries subject to the capital of companies to the tax system. Thereupon from the view of the level of influence of the enterprises that participate in controlled transactions of transfer pricing to the global tax revenue, is plausible to identify the impact factor of capital, when there exists that factor with the case which that factor is avoided. Then the impact factor of capital in combination with the tax revenues is determined through the Q.E. method. Moreover, the risks which handle the enterprises in the tax system. Therefore, it has made an analysis of the impact factor of the tax revenues of the countries subject to the risks of companies in the tax system. Thereupon from the view of the level of influence of the enterprises that participate in controlled transactions¹ of transfer pricing to the global tax revenue, is plausible to identify the impact factor of risk, when there exists that factor in the case that factor is avoided. Therefore, it clarifies the behavior of the tax system subject to the capital of the tax system. The current work confirms that the risk is proportional to the capital.

Keywords - Capital, risk, tax system, tax revenue

I. INTRODUCTION

The quantification analysis of the capital of the tax system with the tax revenue from a global view is done by the application of the Q.E. method. On that ground of this method is determined the behavior analysis of mathematical equations. Thence, there are clarified two levels to the analysis of the Q.E. method:

• 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.

• 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 the impact that one independent variable has with one or more other independent variables.

Thereupon, using the previous two axes of the Q.E. method is plausible to extract conclusions about the behavior of mathematical equations, and the way that some factors react to changes. Consequently, is plausible the transformation of quality data to quantity data. This method is applied for this study for controlled transactions and more precisely in the variables of the impact factor of the tax revenue [1-4]. The mechanism of Q.E. is based on the dependent variables which are modified for the generator. Thereupon, the generator produces values for the dependent variables. The extracted values of the generator permit the creation of magnitudes, which are the base for comparisons, and for the scrutiny of mathematical equations. Thus, is plausible to quantify quality data. In our analysis, this method is used for clarification of the behavior of the impact factor of the global tax revenue.

II. LITERATURE REVIEW

The impact factor of tax revenues of countries which are tax heaves, *s* according to the "Methods of controlled transactions and

¹Controlled transections are the transections which happen between companies that control their transactions with such way to have profits and control of their losses.

identifications of tax avoidance" is determined as that:

$$s = \frac{k+l}{r+c+t+i}.$$
 (1)

Therefore are countries that receive the products that are taxed in different countries. This allocation of profits between profits and losses permits the enterprises that participate in controlled transactions of the transfer pricing activities to maximize their utility. But, contemporaneously the tax revenue from a global view is declined. Then, the loss of tax income from some countries is more than the profits that make the countries which are tax havens. Thereupon, the symbol of s is the impact factor of tax revenue from a global view, and there are some coefficients which are k, l, r, t, i, and c [5-8]. Thus, the symbol of k is about the impact factor of capital, l is the impact factor about the liability of the authorities on the tax system.

The interpretation of the liability is about how unbalanced it is the tax system. The parameter of r is about the risk, the t is about how much trustworthy is the tax system (bureaucracy) [9-13]. The symbol of *i* examines the case of intangibles (the intangibles charged to the subsidiaries) of the tax system. Additionally, the symbol of c is about the cost of enterprises. The symbols with the "~" are accordingly the same thing but from the view of the uncontrolled transactions [14-16]. Thus, the numerator is proportional to the income of taxes, as the investments and the stable tax environments, with liability enhance the tax income [16,17]. On the other hand, the denominator is inverted and proportional to the tax income, as the risk, the cost, and the unbalance of taxation cause less tax income:

$$\tilde{\nu} = \frac{\tilde{k} + \tilde{l}}{\tilde{r} + \tilde{c} + \tilde{t} + \tilde{\iota}}.$$
(2)

Since Eq. (3) determines the aggregate impact factor of tax revenues, which is symbolized by \hat{s} , and is defined as follows:

$$\hat{s} = s + \tilde{s} . \tag{3}$$

Based on the prior equations follows the identification of the behavior of the impact factors of tax revenues in the case of tax heavens, and in the case of the non-tax heavens. Consequently, using the prior equations is plausible to examine the controlled and the uncontrolled transactions.

Then, s is a factor that allows the comparison between the controlled with the uncontrolled transactions. Thence can have a standalone behavior analysis of controlled transactions and a combined behavior analysis between the controlled transactions with the uncontrolled transactions. The next section analyzes the impact factor of tax revenues with the rest impact factors.

III. METHODOLOGY

The determination of capital of the tax system is established by the impact factor of capital which shows the level of influence of capital in the business plan of the enterprises. To clarify the way that capital affects global tax revenues:

In the first application of Q.E. methodology, all the factors of the global tax revenues. In that case, is plausible to obtain the behavior of the global tax revenue using the completed form of Eq. (1).



In the second application of the Q.E. methodology, all the factors except for the factor which is under review. Thereupon, in that case, the factor of the capital of the tax system, *s*.

In the previous scheme, the methodology followed by the Q.E. method to determine the behavior of the global tax revenue in the case that there exists capital in the controlled transactions of the transfer pricing and the case that we have an absence of the impact factor of capital [2, 18,19].

IV. RESULTS

The capital of the tax system is in interaction with the impact factor of tax revenues. This behavioral analysis is the model that explains the behavior of the impact factor of tax revenues with the existence and with the avoidance of the impact factor of capital [20-23]. All the necessary equations have been referred to in the previous sections, except for one condition. Then, for the application of the Q.E. method we use the following condition, which is:

$$t > l > i > r > k > c$$
. (4)

Thus, is plausible to proceed to a quantity analysis using Eqs. (1), (2), and (4). The examination of tangibles with the capital is important for the transfer pricing theory [5, 14, 15]. The examination of capital is used many times from the enterprises of controlled transactions to reach the arm's length principle. Therefore, applying the Q.E. method and choosing the appropriate values for the coefficients of global tax revenue, we have that:

Factors	Table of values			
	Values of s	Values of s'	Values of s'	
k	0,4	-	0,4	
i	0.6	0.6	0.6	
1	0.7	0.7	0.7	
r	0.5	0.5	-	
с	0.3	0.3	0.3	
t	0.8	0.8	0.8	
fs	<0.3	< 0.3	< 0.3	
fsi	< 0.3	< 0.3	< 0.3	

TABLE I. COMPILE.

Thereupon, using the previous factors can determine the behavior of the model through the generator of the Q.E. method. The factors of the prior table have an upper limit the 1 and a lower limit the 0. But, s and \tilde{s} are plausible to receive values greater than one as their mathematical structure allows this. After 461 iterations the received the diagrams of capital and risk impact factors.

According to Fig, 2 (a), It is used \hat{s} , which here is the same for the case that the capital and for the case that avoided the capital. Then, *s* (blue line) symbolizes the case that the impact factor of *k* which symbolizes the capital that has the enterprises in the environment of the tax system. With s' (red line) symbolizes the case that avoided the capital, *k*. The global tax revenue is higher in the case that has the capital (blue line) than in the case that the impact factor of capital is avoided (red line). As was expected the absence of capital In the prior figure is used in the \tilde{s} , which here is the same for the case that there is capital and in the case that it has been avoided the capital.

Then *s* (blue line) symbolizes the case that there is the impact factor of k which symbolizes the capital that has the enterprises in the environment of the tax system. With s' (red line) symbolizes the case that it has avoided the capital, k. The global tax revenue is higher in the case that has the capital (blue line) than in the case where the impact factor of capital is avoided (red line). As it was expected the absence of capital declines the global tax revenues[24-28]. The reason for the diminished global tax revenues in the case of s' is that the capital makes the companies of controlled transactions enforce and extend their activities. Should be noted that for the comparison analysis, it is used sas a constant to be able to compare s with s'. In Fig. 2 (b) it is used the \tilde{s} , which here is common in the case that we have the risks and in the case that we have avoided the risks. Then s (blue line) symbolizes the case that we have the impact factor of r which symbolizes risks of the tax system. With s' (red line) it symbolizes the case that we have avoided the risks of the tax system, r. In the case of s we have a tax system where the controlled transactions of controlled transactions have



risks. Moreover, with s' we have a tax system, without risks. The global tax revenue is higher in the case that does not have the risks (red line) than in the case that the impact factor of risk is used (blue line). As we expected the existence of risks decline the global tax revenues. The reason for the diminished global tax revenues in the case of s is that the risks make the companies of controlled transactions stop their activities. Should be notified that for the comparison analysis, we use \tilde{s} as constant to be able to compare the s with the s'.

V. CONCLUSIONS

This paper verifies the initial hypothesis that as capital increases, so does the risk of a business. This is verified by this quantitative method and confirms the initial hypothesis through mathematical, qualitative, and quantitative analysis, and using code.

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Building Resilience to Job Loss of Older Workers by Enhancing Their Digital Literacy

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Abstract—The digital transformation causes changes in the labor market in terms of increased need for digital literacy, but also the taxonomy of jobs due to the emergence of new professions. The lack of digital skills among employees and the growing demand for specific knowledge represent a big challenge for companies and the economy in general. Older workers are a particularly vulnerable part of the working population because the digitization of the work environment brings them the need to acquire new knowledge and the potential danger of losing their jobs if they fail to keep up with intense changes. In this research, the level of digital skills of the population aged 55-64 was analyzed, and the impact on the employment rate was tested. The research results indicate a clear and significant influence of the level of digital literacy on the employment rate. Furthermore, it is emphasized the importance of training provided by employers to increase digital inclusion and job-losing resilience of older workers.

Keywords – Digital literacy, older workers, joblosing resilience

I. INTRODUCTION

Digital transformation consists of powerful and accessible information and communication technologies integrated into all areas of life and the necessary digital literacy for its adequate use [1]. Social and economic inclusion today, and especially in the future, seems to depend on the acceptance means of digitalization.

The digital environment represents the framework in which business and management systems are being organized. Therefore, in addition to digital skills and literacy being necessary for functioning in everyday life, they signify critical elements for also the participation of many employees in work processes. Focus on technology in companies often can lead to neglecting certain internal aspects of business, especially employees [2]. To be more specific, a particularly vulnerable part of the working population are older workers because many existing business strategies do not include the empowerment of this group in order to make the new, digital working environment more inclusive and employees more job-losing resilient. Being an older employee in the era of intense digital transformations not only means an increased need to master new skills and meet the requirements for specific qualifications but also the potential danger of job loss due to the inability to meet the requirements adequately.

The importance of researching the implications of digitization for older adults is reflected in several facts:

1. The world population is ageing - The United Nations estimates that by 2050, 16% of the world population will be over 65 years old [3]. In the European Union, statistics indicate an even more progressive population ageing. The share of people aged 55 years and more is projected to reach 40.6 % by 2050 [4].

2. Life expectancy is increasing - In the EU, the population lives longer than ever before. Life expectancy at birth in the EU was estimated at 80.1 years in 2021 [4].

3. The working population is decreasing -An additional problem associated with ageing is that the working population will decrease, and the number of older people in the total population will increase. The ratio that measures the level of support for older people by the working population is the old-age dependency ratio, and for the EU was 33% on 1 January 2022. This means more than three working-age people for every person over 65 and older. Furthermore, when the ageing trends of the population and life expectancy projections are taken into account, the old-age dependency ratio in the EU will be 57.1% by 2100 [4].

4. Retirement occurs later - As a consequence of the above, many countries are increasing the retirement age. This aims to keep older people at work as long as possible, reducing the financial burden for pensions and the old-age dependency ratio. In 2020, in EU countries, the lowest statutory pension age was 60, while the highest was 67 years. Statistics show that in 2019, 31.6% of the EU-27 workforce aged 55-64 years left their last job to take normal retirement. Also, according to these statistics, one of the main reasons for people not in employment leaving their last job, by age class 55-64 years, is because they had been dismissed or made redundant, as much as 14.2% [4].

Looking at the statistics and trends, it can be concluded that the role of older employees in the processes of digital transformation cannot be ignored, and therefore, the issues of digital literacy of employees are important both for academia and for practice. So far, researchers have perceived digital literacy as a multidimensional subject through the prism of required skills and knowledge [2]. According to the definition proposed by UNESCO: "Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs and entrepreneurship. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy"[5].

The vision of digital Europe in the future is for residents to reach the level of digital knowledge and competence to overcome the challenges brought by the digital transformation era and to overcome the fear and consequences of rapid changes. However, according to [6], 52% of the European workforce will require reskilling. Digital literacy shortage in many industries and other observed digital gaps pose a question of the inclusiveness of digital transition. One side of this problem is the transformation of educational systems to adequately train young people for new jobs related to digital knowledge. The other side is the workforce ageing, which population also belongs to those with weaker digital skills and is at risk of job loss and social exclusion. Joblosing resilience is reflected in the ability to prevent challenges arising from digital transformation through continuous digital skill upgrading while at the same time empowering employees to ensure their social and financial security.

This paper aims to determine the impact of digital literacy on the employment rate of older adults in order to analyze their resilience to job loss. Data from the Eurostat database is used to test the level of digital literacy and its impact on the employment rate.

II. THEORETICAL BACKGROUND

The intense and unpredictable dynamics of changes that digital transformation brings to society and the economy condition the emergence of digital divides at different levels because certain social groups struggle to adapt in an adequate way. Given the severe consequences of the digital divide, they are attracting the significantly attention of researchers and policymakers in order to determine and overcome emerging challenges [7-9].

The use of benefits brought by digitalization in many business activities is limited by the level of skills of employees [10]. The necessary level of digital skills for business operations in contemporary conditions is often difficult to achieve due to workers' low level of digital literacy. Zulu and associates [11] investigated the attitudes of persons in managerial positions to determine individual factors for the acceptance of digitization by employees. Age was highlighted as one of the key predictors of digital literacy. It is stated that younger employees acquire new digital skills more efficiently and faster and tend to possess a higher level of digital literacy than older workers [11]. Considering the ageing of the population and the experience that older workers have gained by applying the traditional way of working in many sectors, replacing older employees with younger ones is not feasible. However, the fact that younger workers are identified as more digitally ready puts older

workers under pressure from the possibility of job loss caused by technological obsolescence. Overcoming these challenges and creating resistance to job loss for older workers requires constant occupational training and training for using digital technologies [10].

However, improving the digital literacy of employees through specific training is not without difficulties. Reference [12] analyzed the digital gap that occurs among older adults in the level of Internet use, examining facilitating conditions that can be implemented through digital literacy support programs. This research shows that older adults are not a homogeneous group and that a single approach cannot be applied. Also, socio-demographic factors influence mostly indirect on the basic level of Internet use, which primarily relates to access and operational use. In the research, the results indicate that age is not a limitation for Internet acceptance and usage. However, the ages are related to factors such as income and education level, which can be limiting [12,13].

References [14,15] identified several barriers to digital literacy training programs, from the administrative level through the training/infrastructure level to the individual level. Some barriers are lack of internet access and adequate ICT equipment, inability to attend training due to financial and geographical barriers, fear of failure or discrimination by more advanced participants, etc., [14]. When looking at older workers, one should add to this the resistance that occurs because they have more difficulties acquiring new knowledge and do not recognize the need for a certain type of learning [16]. additional Reference [17] determined that work on the digital literacy of older people is a gradual process whose dynamics depend on motivation and support. Also, research has shown that continuous training progressively improves digital skills. Therefore, lifelong learning is recognized as very important for individuals, their quality of life, psychological health and social relations, but also for transforming the workforce into a more adaptable and job-loss resilient [18].

The analysis of the literature dealing with the level of digital literacy and the employment rate of the population aged 55-64 indicates that there is room for further research. In addition to examining the connections between the mentioned elements, it is important to explore the factors that influence the success of digital literacy training to gain not only theoretical insights but also to give suggestions to companies' management for developing and implementing practices to increase the resilience of job losing of this population.

III. DIGITAL LITERACY MEASURES

The European Commission and other institutions, such as the World Economic Forum and OECD, defined digital skills as basic and advancing digital skills [19,20]. Basic digital skills include an individual's ability to find and exchange information online, create certain digital content, use online services and all this in a safe way, limiting access to their data [20]. Basic digital skills are necessary for the smooth performance of daily activities, but the performance of business activities often requires a higher level. In this light, a digital skill gap appears because the data indicate that 3% of EU citizens in 2021 did not have even basic digital skills, while for 11% of the population, the level of digital skills could not be assessed because individuals did not use the internet in the last three months prior data collection [21].

There is a lack of quantitative research related to the impact of digitization on the quality of work and life of older employees. The Eurostat database contains data on the digital skills of residents of EU member states and other European countries, which are used to monitor the progress of the digital economy. This research uses these data to test the relationship between digital literacy and the employment rate of the population aged 55-64. Also, in addition to data on digital skills, the Eurostat database contains data that can be used to analyze other elements related to the conditions for acquiring digital skills.

A data set was created on the level of digital competencies of the population aged 55-64, along with data on the employment rate of this population. The data were observed for the 2015-2021 period for 33 European countries, where a sample of 160 elements was used to test the research assumptions.

IV. RESULTS

Eurostat data from 2021 (EU - 27 countries) on the level of overall digital skills among Individuals aged 55-64 show that 17.8% have a low level, 25.3% have a basic level, and 4.3% do not have digital skills. Observed by single countries, the highest percentage of individuals with above basic overall digital skills is in Netherlands 42.5% and Finland 35.9% while the lowest rate is in Albania 0.2%. The highest number of individuals with no overall digital skills is in Albania, 16.4% and Romania, 14% [21]. It is important to analyze these data not only from the aspect of employability but also from the social aspect, considering that individuals without digital skills and even those with a very low level of digital skills are a group that is considered socially deprived and at risk of social and economic exclusion.

Also, data collected in 2018 for the EU show that the primary job tasks of 6.8% of individuals aged 55-64 changed as a result of the introduction of new software or digitalized equipment, 11.2% of workers had to learn how to use new software or digitalized equipment for the job, and for 5.3% needed further training to cope well with the duties relating to the use of computers, software or applications at work [21].

According to the obtained results of multiple regression, 42% (F(4, 155)=27.94, p<0.0001) of the variability of the employment rate in the population aged 55-64 can be explained by a model based on indicators of basic digital literacy. At the same time, the results indicate that Basic information and data literacy skills and Basic communication and collaboration skills do not have a single statistically significant influence on the employment rate. the other hand, standardized beta On coefficients and significance for Basic problemsolving skills (β =0.329, p<0.0001) and Basic digital content creation skills (β =0.447, p < 0.0001) indicate a statistically significant contribution of these indicators to the employment rate of the population aged 55-64.

When considering the influence of the digital literacy indicator whose level is above basic, it can be seen that 58% (F(4, 158)=54.46, p<0.0001) of the variability of the dependent variable *Employment* can be explained in this way. When considering the contribution of individual indicators, it can be seen that *Above basic information and data literacy skills* ($\beta=0.606$, p=0.001) has the strongest influence, followed by *Above basic communication and collaboration skills* ($\beta=0.345$, p=0.002). The indicator *Above basic problem-solving skills* has no statistically significant individual influence in the model. In contrast, the indicator *Above basic digital content creation skills* shows a

negative effect with β =-0.428 and p<0.0001. Also, by considering the correlation matrixes (Tables I and II), it is possible to conclude that the indicators of digital literacy are significantly correlated with each other, presented in Table II, which is not the case with the basic level, Table I.

Additional data analysis was performed on how the population aged 55-64 acquires digital knowledge and skills. Data indicate that 15.7% of individuals carried out at least one training activity to improve skills related to using computers, software or applications. Fig.1 depicts various ways of obtaining ICT skills. It can be concluded that the highest percentage of those who carried out training activities did so as part of on-the-job training.

 TABLE I.
 CORRELATION MATRIX FOR BASIC

 DIGITAL SKILLS.
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	Basic_C_CS	Basic_PSS	Basic_CCS		
Basic_I_DLS	0.170*	0.359**	0.034		
Basic_C_CS		0.131*	0.361**		
Basic_PSS			0.506**		
**Correlation is significant at the 0.01 level (2-tailed)					

**Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). I_DLS- information and data literacy skills, C_CScommunication and collaboration skills, PSS- problemsolving skills, CCS- content creation skills

 TABLE II.
 CORRELATION MATRIX FOR ABOVE BASIC DIGITAL SKILLS.

	Above_basic _C_CS	Above_basic_ PSS	Above_basic_ CCS
Above_basic _I_DLS	0.869**	0.925**	0.880**
Above_basic _C_CS		0.774**	0.813**
Above_basic _PSS			0.891**

**Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

I_DLS- information and data literacy skills, C_CS-

communication and collaboration skills, PSS- problem-solving skills, CCS- content creation skills

V. DISCUSSION

For the research, secondary quantitative data, which can be found in available databases, on the level of digital literacy of the population aged 55-64 was collected to analyze the connection between digital skills and the employment rate. Through testing two regression models, the basic and above-basic levels of digital skills were utilized to determine whether they impact the employment rate.



The research results indicate a clear and significant influence of the level of digital literacy and the employment rate in the population 55-64, which aligns with other studies [12]. Also, the results indicate certain specific skills that contribute to the employment rate, namely the knowledge of basic problem-solving skills and basic digital content creation skills. This confirms that the basic level of digital literacy is insufficient to perform certain more sophisticated business operations.

The results of the analysis of the correlation matrix for indicators of the above basic digital literacy and their strong connection lead to the conclusion that the level of digital skills simultaneously, which is increases also indicated in the research [17]. In this way, the importance of continuous education is highlighted. An additional analysis of the data on the way of acquiring digital skills emphasizes the importance of training provided employers and implemented bv within

companies that enable older employees to respond adequately to changes in the workplace.

VI. CONCLUSION

This research confirmed the importance of digital literacy for the employability of individuals as well as for their resilience to job loss. Having a higher level of digital literacy contributes to greater autonomy and better financial and social inclusion. Research focuses on the population aged 55-64 as they are vulnerable to digital transformation and potentially face difficulties adapting to work environment changes.

In recent years, a significant commitment of policymakers to the problems of the digital divide and the use of the potential of digitalization has been observed. Numerous EU initiatives have been launched to overcome the challenges of digital inclusion, such as the European Skills Agenda, Digital Education Action Plan, and, especially important for raising the level of digital competencies of the workers, Digital skills and jobs coalition. "Digital Literacy 2.0" was a European project that aimed to develop basic digital skills that should facilitate the daily life of citizens in terms of communication, finding reasonable prices, participating in public debates, buying free services, etc. [5]. The project experiences were later used to develop the European Commission's Digital Competence Framework for Citizens (DigComp 2.0), which has aimed to help companies and individuals identify the necessary digital skills in today's context [21]. The long-term goal of the EU institutions is to increase digital skills beyond a basic level. However, there is still a strong struggle to reach a basic level among as many residents as possible and to increase digital literacy, especially among groups at risk of social exclusion.

At the company level, the changes caused by digitization are frequent and, in some way, mandatory. Companies now place their products and services globally and online. Many jobs can be performed from anywhere, many undergoing physical transformation, and, in this way, working conditions end environment change significantly. The lack of workers of specific profiles or the struggle of existing workers to adapt to new working conditions can harm profits and competitiveness and threaten future business. Therefore, in order to fully benefit from digital transformation, companies must not only digitize their business processes but also continually improve their employees' digital skills.

The paper contributes to existing research by providing a focused view of the population aged 55-64, which is not the case in other studies [11,17]. Also, the paper targets specific indicators of digital literacy, which, for policymakers and companies, can represent a useful starting point for defining measures and activities to increase the job-losing resilience of the older population.

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Transformational Leadership, Police Resilience and Psychological Wellbeing during the Covid-19 Crisis

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Abstract—The additional role of the Royal Malaysian Police (RMP) as COVID-19 frontliners has brought many new stressors to policing work, which can impact police officers' well-being. Nonetheless, some researchers believe that a transformational leadership approach might help officers improve their resilience to overcome various adversities. This study aimed to investigate the effect of transformational leadership on police resilience and psychological well-being during the COVID-19 pandemic. A quantitative approach was employed by using a survey to collect data from a sample of 383 police officers, selected using stratified sampling technique. The collected data were processed using Smart PLS 4 to perform structural modelling analysis. The results revealed that transformational leadership has a significant and positive effect on police resilience and psychological well-being. It was expected that the findings would encourage police leaders to adopt a transformational leadership style in managing their subordinates so that their resilience and wellbeing could be improved during a crisis.

Keywords - Transformational leadership, police resilience, psychological well-being, COVID-19

I. INTRODUCTION

The emergence of COVID-19 disease, caused by the spread of a novel coronavirus (SARS-CoV-2) in China, continues to affect the lives of many people around the globe. The severity of the disease varies, as people infected may experience mild symptoms like cold, flu, vomiting, and fatigue, or serious health complications like pneumonia, kidney failure, pulmonary fibrosis, and respiratory failure [1].

In order to contain the outbreak, Malaysia implemented numerous measures, including several phases of the Movement Control Order (MCO), where people were required to practice social distancing, hand-washing, remote working, and quarantine, as well as the closure of non-essential businesses, country borders, and public places to limit the mobility of people and reduce transmission [2]. The Royal Malaysian Police (RMP) was tasked with enforcing these new regulations, monitoring public compliance with COVID-19 guidelines, responding to pandemic-related emergencies, and supporting frontliners in the healthcare sector [3]. This additional role as frontliners has brought many unexpected challenges to policing duties, including fear of infection [4,5], resources shortage e.g., staff and personal protective equipment (PPE) [6], changes in work practices [7], and trauma from handling too many death cases in a short period of time [8]. All these can lead to increased psychological distress among officers, affecting their well-being [9-11] and job performance [12].

Researchers have suggested police leaders adopt a strong and ethical leadership style like transformational leadership while managing their subordinates during a crisis [13,14]. Transformational leadership is said to result in higher well-being [15,16] and lower burnout [17] among frontliners during COVID-19. Some nonpandemic studies have also highlighted the role of transformational leaders in reducing employees' stress and burnout [18] and fostering resilience [19].

Transformational leaders are known to create a work environment that fosters employee satisfaction of three basic psychological needs, which are autonomy, competence, and relatedness, which, as stated in the Self-Determination theory [20]. Transformational leaders also tend to provide subordinates with a sense of autonomy by involving them in decision-making, develop their competencies, and build strong relationships with them [21]. employees' needs for When autonomy, competence, and relatedness are satisfied, they are more likely to experience higher levels of psychological well-being, including greater job satisfaction, motivation, and commitment to their work, as well as less psychological distress at the workplace [22]. Further, transformational leaders are known to provide their employees with a variety of job resources, such as support, guidance, and encouragement [23]. These resources help employees feel valued, motivated, and empowered, which can lead to increased resilience in the face of job demands.

As shown in some studies, resilience plays a crucial role in protecting frontline workers' psychological well-being from the adverse consequences of stressful situations during the COVID-19 pandemic [24,25]. According to the Conservation of Resources (COR) Theory, resilient people are more likely to perceive challenges as opportunities for growth rather than threats and are more likely to seek out and utilize resources to cope with stressors [26], which can help maintain their psychological well-being during a crisis. Past studies have proven that resilient workers are better able to cope with job demands and stressors by utilizing resources such as social support and coping strategies, as in [27] and [28].

Based on the discussion above, it is expected that both transformational leadership and resilience may have a positive effect on police officers' psychological well-being throughout the COVID-19 pandemic. Nevertheless, not many studies have investigated the effect of these factors on psychological well-being in the context of policing in Malaysia during a crisis. To the best of our knowledge, prior COVID-19 studies are more focused on other outcomes of police transformational leadership, such as job satisfaction [29] and work engagement [30], and are more focused on the resilience of frontliners in the healthcare sector and in international settings [27,31,32]. Therefore, this study was carried out as an effort to investigate the effect of transformational leadership on police officers' resilience and psychological well-being during the COVID-19 crisis. The outcomes of the study were expected to help leaders within RMP acknowledge the best approach in managing police officers in times of pandemic, so that their well-being will not be affected by the numerous challenges and stressors created by the pandemic circumstances.

II. LITERATURE REVIEW

A. Transformational Leadership

Transformational leadership is a leadership undertaken by approach leaders who demonstrate four transformational characteristics: Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration [33]. Researchers agree that transformational leadership can be a valuable approach to helping employees dealing with uncertainties during a crisis [34,35]. By displaying idealized influence behaviors such as integrity, ethical conduct, and a strong sense of purpose, transformational leaders help followers feel more secure and stable during uncertain times [36]. By articulating organizational visions clearly, the leaders can help their followers feel a sense of purpose and motivation, even in the face of challenging circumstances [34]. Moreover, by encouraging followers to adapt to new situations and develop the skills necessary to navigate difficult circumstances, transformational leaders can help them feel more confident in times of crisis [34,37]. By providing emotional support, transformational leaders can help reduce stress among their followers, and help them feel less isolated during difficult times [34].

B. Resilience

Resilience refers to the ability of an individual to adapt to stressful situations or deal with numerous stressors in the face of traumatic events or challenges [38]. In the context of COVID-19 pandemic, police officers' resilience is vital because their role as frontliners requires them to support healthcare workers in responding to COVID-related emergencies, which can lead to increased stress and anxiety of virus infection [11,25]. Furthermore, this extended role can cause higher stress due to increased workload, limited resources, lack of support etc., which has a potential to impact their health and wellbeing [5,39].

C. Psychological Well-Being

Psychological well-being is described as the state of having positive feelings (happiness and contentment) in the absence of psychological symptoms such as burnout, anxiety, or depression [40]. During a pandemic situation, police officers' psychological well-being must be maintained because psychological problems such as depression, anxiety, and burnout can undermine their capabilities to perform their job well [41]. Furthermore, officers who are struggling with mental health issues may be prone to making mistakes, which could put themselves, their colleagues, and the public at risk [42]. In line with this, researchers have suggested police leaders pay more attention to officers' well-being so that their performance will not be jeopardized by the pandemic circumstances [7].

III. UNDERPINNING THEORY AND HYPOTHESIS DEVELOPMENT

A. Self-Determination Theory

This study will employ the Self-Determination Theory (SDT) to explain the effect of transformational leadership on officers' resilience and psychological well-being during COVID-19. This theory suggests that people have three basic psychological needs that must be satisfied for optimal functioning and wellbeing: autonomy, competence, and relatedness [20]. Autonomy helps them feel in control of their own life and decisions; competence helps them feel capable in their actions; and relatedness helps them feel connected to others [20].

Several studies have utilized the SDT and shown the effect of transformational leadership on employee well-being [43-44]. Based on this notion, we believe that police transformational leaders can fulfill officers' psychological needs for autonomy, competence, and relatedness, which in turn results in lower psychological distress throughout the pandemic.

B. Transformational Leadership and Psychological Well-Being

In the context of the COVID-19 pandemic, transformational leadership has been found to reduce burnout among employees [36] and improve psychological well-being [16]. Similar findings are shown in non-pandemic studies like [46] and [47] that transformational leadership reduces burnout among employees. Hence, the first hypothesis is proposed:

•H1: There is a positive and significant relationship between Transformational Leadership and Psychological Well-Being

C. Transformational Leadership and Resilience

Past research has also shown the association between transformational leadership and resilience, where transformational leaders positively influence employee resilience [48,49]. Transformational leaders tend to encourage employees to be more adaptive and able to endure work challenges, thereby increasing their resilience [19]. Based on these findings, the second hypothesis is proposed:

• H2: There is a positive and significant relationship between Transformational Leadership and Resilience

D. Resilience and Psychological Well-Being

In the context of the COVID-19 pandemic, various studies have presented empirical evidence regarding the link between resilience and psychological well-being among frontliners [27,32]. Pink et al. supported these findings, claiming that the resilience of first responders in Wales was negatively correlated with the level of their psychological distress during the pandemic [25]. In line with these findings, we believe that resilience contributes to police officers' psychological well-being during the pandemic. Thus, the third hypothesis is proposed:

•H3: There is a positive and significant relationship between Resilience and Psychological Well-Being

E. Theoretical Framework

The theoretical framework of the study is illustrated in Fig. 1 below.



IV. MATERIALS AND METHODS

The study has employed a quantitative approach through survey method to answer the research questions. The target population was all Malaysian police officers who served under RMP (*Polis Diraja Malaysia* or PDRM) during the COVID-19 pandemic period. A stratified sampling technique was employed to select the sample, where 383 police officers were randomly selected as respondents from within the firstlevel subgroup (based on police contingent) and second-level subgroup (based on job position) of the population. The reason for choosing this sampling technique was to ensure that the data adequately represented all contingents and job positions within the police population.

A self-administered questionnaire was used as the research instrument to collect the data. Established scales from the literature were adopted to cover all relevant measurement constructs in the instrument. Transformational leadership was measured by adapting the Multifactor Leadership Questionnaire (MLQ5X) developed by Avolio and Bass [50]. Resilience was measured using the psychological resilience scale [51], while psychological well-being was measured using the burnout and job satisfaction scales [52-53]. The response options were given on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). A pilot study with 50 volunteers confirmed the reliability of the scales, where the values of Cronbach's alpha were 0.890-0.915 for all transformational leadership dimensions, 0.825 for resilience, and 0.662 for psychological well-being.

Data collection was carried out by uploading the questionnaire online using the Google Form application and sending the link to the selected respondents, where they were asked to complete the questionnaire as accurately and honestly as possible. The collected data were then processed by applying the Partial Least Squares Structural equation modelling (PLS-SEM) analysis using SMART PLS 4 software.

V. RESULTS AND DISCUSSION

The sample consisted of 260 male police officers (67.9%) and 123 female police officers (32.1%). Majority of the respondents were Malay (74.4%), belonged to the oldest age group (above 45 years old) (26.6%) and the 'general employee' category, ranking from Sub Inspector to Constable (47.8%), and received between RM2,501 and RM5,000 monthly salary (34.5%).

A. Measurement Model Analysis

Measurement model analysis was carried out first using the PLS procedure in SMART PLS 4 to assess the outer loadings for all indicators, average variance extracted (AVE), construct and composite reliability, and convergent validity. This step is important to ensure that the collected data are reliable and will produce accurate findings [54]. The results are shown in Table I.

The results indicate satisfying Cronbach's Alpha and composite reliability values above the threshold of 0.6 for all constructs [55]. All indicators' outer loadings are statistically significant, and the AVE values for all constructs are above the threshold of 0.5, indicating acceptable convergent validity [55-56]. The evaluation of cross-loadings shows that none of the items load higher than the assigned construct. In addition, the Fornell-Larcker criterion, which states that the square root of AVE should be greater than the correlations with all other constructs in the model, is also fulfilled [55]. Based on the results, the validity and reliability of the measurement model were confirmed.

	Reliability and Convergent Validity ^a			Discriminant Validity (Fornell-Larcker) ^b		
	α	ρc	AVE	TL	RES	PSY
TL	0.983	0.984	0.757	0.870		
RES	0.884	0.915	0.684	0.596	0.827	
PSY	0.616	0.836	0.719	0.538	0.338	0.848

Note. TL: Transformational Leadership; RES: Resilience; PSY: Psych. Well-Being. a. α : Cronbach's alpha; ρ_c : Composite reliability; AVE: Average variance extracted. b. Correlation and square root of AVE.

B. Structural Model Analysis

Structural model analysis was carried out using the bootstrapping procedure with 5000 resamples to analyze the relationship between the variables in the model, thus testing the hypotheses. First, the model's explanatory power was determined to interpret the combined effect of predictor variables on dependent variables using the R^2 value, also known as the coefficient of determination [55]. Generally, R^2 values of 0.670, 0.330, and 0.190 are regarded as substantial, moderate, and weak, respectively [55]. The evaluation of explanatory power indicates R^2 values of 0.289 for *PSY*, and 0.354 for *RES*, implying a moderate level of explanatory power for these two endogenous constructs.

In assessing a structural model, the change in the R^2 value when a specified predictor variable is removed from the model should also be examined [55]. The change in the R^2 value is called effect size (f^2) . The magnitudes of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively [55]. The results effect showed large sizes for $TL \rightarrow PSY (f^2 = 0.378)$ and $TL \rightarrow RES (f^2 = 0.548)$, indicating significant relationships. However, the effect size for $RES \rightarrow PSY$ was very small $(f^2 = 0.001)$, implying a non-significant relationship.

Next, significance testing was carried out by observing the *p*-value, as well as the empirical *t*value, path coefficient (β) and confidence interval to accept or reject the hypothesized relationships. A relationship is statistically significant if p < 0.05, or that there is less than 5% probability that the null hypothesis is correct. This means that we reject the null hypothesis and retain the alternative hypothesis. The null hypothesis is also rejected if t-value is greater than 1.96 for p < 0.05, and β -value is greater than 0.10 [55]. Confidence interval upper limit (UL) and lower limit (LL) values must be either positive or both negative to reject the null hypothesis [55]. The results of significance testing are summarized in Table II below.

The results indicated a significant relationship between *TL* and *PSY* for hypothesis H1 ($\beta = 0.521$, t = 9.375, p < 0.05, LL = 0.406, UL = 0.623), implying that transformational leadership had a direct and positive effect on psychological well-being, thus H1 is supported. The results were in line with previous studies that transformational leadership is significantly related to employee well-being in the context of pandemic settings [16,36,45] and non-pandemic settings [46,47]. Therefore, it was concluded that police transformational leadership helped officers experience less distress and maintain their psychological well-being throughout the pandemic.

TABLE II.SIGNIFICANCE TESTING.

Direct Effect ^a	β	t	p^{b}	LL	UL
TL→PSY	0.521	9.375	0.000	0.406	0.623
TL→RES	0.596	13.221	0.000	0.507	0.684
RES→PSY	0.048	0.810	0.418	-0.068	0.165

Note. a. TL-Transformational Leadership; RES- Resilience; PSY – Psych. Well-Being. b. Level of significance, p<0.05

Further, the results indicated a significant relationship between TL and RES for hypothesis H2 ($\beta = 0.596$, t = 13.221, p < 0.05, LL = 0.507, UL = 0.684), implying that transformational leadership had a significant direct and positive effect on resilience. Based on this finding, H2 is supported. The results supported previous studies that transformational leadership is significantly related to employee resilience [19,48,49]. These findings were also consistent with prior studies regarding the appropriateness of transformational leadership approach in managing crises [34,35,37]. Therefore, it was concluded that police transformational leadership helped increase officers' resilience during COVID-19, making them more adaptive to the changes induced by the pandemic.

However, the results showed a nonsignificant relationship between RES and PSY for hypothesis H3 ($\beta = 0.048$, t = 0.810 , p > 0.05, LL = -0.068, UL = 0.165), implying that resilience had no direct effect on psychological well-being. Based on this finding, H3 is not supported. Surprisingly, the results did not support previous studies that have shown a positive association between the two variables [25,27,31,32]. One possible explanation for this is that police officers' well-being might be influenced more by other factors such as leadership, organizational climate, police culture, organizational support, relationships with colleagues etc. [57], which explains why their psychological well-being is not influenced much by resilience during the pandemic. Another reason is that police officers are often exposed to extreme stressful situations over the course of their careers, making them highly resilient, hence hardly affect their mental conditions [58].

VI. CONCLUSION

The present study set out to fill in the literature gap regarding the effect of police transformational leadership on officers'

psychological well-being and resilience during the COVID-19 crisis. The findings revealed a direct effect of police transformational leadership on both psychological well-being and resilience, but no direct effect between psychological well-being and resilience.

Several practical implications can be derived from the findings. First, police leaders should ensure that their subordinates' psychological well-being is protected from the adverse consequences of any stressful and traumatic situations during a crisis. Secondly, police leaders should adopt a transformational leadership approach when managing subordinates during a crisis. By embracing transformational leadership traits, leaders can help officers remain focused and motivated to achieve organizational vision, become more creative in using the available resources to troubleshoot problems, and feel supported throughout the crisis period. Thirdly, this study has contributed to the literature by supporting the use of Self-Determination Theory to understand what way transformational leadership in contributes to officers' resilience and psychological well-being in the context of policing in Malaysia during a health crisis. Other than that, the study has enriched the leadership literature by confirming the suitability of a transformational leadership approach to managing employees during crisis situations.

The present study also has several limitations. First, this study only focused on transformational leadership and resilience as the determinants of police officers' psychological well-being. In other words, the study did not consider other factors, either work-related or social-related, that might have an impact on well-being during police the pandemic. Secondly, transformational leadership in this study was evaluated based on the perceptions of police officers towards their leaders' behaviors. Therefore, generalizing the results of this study should be done with caution. The study also did not consider any mediation or moderation effects between the variables. Therefore, future research should consider investigating the role of transformational leadership as a moderator, or resilience as a mediator of the relationship between COVID-19 stressors and psychological well-being. This might produce a better model for predicting police psychological well-being during a crisis. Finally, the present study was limited to police officers in Malaysia. Potential cultural limitations may exist as the majority of

the police officers were Malays. Therefore, future research could target different cultural contexts in order to validate the results and the predictive power of our model for a broader spectrum of cultures and societies.

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Management of Innovations in Modern Business Processes

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Abstract-Innovation represents one of the key aspects of realizing the advantages of organizations. The process of transforming inventions into innovations has been identified as a critical challenge in managing organizational development and changes. the ability of organizations to manage innovation is one of theirs of key competitive advantages Creating new opportunities innovation, through in an increasingly competitive and technologically intensive environment, is increasingly a key factor in business success. It is evident that the transformation of inventions into innovations includes a large number of activities, from the search and development of new ideas, through the preparation of solutions to entering the market, applying and monitoring the effects of the innovation. This process can be performed in different ways and largely depends on the characteristics of the organization itself. Numerous cofactors influence organizational innovation. Without any doubt, adequate knowledge management is one of the necessary prerequisites for increasing the innovativeness and competitiveness of the organization. In the modern economy, the basic economic resource is no longer capital, nor natural resources, nor labor - but knowledge. Accumulated and absorbed knowledge stored within an organization can be innovation catalysts. Within the conclusions of the paper, the future directions of the development of innovative organizations were pointed out, as well as the need for innovation management and change management to be based on organizational knowledge.

Keywords - Innovation management, business processes, organization

I. INTRODUCTION

In the modern conditions of performing business processes, the main competitive advantage for organizations can be provided by innovation management [1]. In an intense competitive and technological environment, the creation of new business opportunities through innovation is a key factor in business success, especially when it comes to the field of services [2]. Globalization, continuous acceleration of business processes through technological development, ubiquitous competitive activities, simply impose the need for companies to find new ways, methods and procedures in performing business processes, to innovate, in order to maintain an equal participation in the market competition, or not to be squeezed out by markets, or that they would not be able to expand to other areas or markets [3].

II. INVENTIONS, INNOVATIONS AND INNOVATIVENESS

The concepts of invention and innovation are related to organizations that through the process of transformation gain their competitive advantage, in modern turbulent business conditions. However, it should first be pointed out that the concepts of invention and innovation are by no means synonymous, although they are directly related [4]. Thus, an invention is defined as a new, original idea, which has the potential to be profitable and useful [5]. An invention, in essence, is an idea, concept or method for introducing something new, be it a product, service, process or system. By its very nature, an invention is the result of a mental process of conceptualization. It can be understood as a new idea that contains the potential to develop and

transform into an innovation. Reference [6] emphasize that invention is only the first step, creating the concept of a new idea and creating opportunities for innovation. However, before further transformation, each invention must pass the reality test [7]. Invention occurs as a result of theoretical research and analysis: data, methods or needs [8]. However, innovation is a product of the creative process of converting an invention into a new product and business [8]. Innovation is any new product, service, process or technology that was created by applying own or others' results of scientific research work, discoveries and knowledge that is placed on the market with an appropriate value. Innovations can occur in different forms and can be found in different phases or levels, but in the end they must have their use value recognized by the market [5]. There is a solid, organic connection between the concepts of invention and because: invention without innovation, innovation represents only imagination, and innovation without invention represents a pure procedure that ultimately turns out to be useless for the organization. In practice, it has been proven that the greatest number of innovations comes from inventions [9]. The concepts of innovation and innovativeness bring with them some specificities that should be taken into account when talking about innovation management. According to [10], according to the size of the changes they bring, innovations are divided into three groups:

1) Epoch innovations - completely change the market rules of the game and thereby affect global flows;

2) Conservative innovations - include small and purposeful changes in the daily life of organizations;

3) Innovations based on differentiation - distinguish a certain product or/and service from other market participants.

A number of factors influence organizational innovation. In the first place, there is appropriate knowledge management, one of the most important conditions for improving innovation, and thus the competitiveness of the organization [11,12]. In modern science, knowledge is treated as a kind of economic resource which, by its very nature, is capable of influencing inventions and innovations [5]. In modern economic theory, the most important resources are no longer capital, nor natural resources and labor - now knowledge is the most important resource of the organization [13]. Accumulated and adopted knowledge stored within the organization becomes a catalyst for innovation [12]. That is why the organization must provide a knowledge management system, which positively reflects on all organizational processes as well as change management [14]. This strategic approach implies positive implications for increasing competitiveness, and thus innovation [15].

On the other hand, regardless of constant technological progress in competitive conditions that encourages innovation, not all organizations are equally ready to innovate. Some authors use the term innovation capacity, emphasizing that the organizational culture, the organization's resources, its competencies and connections with the environment are the main conditions for strengthening innovation [16]. Each of these elements has an important role in the development and implementation of innovations in a specific organization. Also, many authors deal with problems related to obstacles in achieving a sustainable competitive advantage based on innovation. In this sense, economic, financial, organizational, institutional or contextspecific problems are most often mentioned [17]. Other authors specifically mention an inadequate strategy, the lack of a business model that stimulates innovation as the most important obstacle to the development of innovation in organizations in the modern business context [2]. References [16,18] state organizational culture as the most important obstacle, while Blanchard indicates that there is a difference in the perception of obstacles in those organizations that do not innovate at all, compared to those organizations that do not have enough strength to implement innovations, especially if they have previous negative experiences.

III. CHANGE MANAGEMENT IN THE CONTEXT OF INNOVATION MANAGEMENT

According to its essence, innovation is a multi-stage and complex process [5]. It is logical that the complexity of the innovation process requires specific problems and real challenges in management. According to one definition, the concept of innovation management in an organization refers to "planning, organizing, controlling innovation coordinating and processes and innovations - from idea to realization" [19]. The very procedure of introducing an organizational change, which refers to the introduction of a new product and/or service, is difficult in itself, so the success of innovation management depends on numerous and different factors. The success of innovation management depends on four main factors, namely: environment, market. existing organizational structure and technologies [18]. This systematization of factors that influence innovation management can be taken as valid when it comes to innovation management within the organization itself. However, if one considers the management of innovations that by their nature include the participation of external organizations, or that by their nature span multiple organizations, communication and effective exchange between organizations, which results in the transformation and integration of knowledge into commercial innovation, is a key prerequisite for the successful management of innovations [20].

Modern information and communication technologies have opened up new possibilities when it comes to managing changes and leading innovations. The use of information technologies in itself represents an innovative way of working for many organizations and managers [21]. Today, information technologies have created opportunities for rapid organizational changes, generation and upgrading of organizational knowledge and more effective knowledge management [22] The introduction of new internal communication tools can trigger employees to work on the introduction of inventions for commercial purposes [23]. These factors favorably affect the development of innovation management in organizations, considering that the new paradigm of knowledge management, based on the accumulation and sharing of knowledge, using information and communication technologies, gives support for the application of the new innovation management paradigm [24]. Also, the quality of innovation management implies the coordination of the portfolio of development projects within a clear innovation platform, which is in agreement with the general business organization strategy. Numerous authors define the key elements that are included in the innovation management process [25,19]: "1. Defining the innovation strategy and aligning it with other strategies; 2. Portfolio management for the selection of innovative projects; 3. Generation of ideas and the movement of knowledge aimed at new and improved products, processes, services, technologies, organization, marketing: 4. Development of ideas through working prototypes; 5. Transferring ideas into production,

distribution and use; 6. Development of innovation incentive system and determination of innovation performance" [19].

Defining the innovation strategy is one of the key factors in improving the success of the organization [26]. Organizations that have defined an innovation strategy and linked innovation projects with the overall development strategy have a significant advantage in achieving radical innovation compared to those that do not resort to these solutions [27].

Managing the innovation portfolio is a particular challenge for organizations. The success of innovation portfolio management depends on the selection of projects, but also on the allocation of resources for the implementation of innovative projects [28]. Reference [29] believe that the successful management of the innovation portfolio is the key factor in the successful management of innovations in organizations. Idea generation and adequate management of ideas are one of the key factors for increasing the innovativeness of companies [5]. For these purposes, the organization should promote and encourage creativity, as a precursor to the generation of ideas, at all levels [30].

Although organizations are often good at idea generation, the innovation process and innovation management make broader demands than idea generation itself [31]. The development of ideas through working prototypes is present in many companies that have research and development departments. Here. matrix organizational management often occurs, in which there is a double coordination: at the level of the head of the innovation team, and at the level of the head of the department [32]. However, many companies in the service industry, even when it comes to international companies, do not have specific departments for research and development, but innovation management is carried out within the framework of different departments within the organization [33]. Reference [5] believe that the transfer of ideas to production and use is an integral part of the innovation management process.

Creating a stimulating environment for innovation by employees, along with a system of motivation and rewarding innovative thinking, represents a significant aspect of successful innovation management [34,35]. Organizations use different forms to approach innovation management in the most efficient way. In

addition to organizational units for innovation activities, i.e. departments for research and development, and matrix organizational structures, multi-project management, in which a large number of development projects are simultaneously managed, and virtual teams, whose work takes place in virtual Internet space and who work on leading innovations with the information and communication use of technologies for mutual communication and exchange of ideas [36], as well as structures that are, as a rule, autonomous in relation to the organization, and which are specifically engaged in leading innovations, which can be high-risk by organizational performance or reputation [37].

IV. MODERN TENDENCIES, MODEL II TECHNIQUES IN INNOVATION MANAGEMENT

Innovation can be seen as the development and commercialization of knowledge, turning ideas and research into added value products, processes or services. Innovations arise in order to create better performance of products and services. However, the innovation process is not exclusively automatic nor is it always positive. Therefore, the innovation development process should be carefully planned and precisely directed in order to obtain positive final results [38]. The innovation process represents a time sequence of events that occurs when people interact with other people to develop and implement their innovative ideas within the institutional framework. The innovation process is composed of different activities that interact with each other according to a clear sequence of activities, such as: gathering information about the problem, research (general or applied), ideas and developing ideas, finding solutions, marketing solutions, etc. At the same time, the innovation process is focused on different phases of a specific innovation effort, where each phase corresponds to a unique set of activities. For example, the basic stages of the innovation process are problem identification, alternative evaluation. decision making, and commercialization. In the context of the above, conclusion emerges that innovation the management is a unique process that consists of several stages. Since innovation is seen as a complex process consisting of many different activities, the basic questions that are asked today are related to the possibilities of innovation management. In this regard, the attention of modern authors from the field of innovation management is focused, first of all, on defining the different degrees, i.e. phases of the

innovation process, as well as the role of participants in the organization during their development. Various researches have been conducted with the aim of determining the key characteristics of the organization. and management that need to be developed in order to successfully manage innovations [39].

In the modern environment, innovation management includes an organized, systematic and continuous search for new opportunities. At the same time, appropriate opportunities and opportunities can arise from different situations and sources: from unexpected changes in the market caused by external events or measures of the social community, from the needs of work processes or suppliers, from changes in the understanding of fashion, from the need to satisfy some seasonal customer preferences , from events related to the work of competitors, from some scientific and technical achievements and commercial applications in that domain, as well as from many other situations and sources [40].

Innovation traditionally implied a technical context, so it entailed the creation of either new or improved consumer goods [41]. From such a context, one should not draw the wrong conclusion that innovation always means using the latest technologies. On the contrary, innovation is rather a way of thinking and creativity that is expressed through the development of a new product, process or service. In this sense, innovation should be an economic and social rather than a technical term [42]. The extent and success of an organization's innovative efforts is a key indicator of its overall business success [43]. In this regard, two groups of factors affect the degree of innovativeness of the company. The first group of factors refers to the organizational dimension of the company and includes the organizational structure, organizational culture and the ability of the company to make quality decisions in conditions of uncertainty. Another group of factors are financial factors, which refer to the financing of investment projects. These factors affect the reduction of risks and costs of projects through connection with other companies and thus affect the increase of competitive advantages of the company [44]. So, as you can see, in order for the innovation to be successful and applicable, the management of the organization is faced with the task of cost management.

The better the cost management, the greater the chance that innovation will be programmed

into the company's business structure. Therefore, it follows that the primary task of management is to initiate and ensure the development of innovative processes and the introduction of the most diverse novelties into the company's production program and operations [45].

The management of innovation projects in the organization (enterprise), as we have seen from the previous considerations, starts from a very clearly defined innovation process in which phases and key operations are separated. In this way, the necessary investment and allocation of resources in individual phases of the innovation process is enabled: human, material, financial, as well as the determination of deadlines and results that are clearly related to individual phases. In addition, the financing of innovation projects, either from internal or external sources, is carried out with a clear report that is presented to a potential investor and which includes a detailed description of all necessary investments, along with a projection of profit from innovation activity. Such an elaboration is the basis for making a decision on investing in innovations. The necessary agreement and support of the management of one's own organization, as well as the interest of external investors in the innovation project, implies the most detailed analysis of the planned investments with the presentation and assessment of all the risks that the project [46].

Management of innovation projects includes planning, implementation and control of all phases of the innovation process in accordance with the set goals. However, innovation projects are very specific in several key aspects. Namely, they usually start with poorly defined, and at the same time ambitious goals, which are elaborated and become more and more clear during the development of the project. Likewise, innovation projects are experimental in nature and rarely follow strict linear paths. Also, innovation projects are characterized by uncertainty, risk and a high degree of danger of failure. However, although innovation processes are characterized by uncertainty and a seemingly random nature, it is still possible to find some basic forms of success. It is a fact that many innovation projects experience failure, but that is why some of them bring great success and profits to both organizations and individuals. Accordingly, it could be concluded that successful innovative organizations have developed innovation management techniques, so that although there is never a firm guarantee of success, by

implementing certain activities, the probability that innovations will be successful can be increased to a certain degree. In this context, innovation management techniques can be seen through a whole series of the most diverse measures and methods by which organizations (companies) can more easily adapt to current conditions and thus avoid the dangers of failure.

Among the most used techniques for innovation management, the following can be singled out [47]: 1) Knowledge management; 2) Technique of market intelligence; 3) Cooperative technique and networking technique; 4) Human resource management; 5) Interface Management; 6) Techniques for developing creativity; 7) Process improvement techniques; 8) Innovation project management; 9) Design management; 10) Techniques of establishing a company.

The newer innovation management methods are two techniques: first, the innovation radar technique, and second, the innovation pyramid technique. The innovation radar technique is a technique that shows all the dimensions through which a company can look for favorable opportunities for innovation. Therefore, some authors consider this technique as a technique for scanning the environment rather than a technique for innovation management. However, when looking at the essence of all twelve dimensions that this technique includes, it can be seen that the innovation radar technique is a useful tool for managing innovations by company managers and entrepreneurs. Otherwise, the innovation radar technique resembles a map made up of four dimensions, the so-called "business kev anchors", namely: offer, customers, processes and market presence. The technique known as the innovation pyramid is composed of two basic components, namely: the innovation pyramid and the investment pyramid. At the same time, the pyramid of innovations contains types of innovations, according to importance and number: importance and number are in inverse relationship and are arranged according to Pareto's ABC analysis. At the same time, radical innovations are the most valuable, but they are also the fewest, so they are presented as the top of the pyramid. The middle part of the pyramid consists of promising innovations, which are more numerous than radical innovations, but their number is smaller than incremental innovations. At the bottom of the pyramid are the most numerous and least valuable innovations, as they consist of incremental improvements.

The investment pyramid is the inverse of the innovation pyramid. Since radical innovations are the least numerous, but the most valuable ones require the most investments, the bottom of the pyramid of investments is shown alongside the top of the innovation pyramid. Promising innovations are more numerous than radical innovations, so they occupy the middle part of the innovation pyramid. They require less investment than radical innovations, so the middle part of the investment pyramid corresponds to them. Incremental innovations (continuous improvements) are the most numerous and are shown as the bottom of the pyramid of innovations, but they require the least investment, so accordingly, they correspond to the top of the investment pyramid. Analogous to the above, the following conclusion emerges for the innovation pyramid:

Radical innovations = *Big investments*,

Promising innovations = Medium investments,

Incremental innovations = Small investments.

Only one of the pyramids can be shown, but in the eyes of an experienced and competent manager, another will immediately appear. In this way, the innovation pyramid is associated with the investment pyramid, and the investment pyramid is associated with the innovation pyramid. At the same time, as we have seen, even individual parts of the pyramids speak in isolation about the relationship between innovation and investment.

Similar to the innovation radar technique, the innovation pyramid technique can be applied only in certain stages of the innovation management process, but also as a technique for managing the entire innovation process. The bottom of the pyramid then means the collection of proposals (of which there are the most), the middle part means the testing of proposals and acceptance (not all proposals are accepted), while the top of the pyramid means the implementation of the innovation (only one or a small number of proposals are implemented).

In the literature on innovation, there are a large number of different approaches, i.e., innovation management models, but in general, all models could be differentiated into four basic groups, namely: 1) Linear models; 2) Simultaneous models, 3) Interactive models; 4) Network models. The first three groups of models belong to the so-called traditional closed models, while the last network model belongs to the group of so-called modern open innovation management models.

The basic characteristic of traditional innovation management models is the closedness of the innovation process. Innovative activities of the company are carried out only within the company, based on available knowledge and technology, and intellectual property is a business secret. Researchers and managers in the field of technology and innovation management connected to internal research are and development centers that are responsible for the development of innovations. Innovation and entrepreneurship are closely related, in fact, constant innovation is immanent an characteristic of entrepreneurship [48].

According to this approach, successful innovation occurs as a result of innovative activities within the company, and therefore it is necessary to ensure full control over these activities, in order to make them easier to manage. The basic assumption of the closed innovation model is that successful innovation requires control. The company is expected to independently complete the entire innovation process. and business process, from idea to development The open model of innovation management represents a modern and at the same holistic approach to innovation time management, it arose as a response to the globalization of the economy and the use of information technology. increasing the abundance of the workforce and the increasing presence of joint ventures. Therefore, the model emphasizes the need for greater cooperation between different companies in order to reduce potential risks and costs and at the same time increase the efficiency of the innovation process and better commercialize the innovation idea on the market.

The latest generation of the innovation process began in the nineties of the 20th century and continues to this day. It is the result of globalization, growing competition as well as a strong wave of technological changes in a number of areas. Namely, starting from the nineties of the previous century, the phenomenon of limited resources became a central factor. All this has the effect of intensifying the need for integration and networking, in order to guarantee flexibility and speed of development. Business processes have become automated through resource planning and production information systems. In doing so, various business alliances were formed and collaborative marketing and various research initiatives were affirmed. The contemporary generation of innovations indicates the unsustainability of seeing innovation as an isolated change, without considering the wider context and influences coming from the surrounding

V. CONCLUSION

As can be seen from the above, the importance of innovation today is huge, and the greatest importance is technological innovation, which is the result of organized scientific research and development work of specialized experts and organizations. During the past 20th century, this led to major changes in the structure of production and the emergence of new industries, which themselves became carriers of technological development. On the basis of what was presented in the previous chapters and a review of the available literature regarding the contemporary context of innovation and knowledge management, the following conclusions can be drawn:

Innovation management is important for the functioning of modern organizations. In today's knowledge-based economy, innovation management is a critical factor in ensuring the competitive advantages of organizations in a sustainable manner.

Management of inventions and management of innovations represent different management processes. The process of transforming inventions into innovations represents a critical challenge in the management of organizational changes and development.

Innovations have numerous impacts on the organization. Every innovation by itself implies changes in various forms of organizational action and behavior, so the concepts of change management and innovation management are mutually inseparable.

The future of organizations is directed towards the creation of innovative organizations. Organizational changes enable the transformation from flexible models to innovative organizational models.

Methods of improving both invention and innovation processes ensure continuous improvement of innovative performance of organizations. In the modern organizational environment, innovation management, as well as change management, should be based on organizational knowledge and these processes are interconnected in modern organizations.

For effective innovation management, modern organizations can use the following systems and structures: Units for innovation activities; Research and development departments, matrix organizations; Multi-project management, Virtual teams; Units for the development of new businesses.

At the end of this paper, it can be briefly concluded that the approach and treatment of the innovation process, that is, the model, must be of a holistic character. In future research, it is possible to put additional emphasis on organizational management knowledge in the context of innovative changes, as well as a more detailed understanding of the role of innovation in shaping modern organizations and systems.

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Algorithmic Management: Utopia or Dystopia of the Platform Work?

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Abstract-Platform work is an atypical form of work in which individuals use online platform to offer service in exchange for monetarv compensation. In order depict to this phenomenon it is necessary to discern that paid activity is platform mediated. That is to say digital platforms undertake agency movements in order to connect clients and service providers. A clear-cut definition of digital platform is almost impossible to constitute, but we can at least draw some key features. In legal terms, digital platform facilitates transactions and generates value. By using digital tools platforms coordinate working activity. Moreover, the entire working process is governed by algorithms. To be precise, certain mathematical formulas are embodied in algorithms with an objective to direct, evaluate and discipline workers. Hence, managerial functions conducted by humans are transferred to new boss, the so called, algorithmic management.

Keywords - Digital platforms, platform work, algorithmic management

I. INTRODUCTION

There is no doubt that artificial intelligence is rapidly transforming the way how work is organized, executed and managed. It is acknowledged that automation technology forms parts of digital revolution. Historically speaking, there are three revolutions which took place in the last 200 years: agricultural revolution, industrial revolution and digital revolution [1]. The latter represents all forms of human connection and digital interaction through cyber infrastructure ensuring in that homogeneous communication and way materialization of services. In that sense, artificial intelligence is a basic element of digital revolution [2].

Moreover, digitization has facilitated the creation of new types of work including platform work. Generally speaking, platform work is a new method of providing service. "In this form of work, digital infrastructure facilitates the matching between the demand and supply of specific services and organises their performance utilising algorithmic management, customer reviews, internal ratings, incentives and automated decision-making systems" [3]. As noted, platform work is inextricably linked automation to and flexibilisation.

II. BUILDING A GATEWAY FOR TECHNOCRATIC LAISSEZ FAIRE

When it comes to automation different opinions are represented in legal circles. On the one hand, automation is seen as a legal way to avoid labor cost and human related risk. Human work is being replaced by machines able to perform wide range of task [4]. Moreover, algorithmic management has been defined as an enlargement or full automation of traditional employer functions. Thus, traditional model of employer-employee relations is transformed by the advent of artificial intelligence [5].

Namely, working tasks are performed via platform which uses automatic system for coordination. Algorithms play the most important role in this scenario, thus, it is logical that their usage firstly appeared on digital platforms [6]. Although the use of algorithmic management is not limited to the work provided on or through digital platforms, in this paper we will primarily analyze digital platform work.

Considering important aspects of digital platforms algorithmic management forms indispensable part of its organizational structure [7]. This topic has been relevant for decades in both scientific and professional circles. Interest in functioning of algorithmic management may be found in plethora of books.

In short, managerial functions conducted by humans are transferred to new boss, the so called, algorithmic management [8]. Therefore, employer's functions are brought together and represented in one governing body. Namely, artificial boss is a cornerstone in building the gateway for deregulation. To illuminate, the rationale behind full automation is deletion of rules in labor law field [9].

Digital infrastructure creates the legal tools for lawful removal of labour rights in the sphere of platform work. Therefore, the ultimate goal is erasure obligations on employer side by transforming jobs and working patterns [5,8,10]. Figuratively speaking, make a reboot of working organization and management practices means diving into a gray zone of technocratic laissez faire [5]. From employer perspective that is a good way to avoid labor costs and legal responsibilities.

A large number of workers are facing dictatorship under the rule of technology. As a matter of fact, they are struggling to safeguard their individual and collective rights. Therefore, the use of artificial intelligence in the hiring and firing process must be controlled and limited otherwise human work will be depreciated [11].

III. CLARIFYING THE CONCEPT OF DIGITAL PLATFORM

Digital platforms have gained prominence all over the world. Among legal experts this concept was analyzed, yet it has not been found permanent solution for denominational issue [12]. Regrettably, profound explanation able to clarify complex nature of this business model is still non-existent. Lack of clarity arouses even more public attention, which is why we decided to investigate this concept anew.

What are digital platforms and how they work? It seems like a basic and easy inquiry, but in reality it is very difficult and complex to handle it.

We are faced with vague understanding of the basic of this concept. It is not only the lack of a definition of digital labor platforms problematic, but also no unified approach to the key elements of the algorithmic management system [13]. In this instance paper refers to the main characteristics of digital platforms, while the algorithmic management will be discussed later.

Digital platforms are new business models for connecting supply and demand for work around the globe. The principle of territoriality does not apply to digital platforms, taking into account that digital platforms operate regardless of space and time [14]. Therefore, erasure of spatial and temporal boundaries led to the conclusion that digital platforms operate in their own orbit of cyberspace. In these context, one concern emerges are digital and online constituents so intermingled that we can not identify them but instead we are discussing about 'phygita' experiences [15].

In light of the above mentioned, digital work platforms are web-based business models which are operative by virtue of internet connection. Because of that, digital platforms are most often defined as internet providers that match supply and demand through an automated system [16]. The role of a platform business is to provide a governance structure and a set of standards and protocols that enable interactions at scale, thereby unleashing network effects.

It is a new employment form where digital platform mediates contractual relationship between worker and client [17]. In other words, digital platforms assist in establishing working arrangements therewithal constituting reciprocal duties between parties involved. However, the number of subjects does not correspond to a traditional employment relationship. Moreover, platform work presupposes presence at least three subjects [18].

Accordingly, digital technology accelerates processes of making material products and facilitates the delivery of services. Enormous popularity of this quasi labor market is apparent in all sectors where there is a need to connect several parties with different needs [19].

Drawing upon these threads, digital platforms manifest an economic system or separate market where workers and clients intersect. Put differently, platforms are set up for the purpose to further performance of workrelated tasks at a given period of time [20]. In the light of this, digital platforms are perceived as intermediaries between service users and service providers. This concept is also defined as "business model, consisting of shared access to goods or services through free or paid transactions, by means of physical or digital networks" [8].

Thus, digital platforms are intermediaries between persons who need work to secure a livelihood and persons or organizations who need human labor to meet business goals. It has been pointed out that digital platform are running digital marketplace for short-time contractual relationships. Looking through the labour law lenses working platforms are "digital networks that coordinate labour service transactions in an algorithmic way" [21,22].

The main advantage of digital platforms is that they enable companies and workers to rent out or share their physical capital easily. Hence, in exchange for a monetary compensation companies obtain a significant asset in terms of skills and abilities. Moreover, this is the one of the features craved by employers because it assures low transaction costs [20]. In relation to that, method of payment can be determined by mutual consensus although platforms may apply the principle of minimum fee or fixed price for certain services. Payment can be made directly after the service is rendered or indirectly when commission is paid by the platform upon completion of the task [21].

Technological progress has enabled the development of various models of digital platforms [23]. Splitting job task into several units assigned to a legion of low-paid workers for a short-period of time is the most common model. The strategy of platform operator is to use cheap workforce to complete the project or task. Workers are not able to refuse or cancel work without having it a negative impact on their rating, which automatically reduces access to better-paid jobs or leads to the loss of bonuses [24].

Taking everything into account, three main characteristics of digital platforms prevail. First, regardless of the type, digital platforms strive to mobilize human capacities. Second, provision of service is rendered through digital platform. Finally, digital platforms use algorithms to evaluate, control and discipline workers [25]. In fact, a major transformation is taking place today if a comparison of management practices is made.

It not amplification of state of affairs by saying that course of action is taken to neutralize the difference between material and immaterial elements. Namely, "software was formerly embedded in things, but now things services as well as physical objects—are woven into software-based network fabrics" [26]. To summarize, digital platforms are complicated mixtures of software, operations, networks and human capital.

IV. WHO IS AN EMPLOYER: DIGITAL PLATFORM OR ALGORITHM?

Progress of machine learning has brought to the use of artificial intelligence systems which generate enormous amount of data. Machine learning is process of discovering correlations between variables in a large data set in order to predict or assess the outcomes [27]. It is a set of instructions written by a programmer about how a computer should collect and process data.

Hence, digital platforms operate according to the principle of recording and evaluating all relevant data. Date serve as a basis on which problem solving patterns are formed suggesting that in the heart of decision-making system is an algorithm. Put differently, "an algorithm is a computational formula that autonomously makes decisions based on statistical models" [6,28].

Legal scholars have indicated upsurge of algorithmic management in making decisions on crucial matters relevant to the position of workers. In essence, algorithmic management represents a simplified way of decision-making. Namely, the algorithm does not and cannot take into account all related facts, but only the most important ones or those that are singled out [29,30].

The origin of algorithmic management can be found in Weber's theory of the bureau where three characteristics are particularly prominent: detailed division of labor, process formalization and hierarchy at work [31]. Nevertheless, the first use of the term is attributed to Lee who carried out with her colleges a pioneer study on repercussions of management by algorithms on workers position [32]. In the co-authored work of art algorithmic management has been given much critical praise, considering the fact that algorithmic management enables companies to supervise workers in a refined way [33].

The idea of creating a machine that imitates human beings is not now [34]. For example, famous english philosopher Thomas Hobbes in his best known book Leviathan, alluded that man can create an artificial animal -a watch. That is to say man can become a god in the sense that he can create artificial animal in his own image just as god created man [35].

By way of illustration, Homer's epochal work the Iliad presented in its content imagination of autonomous tools like tripods of the god Hephaistos. Similarly, in ancient Greek and Roman novel a plot device was introduced to the audience as a divine intervention to solve a crisis or difficulty [5].

A god appears in Sophocles' Philoctetes and in the most of the plays of Euripides to resolve an expected and unlikely occurrence. In particular, Euripides enjoyed delivering gods to the stage with the help of a machine kind of like a crane [35]. Hence the name, Deus ex machine, which is used by contemporaries when they want to explain on which principle algorithmic management works. According to this, Aloisi and Stefano write: "Today, these methods aimed at running a business in an efficient and data-driven way, epitomize new evidence-based human resources practices, which can be boiled down to the expression 'boss ex machines', an adaptation form the Latin phrase 'deus ex machine' (a god from the machine) describing a theatrical trick used in Greek and Roman theatre whereby a divine creature abruptly entered the scene via a mechanical crane to provide an artificial solution to a problem in the story, by altering the plot of events or even rewriting the fate of the protagonists, often against all logic [5]."

Let's get back to reality! Since its inception algorithm has been used as an instrument to solve diverse issues in different areas. For instance, algorithms are regularly used in administration of business organization under denomination algorithmic management.

Briefly, management is umbrella term used to describe how businesses organize and direct workflow, operations, and employees to increase performance, productivity and efficiency [36]. Taken together, algorithmic management is "a diverse set of technological tools and techniques to remotely manage workforce, relying on date collection and surveillance of workers to enable automated or semi-automated decision-making" [37]. Also, "algorithmic management can be defined as the use of computer-programmed procedures for the coordination of labour input in organization [31]."

The managerial, normative and disciplinary prerogatives traditionally held by employer are and delegated to machines. transformed Algorithms either completely assume managerial functions or assist management in making decisions. Hence, the difference is made between full and partial automation on decision-making processes [38]. In the first case, the algorithm provides suggestions to managers on how to control and evaluate workers. Unfortunately, this model does not prevail in practice, thus platforms resort to automatic decision based on data collected by algorithms. Furthermore, it means that human dimension is lost or decimated given that in rare cases decisions pass human control [39].

Algorithmic management is used as a generic term to denote automated systems for monitoring, supervising and evaluating work performance. In other words, it is automated decision-making systems that affect the working conditions and position of platform workers. Nevertheless, algorithmic management is not conditioned by existence of a digital platform if information about the work process is collected and stored in the computer systems and directly used by managers with the purpose to inform workers. However, this management system is mostly applied on digital platforms that have encouraged its implementation [40].

Moreover, the difference between automatic monitoring of work through electronic devices and automatic decision-making is artificial, since they represent two parts of a single prerogative. Hence, managerial authority is ramifying and extending from right to direct to right to discipline. Digital platforms issue work instructions to platform workers and sanction their behavior [41].

Due to widespread use of digital platforms in all spheres of human activity some labour law concepts have been called into question. As a consequence we are witnessing a long present and gradual deterioration of working rights. Lukas Biewald in his statement asserts that "Before the internet, it would be really difficult to find someone, sit them down for ten minutes and get them to work for you, and then fire them after those ten minutes. But with technology you can actually find them, pay them the tiny amount of money, and then get rid of them after you don't need them anymore" [33]. Moreover, the negative effects of new trends in labor law are becoming apocalyptic. Human work is revalued and replaced by machines which are capable enough to accomplish every task. It is noted that artificial intelligence steals jobs from humans but that it also assume control of managerial functions. As a consequence, humans are being replaced by machines [42]. Machines are cheaper and better worker than humans because they do not get sick neither they take a break to rest.

The argument that a robot never gets sick is not applicable here since a machine could also stop working for some reason. On contrary, some argue that the interpretation of automation as a job killer is exaggerated and not based on genuine facts. We oppose that claim, since empirical research has shown multitude negative effects on the individuals and on work as well [43].

Apart from that, workers are dealing with the problem of constant and intensive control of their actions. It is worth reiterating that workers are under intensified supervision given that algorithms are programmed to measure every motion [21,30,42]. It should be emphasized that algorithmic management systems are not passive observes, they make real-time decisions about workers, plan, allocate task, control performance, but also track workers and predict theirs course of action. As said before, every movement and every pause of the driver is recorded in order to control his or her behavior. Because of that workers are competing between themselves intensifying efforts to complete tasks which may endanger their health and psychological well being [20].

Furthermore, algorithmic management can automatically push workers to the bottom of the option list if they frequently turn down job offers or do not execute them in the desired manner, reducing in that way the possibility of generating adequate income. Therefore, it is correctly observed that algorithm is not just a digital tool for coordination of working activities within the organization, but a groundbreaking management approach that impact works on various levels. The mission of the new boss is clear judge without feelings and without the right to appeal [44].

Thus, the main problem in this regard is the lack of transparency and accountability in relations to labour and social security rights. Digital workers are deprived of many rights (overtime pay, sick leave, compensation for unlawful termination of employment etc.) which bring into the question existence of decent work in platform economy. Bearing that in mind, numerous proposals were made with the purpose of building the adequate legal framework [45].

Moreover, blind faith in the machine may lead to unfair outcomes such as an unjustified lower salary, unpaid time off, unsuited transfer to another workplace. It is as clear as day that business entities use it as an alibi for violating the protection norms of labor law [46].

On the top, the discrimination made by the algorithms becomes more pronounced. Given the numerous cases of algorithmic properly discriminatory practices it is concluded that technological agents lack moral authenticity. As indicated by Guy Standing, no one should take algorithmic accuracy as reality, but more like a utopia of platform work [30].

To conclude, algorithms occupy central position at platform putting employers aside. We should bear in mind that many problems can arise because of the vanishing of the employer. Besides that, the algorithms are not as perfect as the proponents of the technology glorified. Namely, the algorithms display numerous shortcomings while performing managerial functions. Employees may encounter errors in algorithmic calculations or other problems which can affect their employment status or financial position [47].

V. CONCLUSION

The period in which we live can be labeled as a transition period where people are moving from industry to robotics science. Digital transformation offers new possibilities to working people but also new strategies for business management. Planning, organizing, directing and controlling the activities inside the organization using digital tools may be far easier and more efficient. In light of the above mentioned, digital platforms are describe as a pragmatic means of collaboration that may help firms meet business goals and policy objectives. Technological advances have allowed organizations to utilize artificial intelligence in designing business strategies.

Three propellers paved the way for digital progress in the sphere of labour relations: platformization, digitization and automation. The platform economy has multi-sided structure composed of several participants: private individuals, service providers acting in their professional capacity, service users, and a collaborative platform that connects service users and service providers and facilitates mutual transactions. Hence, digital platforms have the special ability to network people with different profiles and preferences.

In this paper, digital platforms have been presented through utopian or dystopian frame. The optimistic version of the emerging digital platform economy suggests that work-related engagements can be reconstructed to benefit all. Similarly, the utopians argue that platforms generate value since they organize a significant portion of work. From a more realistic perspective, workers face problems of infringement of their rights just because smart autonomous decisions are not that smart. Myriad of conflicts related with platform-based work makes it difficult to beget clear rules of the game whether the employer is a platform or an algorithm. Algorithms are regarded as a core element in developing business model of digital platforms. It can be said that platform work is influenced by algorithms, while digital platforms are managed by them.

Algorithmic management, therefore. assumes the role of employer accepting duties and functions traditionally held by human managers. Their primary task is to determine work assignments, monitor and access performance and take corrective action in order to enhance productivity. However, this idyllic image does not correspond to reality wherefore is of paramount significance to assert workrelated rights for the purpose of advancing a certain 'standardization' of the non-standard forms of employment.

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Facilitating Innovation and Competitiveness: The Intermediary Function of the Ease of Doing Business

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Abstract—This study explores the relationship between innovation and competitiveness, with a particular focus on the mediating role of the Ease of Doing Business. It investigates how the ease of doing business can influence the relationship between innovation and я nation's competitiveness. The study acknowledges that innovation is a crucial factor that impacts the performance of companies and the overall competitiveness and productivity of nations. It emphasizes that countries rely on their industrial sectors to create conducive business environments that foster innovation, ultimately leading to enhanced competitiveness. Furthermore, the study discusses the significance of organizational capability development and dynamic capabilities in helping firms adapt and innovate in rapidly changing markets. It also highlights the education, of entrepreneurial importance attitudes, and a culture of innovation in improving a company's competitiveness. Regarding the relationship between innovation and the Ease of Doing Business index, the study suggests that business regulations within countries can influence investments in information and communication technology (ICT) and that favorable regulations can encourage investment. It also mentions how technology, particularly in the economy in the digital age, can reshape commerce and create opportunities for small and medium-sized enterprises (SMEs) in developing countries. The study emphasizes that the digital economy's impact on international business requires countries to adapt their legislation and business practices to align with technological innovations and evolving global trade policies. It underscores the need for countries to proactively address issues related to data flows, trade facilitation, and inclusive gains from digital commerce.

Keywords - Ease of doing business; innovation; competitiveness

I. INTRODUCTION

This study delves into the critical topic of fostering a conducive business environment, which is of great interest to researchers, international institutions, and policymakers worldwide. It mentions the World Bank's Doing Business score as a vital tool used to assess and compare the business regulations in various economies. This score has become instrumental in shaping research and policy decisions. The current study highlights the significant efforts made by public managers across nations to implement reforms aimed at streamlining processes, reducing costs, and expediting the establishment of new businesses. These reforms are pivotal for the development of the public sector and overall economic growth. The literature supports the notion that regulatory constraints, among other challenges, hinder the ease of starting, operating, and growing businesses [1,2]. Importantly, this study underscores the role of governments in either promoting or hindering entrepreneurship and the ease of doing business. It emphasizes the governments creating importance of a framework that facilitates spontaneous transactions among various economic agents. Such a collaborative environment is essential for the emergence of innovative solutions, which, in turn, can lead to economic development. The mention of innovation's positive impact on company performance, national productivity, competitiveness adds depth to the and discussion. It highlights how an optimal business environment can foster innovation and lead to

positive outcomes for both companies and nations. The central focus of the paper is the examination of the relationship between the ease of doing business, innovation, and a nation's competitiveness. It raises a crucial research question: Can the ease of doing business serve as an indirect link between innovation and national competitiveness? This inquiry aims to enhance our understanding of the interconnectedness of these variables. The study's potential contributions are outlined, including its role in guiding governments and their regulatory strategies to improve business environments. Additionally, it emphasizes the importance of companies and investors considering the ease of doing business when allocating resources across different countries. The study's unique aspect lies in its comprehensive approach, combining innovation, ease of doing business, and competitiveness within a single structural model, which better represents the complex dynamics of the global business environment.

II. LITRETURE REVIEW

The relationship between innovation, ease of doing business, and competitiveness of nations is a complex and interconnected one.

A. Relationship between Innovation and Competitiveness:

Innovation has long been recognized as a crucial driver of both company growth and a nation's wealth creation. Scholars have highlighted the significant impact of innovation improving the competitiveness and productivity of nations. Gordon (2016) found that a country's growth is closely tied to innovation and increased productivity. As a result, governments have made innovation a central focus of their growth strategies, investing in research and development (R&D) and industrial development policies [3-5]. Organizational capabilities, particularly dynamic capabilities, have gained prominence as companies seek to adapt and innovate in rapidly changing markets.

B. Relationship between Innovation and Ease of Doing Business

Innovation and the Ease of Doing Business index, developed by the World Bank, have a profound collective impact on a nation's economy. Business regulations within countries can influence investments in information and communication technology (ICT). When the costs associated with starting and operating a business increase, investments tend to decrease. Effective management systems that promote cohesion within organizations are conducive to fostering creativity and innovation. High group cohesion establishes an organizational structure that nurtures creativity and promotes ease of doing business [6]. Technology plays a crucial role in tackling 21st-century business challenges, with human capital formation, technology transfer, innovation, and learning all being essential. Digital innovations have reshaped commerce, particularly for small and mediumsized enterprises (SMEs) in developing countries, emphasizing the significance of intangible products [7]. Technology diminishes the constraints imposed by regulations, enabling seamless international communication and commerce. As digital innovation continues to evolve, it exerts pressure on existing rules and regulations governing business practices.

C. Relationship between Ease of Doing Business and Competitiveness

The Ease of Doing Business index significantly influences various aspects of a nation's economy, including information sharing, ICT development, and per capita income for citizens. Research has shown that business creation is positively related to the ease of starting a business, while costs associated with starting and maintaining a business can impact investments. The index also plays a crucial role in attracting foreign direct investment (FDI) by influencing factors like business startup procedures, property registration, and access to electricity, and insolvency resolution. Regulatory increased improvements can lead to competitiveness by attracting investment and promoting economic growth [8,9]. Specific improvements, such as energy supply enhancements, anti-corruption measures, tax and favorable investment simplification. policies, have been recommended to enhance the ease of doing business.

D. Development of the Hypothesis

The study's hypothesis is built around the interplay of innovation, ease of doing business, and global competitiveness. Previous research has highlighted the mediating role of the ease of doing business in various contexts, showing its influence within relationships relevant to national development. The proposed model seeks to explore whether the ease of doing business acts as a mediating variable between innovation and competitiveness. Mediation analysis is used to understand how one factor influences another, either directly or through the involvement of a third factor. This study employs a comprehensive approach, drawing from psychological models to examine these intricate relationships.

III. DATA AND METHODOLOGY

A. Data

Data was sourced from the GCR 2020 for indicators related to innovation and global competitiveness and from the Doing Business Report 2020 for the EDB index. These reports covered 65 selected developed¹ and developing² countries.

B. Methodology

The study tested the hypothesis that EDB mediates the relationship between innovation and global competitiveness using mediation analysis. In the context of mediation analysis, we can use mathematical equations to represent the relationships between variables. Here is a mathematical approach to represent the relationships described in the text:

Let:

- *X* represent the level of Innovation.
- *M* represent the Ease of Doing Business (EDB) index.
- *Y* represent the Global Competitiveness.

The hypothesized mediation model can be represented mathematically as follows:

- 1. The direct effect of Innovation (X) on Global Competitiveness (Y) can be represented as: $Y=\beta_1X+c$
- 2. The effect of Innovation (*X*) on EDB (*M*) can be represented as: $M = \beta_2 X + a$

- 3. The effect of EDB (*M*) on Global Competitiveness (*Y*) can be represented as: $Y=\beta_3M+b$
- 4. The total effect of Innovation (*X*) on Global Competitiveness (*Y*) can be represented as the sum of the direct and indirect effects:

 $Y = (\beta_1 + \beta_2 \beta_3) X + (c + \beta_3 a + b)$

5. The mediation effect, which is the indirect effect of Innovation on Global Competitiveness mediated by EDB, is represented as: $Y=\beta_2\beta_3X+\beta_3a$

IV. RESULTS

The results provided in Table I, which provided valuable insights into the relationships among innovation, the Ease of Doing Business (EDB), and global competitiveness. These findings confirmed the initial hypothesis, demonstrating that EDB plays a partial mediating role in the connection between innovation and a nation's global competitiveness.

FABLE I.	SUMMARY OF ESTIMATION RESULTS

Variable	Relationship	Result
Innovation	Impact on EDB	Positive
EDB	Impact on Global Competitiveness	Positive
Innovation to Global Competitiveness (Direct Effect)	Relationship	Positive
Innovation to Global Competitiveness (Mediated by EDB)	Mediating Role	Partial (34.14%)
Explanatory Power (R ₂) with EDB	Model Improvement	Yes
Innovation and EDB Relationship	Consistent with Previous Research	Yes
Innovation and EDB	Bureaucratic Obstacles	Overcoming
Innovation and EDB	Technological Innovations	Enhancing Global Competitiven ess

¹United States, Canada, United Kingdom, Germany, France, Japan, Australia, South Korea, Sweden, Switzerland, Norway, Netherlands, Denmark, Finland, Singapore, New Zealand, Belgium, Austria, Luxembourg, Ireland, Iceland, Israel

²Russia, China, India, South Africa, Mexico, Indonesia, Turkey, Argentina, Thailand, Malaysia, Philippines, Egypt, Nigeria, Pakistan, Bangladesh, Vietnam, Colombia, Peru, Chile, Ukraine, Kazakhstan, Venezuela, Ecuador, Sri Lanka, Kenya, Ghana, Saudi Arabia, Iran, Iraq, UAE, Qatar, Oman, Kuwait, Bahrain, Jordan, Lebanon, Morocco, Tunisia, Algeria, Angola, Ethiopia, Nigeria

Specifically, the research revealed that innovation has a positive impact on EDB, which subsequently has a positive effect on global competitiveness. Remarkably, approximately 34.14% of the influence that innovation exerts on global competitiveness is channeled through EDB. This statistic underscores the substantial role played by EDB in shaping a nation's competitive landscape.

Furthermore, the study's results showed that incorporating EDB as a mediating factor significantly improved the model's explanatory power, as indicated by the coefficient of determination (R2). This implies that by considering the influence of EDB, we gain a more comprehensive understanding of how innovation affects global competitiveness.

The findings also aligned with previous research in this field, further emphasizing that innovation indeed impacts EDB. This seemingly counterintuitive relationship suggests that innovative advancements have the capacity to surmount bureaucratic obstacles. In essence, the study's results highlight the potential for technological innovations to drive improvements in the ease of conducting business within a ultimately enhancing nation. its global competitiveness.

V. CONCLUSION

This study underscores the paramount importance of considering the business environment and the Ease of Doing Business (EDB) score as invaluable tools for guiding policymakers and investors alike. It offers a unique perspective by unveiling the mediating role of EDB between innovation and a nation's competitiveness. Through its rigorous quantitative approach and factor analysis, the study underscores the pressing need for more precise methodologies when quantifying the Ease of Doing Business score. It is noteworthy that the World Bank's acknowledgment of inconsistencies in its score development aligns seamlessly with the study's findings, reinforcing their credibility.

The study's most pivotal discovery centers on EDB's pivotal mediating role, enhancing the positive impact of innovation on a nation's overall competitiveness. This revelation has profound implications, suggesting that fostering a conducive business environment, characterized by a streamlined regulatory framework, can significantly amplify the benefits of innovation for a country's economic landscape. The structural model proposed in this research disrupts conventional wisdom, emphasizing the imperative of adapting legislation and bureaucracy to thrive in our technology-driven world.

Furthermore, the study presents a compelling argument for the practical utility of the EDB score as a guiding compass for governments and regulatory bodies. By tailoring their policies to create business-friendly environments, these entities can facilitate smoother trade both domestically and internationally, thereby fostering economic growth.

In sum, this research offers a valuable contribution to our comprehension of the intricate interplay between innovation, ease of business, and competitiveness. doing It underscores the critical necessity for more accurate measurement methodologies within the Ease of Doing Business index, as these can wield substantial influence over investment decisions and strategies for economic development. Consequently, this study calls for a thoughtful reevaluation of how we assess and enhance business environments on a global scale, with the goal of promoting sustainable economic growth and innovation.

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The Concept and the Role of the Operator in Industry 4.0

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Abstract—The term of Industry 4.0 in the world is differently interpreted. Some of explorers and scientists purport that this term presents forth industrial revolution. At the other hand, some of explorers and scientist purport that this term presents evolution of the computers in manufacturing. Although that this term and its meaning are presented more than ten years, it is obvious that Industry 4.0 presents global project and experiment. The main cause of this project is the global competitiveness and the main problem of this project presents the involving of intelligent industrial manufacturing in the real manufacturing. Of course, this Industry 4.0 project purports many different terms, but in complete other concept and role. One of this term is the operator term. This paper was written to present the operator term in the Industry 4.0, with its concept and role.

Keywords - Operator, Industry 4.0, manufacturing, digitalization

I. INTRODUCTION

One of the main signs of the twenty first century is the Industry 4.0. This industry was created after the Third industry for almost half of the century. The main concept that Industry 4.0 was based was the concept of the smart manufacturing. Many new possibilities enable the design, creation and development of the powerful virtual world by digitalisation. This world would manage with real, physical world in the manufacturing, at the first step. After that, it would manage with other economy parts and elements. All of relevant manufacturing factors should be connected and the communication in real time between them must be enabled. Industry 4.0 purports some new ways of communication and interaction between humans and technologies. The concept and realisation of Industry 4.0 purport the use of many new terms and old terms but with totally new role and purposes, related to many factors and parameters. One of those terms is the operator term.

In the dependence of used technologies, this term was used differently. Also, many new terms and elements caused that operator term gets completely new meaning and new role. For example, augmented reality used by operator causes with augmented operator. This new augmented operator is capable for realisation of new tasks in the sense of decision making. The problems of health and safety at work in the industry are also very interesting for this term and its appliance in the Industry 4.0. It was shown that in the case of different technologies implementation, operator was capable to enable the connection and interaction with cyber physical system. However, its role and functioning present something that early has never been done.

This paper was written to show the concept of operator in Industry 4.0-the operator 4.0., the characteristics of operators 4.0., the connections of principles and operators for Industry 4.0 and used technologies for different operators 4.0 [1].

II. HUMAN COMPONENT IN INDUSTRY 4.0

Generally, Industry 4.0 presents integration of information technologies supported by applications of Internet of things, cloud systems, smart manufacturing, robots and others. Industry 4.0 builds smart factories, where people, machines, robots and other systems

communicating with physical and virtual tools, devices and resources. Industry 4.0 caused many changes in manufacturing with the influence of digitalisation. These changes reflected on manufacturing organisation, processes and human role and work. There are many examples for noted facts, such as robots and virtual reality. They provide great support to the worker in the manufacturing operation, creating new ways of interacting between humans and machines. Related to these interactions, operator has new and different roles, in dependence of used technology. For example, added reality used by operator designs so called augmented operator, which is much more capable in the sense of complex decisions making. Related to humans. concept of Industry 4.0 presents great improvement in the sense of safety at work and health. But it is clear fact that many human jobs and activities will be changed by machines and robots. Of course, Industry 4.0 will also provide new jobs and activities, but will the balance be achieved? Will the unemployment degree be reduced or increased? It is obvious that human concept in the future, related to Industry 4.0 will be complex question with many different questions [2].

III. OPERATORS AND THEIR CHARACTERISTICS

The operator 4.0 can be defined as a person with determined quantities of knowledge and skills needed for work in the technological ambient made by Industry 4.0. Every operator in the large technological field of Industry 4.0 must possesses some characteristics. In the dependence of operator's type and job positions, the operator's characteristics can be different. Here are some important operators 4.0 and their characteristics.

Analytical operator realises analyse of large quantity of data and information in smart manufacturing. They are intended for important information and data providing and events prediction.

Augmented reality operator improves the connection and information transfer between digital and physical world. They can be realised as smart phones, tablets or projectors.

Collaborator operator works directly with operator and realises non-inventive tasks with a high number of repetitions. Healthy operator presents very useful operator. It is intended for monitoring and tracking of different information related for core state, stress, pressure, temperature, patient's location, and many other parameters important for human's health. They can be realised in the form of different devices and applications.

Intelligent operator is intended to propose different solutions made by artificial intelligence. It has a great importance in the operator's communication with computers, databases and other information systems.

Social operator is intended for different tasks related to social networking of different companies and firms. This is the way how to connect the companies and firms with smart manufacturing resources. The realisation is reflected in the social Internet of things which serves to commute the information creating the base for decisions.

High power operator is intended for tasks that depends use of great power for their realisation. They present flexible biomechanical systems realised as moving robots. These robots use moving mechanics to realise tasks that humans could not. Human operator in this case use to manage with tasks and functions that don't need great power or effort.

Virtual operator presents special type of operator. Generally, virtual reality provides digital interpretation of manufacturing environment with all of its parts and their interaction. It is intended for functioning, researching and checking of realised decisions without consequences for humans or environment.

IV. OPERATORS AND PRINCIPLES OF INDUSTRY 4.0

The Industry 4.0 defined base elements of their model. These principles are virtualisation, decentralisation, adaptability and reconfiguration. Related to these principles, some connections between Industry 4.0 principles and operators 4.0 can be realised.

Virtualisation purports use of so-called digital twins. All of information from real world are implemented into cyber-physical models. The realisation is carried out with virtual operators.

Decentralisation purports distributive approach. This means that system can be

consisted from smaller parts-elements. These parts-elements can operate independently. It is very important for simple and effective designing, coordination and reliability. The realisation is carried out with smart manufacturing operators.

Adaptability purports the characteristics of modern manufacturing system to adapt to occurring changes. These changes present wide palette of different technical, ambient, social and other changes.

Reconfiguration purports possibilities of modern manufacturing systems but also and other systems to change functioning, location, role, connections and lot of other parameters of their parts-elements in order of resumption, permanence and optimisation of manufacturing. There are possibilities for combination of more sub systems in one unique system and vice versa, in the dependence of needs. The realisation is carried out with configuration operators, analytical operators and communication operators.

The presented model of operator 4.0 has a very important task. This task is reflected in the creation of human cyber physical manufacturing systems. These systems will significantly improve potentials of the operators. One form of noted systems is presented on Fig. 1 as a human cyber physical manufacturing form of digital manufacturing. A human cyber physical manufacturing form of digital manufacturing presented on Fig. 1 clearly shows two important parts, industrial Internet and cloud platform that connect and integrate other systems (cyber, physical, operator etc.). This example presented main task of digital networking the manufacturing and that is realisation of connections, processes, information, operators and others through networks and reconfiguration of manufacturing in the arrays of values. Of course, all of information, activities, functioning and processes related to operator must be supervised in the real time [2-6].

V. OPERATOR 4.0 WITH USED TECHNOLOGIES AND FEEDBACK

Different technologies have a crucial importance for functioning of operators 4.0. These technologies provide feedback information without noted operators 4.0 could not function at all. Here are some examples for used technologies from the operators and provided feedback.

Used technologies for analytical operators could be some smart device, such as smart phone, smart tablet, laptop, smart glasses or similar. In the analyse of large quantity of information, noted technologies provide determiner warnings or reports that demand certain action.

Used technologies for augmented reality operator could be smart glasses. This technology can provide very important information related to manufacturing phases, safety and similar.



Used technologies for collaborator operator could be a great number of smart devices, such as smart glasses, smart phone, smart watch, personal display, tablet and similar devices. These devices should provide information about technical problems and appropriate interaction in the work ambient of collaborator operator.

Used technologies for healthy operator also could be devices for the previous operator: smart glasses, smart phone, smart watch, personal display, tablet and similar devices. The role of this devices for this operator is in the measurement of different physiological parameters. Related to these information and parameters, certain actions can be realised, such as pause, change of activities, influences on ambient conditions. potential medical examination and similar.

Used technologies for intelligent operator also could be devices for the previous operator: smart glasses, smart phone, smart watch, personal display, tablet and similar devices. These devices enable detail event reports, answers on determined questions, reports about processes etc.

Used technologies for social operator also could be devices for the previous operator: smart glasses, smart phone, smart watch, personal display, tablet and similar devices. There are lot of known examples for these devices in the service of social operator such as social manufacturing, Internet products presentation etc. They also provide information about processes, manufacturing, manufacturing phases, technical information and reports, urgent actions etc.

Used technologies for high power operator could be devices such as: smart voice warning devices, smart gloves, special exoskeleton robot, smart glasses, smart phone, smart watch, personal display, tablet and similar devices. These devices provide many information for navigation, purposes such as aiming, calculation. management, safety risk management etc. Thanks to these devices, many feedback information is provided, such as critical functions, danger indicators, optimal routes, aim realisations etc., information about robot pars in the form of arm or hand etc.

Used technologies for virtual operator could be devices such as smart dress or smart gloves. These devices have a great role in the form and design of virtual prototype and its testing in



virtual space, virtual ambient and virtual conditions. Great quantity of feedback information has a great importance in real world, in real manufacturing and real prototypes. Used technologies by operator 4.0 are presented on Fig. 2 [2,7].

VI. CONCLUSION

Smart manufacturing based on Industry 4.0 model presents reality that is increasingly One of the greatest benefits in applied. Industry 4.0 is the time saving. Related to the realised researches, time saving reflected in the training and learning of new workers (50%), processes control and inspection (more than 30 %) etc. Work task are realised much faster and more precisely. The quality and reliability of critical parts and elements in manufacturing (aviation and chemical industry for example) are significantly increased. The appliances of Industry 4.0 showed increased efficiency, errors elimination, reduction of costs, better support and conditions for employees, better communication, significantly reduction of delivery time, significantly increased safety at work etc [2,8].

Operators in Industry 4.0 present new term with new roles in the comparation with the same term in previous industries. These operators, called operators 4.0 have completely new system of work, functioning, communication and collaboration. Smart manufacturing cannot be realised and improved without smart operators with new properties and potentials [2,9].

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Application of Porter's Models in the Analysis of Strategic Competitive Positioning in the Rakija Market in Serbia

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Abstract-Rakija, which is recently included in the UNESCO World Heritage List, widely is recognized as a national Serbian strong alcoholic beverage. Despite 600 of registered distilleries, the rakija industry in Serbia is not financially lucrative and only a limited number of brands are available in the market. Research show that Serbian distillers believe they have quality products but they struggle to sell them and their high expectations of future market opportunities are quite unrealistic. Moreover, only 4% of distillers in the Serbian rakija industry have effectively mastered marketing in their businesses. Author applied the Porter's outside-in models, as Five Forces and Value Chain. It is evident that competition in the rakija market is very vivid, since four of five forces have a significant impact on the competition and market position of individual distilleries. In comparison of to rakija producer, the direct competitor Rubin's vinjak has a much stronger market position with 3 million liters and a very competitive price, which is below 1000 dinars. The crucial flaw of rakija producers is their inability to enter into wholesale. Without market recognition due to poor marketing, and with small quantities, questionable quality, and excessively high prices, entry into wholesale is an impossible mission for many rakija distillers. Rakija distillers should follow the example of vinjak by producing large quantities, offering competitive pricing comparable to that of vinjak. the conducted Based on analyses, the recommended Porter's generic strategy for rakija distilleries would be focus cost leadership on the domestic market.

Keywords – Rakija, positioning, forecasting, Serbia

I. INTRODUCTION

The present paper aims to analyze the rakija market through the application of Porter's strategic models, with the objective of generating feasible strategies that are appropriate for rakija distillers. Following an introduction, the current state of the rakija market is presented based on recent research conducted among rakija distillers. Subsequently, the outside-in strategic models of Five Forces and Value Chain are presented. The central section of the paper is dedicated to the analysis of strategic competitive positioning in the rakija market in Serbia. Finally, the paper concludes by outlining feasible development strategies that can be employed to advance in the rakija market.

II. CURRENT OUTLOOK OF THE RAKIJA MARKET IN SERBIA

Rakija, also known as rakia or schnapps, is a spirit-based beverage that holds significant cultural and traditional value in Serbia [1]. Particularly, šljivovica (also known as slivovitz), a plum spirit or plum brandy, is widely recognized as a national Serbian beverage. However, other types of fruit spirits are also commonly distilled. Recently, the UNESCO World Heritage List expanded to include Serbian plum rakija šljivovica. This traditional plum brandy was recognized as intangible cultural heritage by UNESCO under the name "Social practices and knowledge related to the production and use of traditional plum brandy – šljivovica" at the end of 2022 [2].

Over 600 producers are officially registered [3] and 2,823 tons of spirits worth \$14.5 million are exported, but the value of imports of strong alcoholic beverages In Serbia is higher than the value of exports [4]. Despite the presence of 600 officially recognized distilleries and a multitude of pot stills operated by small-scale producers, the rakija industry in Serbia is not financially lucrative. It is worth noting that only a limited number of brands are available in the market, despite the hundreds of registered distilleries. For Serbian distillers, branding is primarily viewed as a legal requirement and is typically limited to the registration of the product name. In contemporary consumer culture, individuals heavily rely on brand names to identify products that align with their preferences [5]. Brands serve as a guarantee of origin, quality, and overall satisfaction [6]. Consequently, effective branding is crucial for ensuring the long-term success of any business.

Approximately 50 million liters of rakija are estimated to be produced in Serbia, with around 80% of the market operating illegally [7]. The poor market position of rakija producers can be attributed to the prevailing attitude of "I do the same as my grandfather," who primarily consumed rakija himself and shared it with friends. In contrast to contemporary producers, the grandfathers distilled rakija from superior plum varieties without the use of sugar, relying solely on fruit [8]. Present-day producers, however, are unable to surpass the quality of their grandfathers' rakija and often produce products that have little demand. Despite Serbia's status as one of the top five plum producers globally, the export of plums and plum products remains insignificant [9]. Consequently, the areas dedicated to plum cultivation in Serbia have been decreasing [10].

The alcoholic beverage sector has experienced notable transformations over the past four decades [11]. From 1970 to 1997, beer emerged as the most popular beverage, primarily driven by the preferences of young individuals. However, in the late 1990s, there was a shift in young people's beverage preferences, leading to a decline in beer consumption and a surge in the distilled spirits business. This change can be attributed to innovative youth marketing strategies within the distilled spirits industry. The alcoholic beverage market is considered mature and consolidated [12]. In a consolidated market dominated by major players, Serbian spirits producers have the potential to establish a strong brand identity at both the wholesale and retail levels by adopting a niche marketing strategy.

A pioneer study [8] that examined the Serbian rakija market (in comparison to the larger whiskey market), highlighting the lack of consumer knowledge among rakija producers and their limited understanding of successful marketing strategies for different tastes and types of rakija. Additionally, the study identifies a significant gap in understanding the business processes necessary for rakija production to thrive as a successful enterprise in recent decades. The primary issue in rakija distribution is attributed to the establishment of unrealistically high prices that surpass consumers' purchasing power, stemming from an unrealistic and unsubstantiated belief that rakija equivalent to top-tier strong alcoholic is beverages. To gain a competitive advantage in the market, it is evident that only two elements of the marketing mix can be effectively utilized: product and price. These two elements are prioritized in this text. Therefore, it is crucial to offer a superior and high-quality product at a more affordable price, catering to consumer preferences. Prior to defining the marketing mix, preliminary steps in marketing, such as market research and consumer research, must be undertaken. These steps aim to develop a marketing strategy that identifies specific market opportunities and segments to be targeted, as well as the intended consumer base. A comprehensive understanding of the target audience, including specific demographics such as retirees, women, students, or other groups, is essential for effective marketing efforts.

Two interesting quantitative surveys on rakija are published in 2023 [13,14]. The research was conducted online in October 2021, involving a sample of 104 professional and hobbyist rakija distillers. In the first study [13], rakija distillers rated their own product highly, giving it an average rating of around 8 out of 10. However, they expressed dissatisfaction with the market conditions, giving it a low rating of 2.7 out of 7. This concern arisen from the understanding that a good product should possess a strong market position. While we will not delve into the debate surrounding the potentially inflated quality rating, it is evident that conducting business in the highly competitive beverage alcoholic industry necessitates

effective marketing strategies. The lack of enthusiasm among rakija producers for future market success is justified, as they have not embraced the importance of marketing (scoring it 4.2 out of 7 points). To establish a favorable market position, a product must exhibit high quality. Unfortunately, the conventional methods employed by distillers to produce rakija do not guarantee the desired level of quality. The creation of a quality product requires the implementation of branding strategies. While distillers believe they have quality products, they struggle to sell them, and their high expectations of future market opportunities are unrealistic. Furthermore, the existing business practices and outdated production methods may further obscure their future prospects.

produce The 104 distillers 1,069.40 hectoliters of rakija annually with an average strength of 44.25%, and of this amount, twofifths or 434.50 hl are sold at an average price of 950.78 dinars [13]. A typical small-scale Serbian distillery for rakija production is owned by an individual in their forties, lacking a university degree. These distilleries are modest in size, with a capacity of 100 liters, often placed in meadows or under eaves due to the absence of dedicated facilities. The distillers utilize their own fruit, predominantly plums, and work independently as rakija production is their hobby. While their primary goal is to produce enough rakija for personal consumption and visitors, they also aim to sell their product. The resulting rakija is typically strong, with an alcohol content of nearly 45%. This high strength helps mask any shortcomings in the rakija, which may arise from various factors, primarily the poor quality of the fruit. Even if these producers manage to sell their rakija, they often fail to fulfill their obligations to the state and engage in unfair competition with registered distilleries.

The primary finding of the second rakija study [14] reveals that a mere 4% of distillers in the Serbian rakija industry have effectively mastered marketing strategies by employing all four elements of the marketing mix in their business operations. These distillers have also achieved notably higher prices for their products. Evidently, Serbian rakija distillers lack clarity regarding their target market and the potential consumers who would be interested in purchasing their products. The most significant findings pertain to the application of scientific principles in rakija production, particularly the utilization of oenological agents. Approximately 23% of distillers oppose the use of such agents, do not engage in any anaerobic 64% fermentation of the ferment, 43% consistently or occasionally employ sugar, and 45% consistently or occasionally add water to the ferment. Only 27 out of 104 distillers adhere to modern and scientifically accepted processes in rakija production. Modernist were able to attain an average selling price of 1,000 dinars, whereas those who adhere to traditional methods of oenology, with a mindset of "I will work the way my grandfather did," only achieved an average price of 600 dinars. Consumers are cognizant of the difference in taste and exhibit a preference for rakija produced through oenological means, as evidenced by their willingness to pay a significantly higher price for it. This study confirms the hypothesis that Serbian rakija, when appropriately distributed and promoted, can command a higher price. The title of this research highlights the issue of marketing myopia among Serbian rakija distillers. Only four out of 104 respondents utilized all aspects of the marketing mix, and these respondents are currently achieving above-average pricing and likely experiencing favorable business outcomes. The remaining 100 distillers appear to have failed to comprehend marketing principles. It is reasonable to assume that the lack of marketing knowledge is linked to the almost imperceptible business results of fruit products that are ideal for distillation in a country with a high number of fruit plantations, such as plums.

Interestingly, the best-selling spirit brand in Serbia is not rakija, but a domestically produced brandy similar to cognac known as vinjak [14]. This brand is manufactured by the former stateowned company Rubin, which has successfully navigated the transitional period. Rubin's brandy boasts annual sales of 3 million liters [15]. When Serbians opt not to consume beer or wine, their choices typically narrow down to rakija or vinjak. Even the most affordable whiskey available in the market is more than twice as expensive as vinjak. Vinjak and rakija can serve as interchangeable substitutes for one another; in the absence of one, it can easily be replaced with the other. Both beverages are typically consumed from the same glass and are commonly used as a pre-meal aperitif. According to official statistics from the Statistical Office of the Republic of Serbia [16], the average retail price of vinjak is 937.35 dinars, while the average price of rakija in Serbian retail stores is 667.57 dinars. It is worth noting that the market is predominantly

saturated with industrial rakija, which is produced using ethanol and artificial flavors rather than fruit. In order for high-quality fruit rakija, produced using rigorous oenological techniques, to be sold in stores, they must be competitively priced and comparable to vinjak. An equilibrium price of approximately 1,000 dinars would be ideal [8]. This price point serves as both a reference price and a psychological limit for Serbian customers, with an approximate exchange rate of 117 dinars per euro, equating to around 8.5 euros.

The alcoholic beverage market is characterized by intense competition, with numerous brands of spirits and substitutes vying for consumer attention. Without effective marketing and communication with the market, even the highest quality product can go unnoticed. The existing production and business methods employed by distilleries do not align with the market's future vision or the high expectations placed upon it. With current business approaches and outdated production techniques, the future of distilleries appears bleak, potentially worse than the present situation.

III. PORTER'S OUTSIDE-IN STRATEGIC MODELS

Michael E. Porter is a distinguished author who has made an immeasurable scientific contribution to the field of strategic management. Porter is the leading author of the outside-in approach, as evidenced by his most influential works such as Porter [17, 18]. This approach emphasizes the strategic environmental analysis framework. which helps businesses to understand how to fit successfully into the competitive market. For Porter, the environment or industry takes precedence. He developed the Five Competitive Forces model [17] and the Value Chain model [18], which is a tool that helps to understand the linkages and interactions of a firm's activities and processes in a given environment. competitive The outside-in approach emphasizes strategy strategic environmental analysis and positioning, with the main outcome being the fit in the competitive arena [19]. Since long-lasting profitability is difficult to achieve, finding the fit is the most important strategic activity.

Porter's Five Forces Model [17] is a strategic market analysis tool that is specifically designed to evaluate the impact of the industry on a company's competitiveness, and its fundamental principle is based on a clear understanding of the forces within the business environment that influence a company's profitability. The Five Forces Model identifies five key forces that affect a company's competitiveness. The first force is the threat of new entrants, which reduces prices and profits. Existing companies in the industry must create barriers to entry for others, using their profit reserves. The second force is the threat of substitute products, which refers to the introduction of substitutes that can replace the current product. The third force is the bargaining power of buyers, which depends on several factors such as the number of buyers, their level of information, profitability, etc. If buyers are few in number, they will have significant bargaining power. The fourth force is the bargaining power of suppliers, which increases if there is a small number of suppliers or excessive dependence on one supplier. The fifth force is existing competition, which requires additional marketing resources or price reductions compared to competitors.

A high intensity of any force poses a threat to the company, as it will reduce its profits, while a low intensity of any force presents an opportunity for the company to increase its profit. The comprehensive analysis of all constituent elements and sub-elements of the model leads to the determination of the competitive strength of a particular industry market. To effectively navigate these forces, a firm must select from three proven generic strategies to surpass its competitors within the industry: overall cost leadership, differentiation, and focus [17].

Porter deepen his outside-in approach and introduces the value chain [18]. The value chain is a systematic way of analyzing all the activities performed by a firm. It is not merely a list of activities, but rather a depiction of how these activities interact with one another, such as supplier, channel, and customer activities, in order to achieve a competitive advantage. The value chain is a systematic approach to considering all activities that a company performs. Porter categorizes all activities into primary and support activities. It is not just a list of activities, but also an examination of how these activities interact with the activities of other participants in the value chain system, i.e., suppliers, intermediaries, and customers, in order to achieve competitive advantage. The value chain is a valid tool for analyzing a company's competitiveness only if all links in the

competitive environment of the respective company. It is important to emphasize that value chain analysis is a powerful tool for competitive analysis only if it encompasses linkages throughout the entire competitive environment of the firm, i.e., the system chain.

IV. STRATEGIC COMPETITIVE POSITIONING IN THE RAKIJA MARKET IN SERBIA

Competition in the rakija market is highly present. Of the five forces, four have a significant impact on the competition and market position of individual distilleries (Fig.1). As distilleries predominantly use their own fruit for rakija production, and as fruit is not a rare resource in the domestic agricultural market and can easily be obtained from a large number of growers, we assess the bargaining power of suppliers as low. Therefore, it has no influence on the strength of competition in this industry, and we mark it with a minus sign.

It is very easy to enter the market for the production of strong alcoholic beverages, as a large capital is not required for entry and there are no barriers from the state. This force has a positive impact on the state of competition in this industry. There is also a pronounced rivalry among existing companies in the industry. There is a large number of registered and even more unregistered and unregulated distilleries in the market. Therefore, we see this force as having a strong positive impact on positioning in the industry and we will mark it, like other similar forces, with a plus sign.

There is a huge number of products on the market that are substitutes for rakija. These are not only other strong alcoholic beverages, such as vinjak, whiskey, cognac, vodka, and the like, but also other alcoholic beverages - beer, wine, liqueurs, etc. If a consumer wants to buy an alcoholic beverage for the effect of alcohol, rather than taste and aroma, they will reach for



Finally, if consumers were to directly approach distilleries to purchase rakija, as distillers seem to desire due to the almost nonexistent marketing efforts directed towards consumers, this force would not be significant. However, this is not the case, as consumers purchase rakija either in stores or in pubs, and the presence of rakija brands is not sufficiently pronounced, as a large number of small, almost insignificant distilleries lack the business power to break through to the shelves of stores and pubs. Value and system chain analysis (Fig. 2) reveals why bayer power has such a strong positive impact on the poor position of a large number of rakija distilleries in the Serbian market. Namely, in order to reach consumers, producers of national alcoholic beverages must be present in retail. They are not only poorly represented in retail, but they lack a prerequisite, which is entry into wholesale. Wholesalers demand quantities, and small. almost insignificant brands with weak financial capabilities are not of interest to them. Without market recognition due to poor marketing, and with small quantities, questionable quality, and excessively high prices, entry into wholesale is an impossible mission for many rakija distillers.

What is the situation with vinjak, whose business practices rakija distilleries should emulate? Its market situation is very stable (Fig. 3). It is highly represented in both wholesale and retail, and is almost the only producer of cognac clones in the domestic





market, due to the economies of scale achieved by the vinjak producer and high capital investments, it does not expect the entry of new competitors. Similarly to rakija distilleries, suppliers do not have a significant influence on competition in the vinjak market. The only force that can disrupt the competitive position of vinjak is the influence of substitutes, but among those substitutes, rakija is certainly not yet included.

Porter's models not only reveal the current situation in the market for strong alcoholic beverages, but also provide recommendations for how a particular brand of rakija can establish a strong position in this market. Specifically, the brand should follow the example of vinjak by producing large quantities, offering competitive pricing comparable to that of vinjak, and implementing innovative marketing strategies. These fundamental assumptions are necessary for any serious attempt to enter and succeed in spirits market.

V. CONCLUSION

Currently, the alcoholic beverage industry comprises numerous registered distilleries and a significant number of small-scale producers. In the event of market consolidation, it is worth considering the potential implications for domestic alcoholic beverages. Under such circumstances. unregistered small-scale producers may encounter various challenges. However, this consolidation could prove advantageous for the economy, as these producers may opt to sell their distilleries. If they make prudent decisions, large-scale producers may seize the opportunity to acquire these distilleries, thereby reducing market production. The proceeds obtained from these transactions, as well as the time saved, could be redirected towards ventures that are more profitable. Many individuals may not be inclined to engage in the laborious process of distillation when they can

conveniently purchase high-quality spirits from retail stores. Consequently, the resources currently tied up in these distilleries represent a pure economic loss and hinder the well-being of their owners, as they fail to guarantee or generate revenue.

Living within a highly collectivist system often fosters a lack of individual initiative and an expectation of state assistance. However, it is essential to recognize that such assistance is neither a historical nor a contemporary reality capitalist societies. States within and governments do not engage in business activities, as evidenced by the failure of the communist experiment. Our current system does not support such endeavors due to the inherent inefficiency of state management. Economic principles dictate that private property ownership is far more efficient. Moreover, the quality of our bureaucracy and the questionable means by which certain tycoons have obtained their positions further underscore the limitations of relying on the state. Therefore, it is imperative to abandon any expectations of state intervention and instead take personal initiative to achieve desired outcomes.

Based on our conducted analyses, the recommended Porter's generic strategy for rakija distilleries would be cost leadership with a focus on the domestic market (focus cost leadership). To facilitate a more expeditious transition towards growth and development, there are two potential approaches: either an individual enterprise can initiate this process independently, or multiple enterprises can collaborate and commence the journey together. In the latter case, it is anticipated that over time, one entity will acquire the others and fulfill their financial obligations. However, it is crucial to emphasize the importance of initiating this collaboration promptly.

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Right to Privacy *vis a vis* **Cyber Space: Social Perception and Legal Protection**

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Abstract—Since the beginning of human civilization, there has been always motivation and the need to progress. This has led to tremendous progress and development. Among all the progress made by mankind till now, information technology is the most significant one. It has the immense power of information and communication. This technology relating to the computer system, their hardware, software, network, internet and various application running over it, is broadly referred to as information technology. This communication takes place in a virtual medium called cyberspace. The development of information technology heralds a new era of the information revolution. Through which information exchange has become possible on a large scale. There have been fundamental changes in the human lifestyle. Most of the works related to human life is dependent on information technology and now imagining life without technology seems impossible. This paper is an attempt to to analyze the conceptual basis of Cyber space with special reference to cybercrime over the past couple of decades, including its changing nature, prevalence, and its impact. Additionally, this paper also assess the adequacy and effectiveness of current cyber laws in addressing emerging cyber threats while safeguarding the Protection of Idea under the right to privacy of individuals and entities.

Keywords - Cyber space; cyber crime; communication; technology; right to privacy

I. INTRODUCTION

Information technology has knocked in almost every human-related activity. Misuse of Information technology by anti-social elements is a major problem associated with it. Computer, computer system and computer network provide new sophisticated tools to carry out traditional crimes. Hence, computer and networks can be both tools and target of crime. The emergence of this type of crime related to Information and telecommunication is related to the development of the computer, computer network and information technology revolution. Cybercrime is a generic term that covers the entire range of crime that involves a computer or computer network either as a target or as an instrumentality or associate. Any criminal activity that takes place in so-called cyberspace comes under the preview of the term. Cybercrime is a serious threat to civil society, as this is a dark chapter in the development of the information revolution. Cyber hacking, cyber pornography, cyber defamation, money laundering and cyber fraud are very common cybercrimes, their frequency and consequential damages are widespread. The crime committed in the terrestrial world affect that particular area, but the crime committed in cyberspace can have a more widespread effect [1].

II. CONCEPTUAL ANALYSIS

In a common parlance a computer crime or cybercrime is defined as any illegal act requiring knowledge of computer technology for its preparation, investigation or prosecution. It has two main categories. In the very first the computer is a tool of a crime, such as fraud, embezzlement, theft of property, or issued to plan or manages a crime. In the second, the computer is the object of the crime, such as sabotage, theft or alteration of stored data, or theft of its services [2]. Further, it is defined as the act of crating, distributing, altering, stealing, misusing, and destroying information through computer manipulation of cyber space without use of physical force and against the will and interests of victims [3]. Black's Law Dictionary defines Computer Crime as a crime requiring knowledge of computer technology such as sabotaging or stealing computer to commit some other crime [4]. A generalized definition of cybercrime may be "Unlawful acts wherein the computer is either a tool or target or both". Further in another definition "Computer Crime or cybercrime is any illegal behaviour directed by means of electronic operations that target the security of computer system and data processed by them.

Privacy has been derived from the Latin word PRIVATUS which means "separated from the rest" [5]. Privacy refers to the fundamental right of individuals to control their personal information, maintain their personal space, and limit unwanted intrusion into their lives. It encompasses a range of aspects, from data protection and confidentiality to personal boundaries and autonomy. Privacy is a crucial concept in modern society, shaping laws, ethics, and the way we interact with technology. At its core, privacy is about the ability to decide what information about ourselves we want to share and with whom. It involves protecting sensitive personal data such as our medical records, financial information, and communication history from unauthorized access or disclosure. Privacy also extends to the physical realm, where individuals have the right to be free from unwarranted surveillance or intrusion into their homes and personal spaces.

Thus, to know the concept of cybercrime and it's real presence, there are several points of view. Some claim that the first abacus, which was the precursor to the computer, was created at the same time as of computer since people had been abusing calculators for centuries. In fact, the history of cybercrime began with hackers who sought to access networks with high levels of security for the sheer fun of it, or to obtain sensitive or secure information or any secret for personal gain or retaliation. The brief historical development of computer-related crime and computer networks is discussed as under

On the other hand it is very difficult to determine when the first crime involving a computer actually occurred, because gathering of information and mechanical cryptographic system can be traced more than 5.000 years before. Often, early computer crimes involved the subversion of the long distance telephone networks and the physical damages to computer systems [6]. In 1900 B.C. the encryption and decryption system of information was in existence which was used by an Egyptian [7].

In the emergent world the cyber criminals basically use this space for committing financial crimes. In simple words to commit these type of crime they only need computer connected with the internet and the scope of committing crime is limitless. They use their skills to steal, trick, and take advantage of people because it's easy for them to make money without the need to do honest work. Crimes of the past are not at all like crimes of today. These crimes can be done without the criminals being there. The following is a short recent time of cybercrimes that involve computers and computer networks:

It is important to know the concept of the term, privacy for finding out its origin and need for its protection. There is no clarity regarding the meaning of privacy. It starts with the relationship of the person with the society. In this way, its roots can be searched in philosophy and sociology also. Historical use of the term is not uniform and lacks clarity of meaning and scope. Discussion on privacy is as old as mankind. In 1891, the American lawyers Samuel Warren and Louis Brandeis described the right to privacy in a famous article: it is the right to be let alone. In 1967 a new milestone was reached with the publication of Alan Westin's Privacy and Freedom when he defined privacy in terms of self-determination: privacy is the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others [8]. Privacy is often synonymously mentioned with two other terms like secrecy and confidentiality [9]. But secrecy is outer layer of privacy. According to Posner, 'secrecy is ability to control dissemination and use of information by oneself.' Facts of the meeting with the minister are secret and need not be private. Some facts about a person can be called 'secret', e.g. his tastes regarding foods which his culture or religion does not permit, but for the person the declaration of the fact to society is losing his reputation in the society. That fact is not privacy in full sense for the person but only an aspect to his privacy [10]. "Privacy implies legitimate denial of access, while secrecy implies that denial of access which is illegitimate" [11].

This access is of strangers to the person. As Barrington Mooreaptly defined, 'without public nothing can be private'. "People are more likely to seek escape from watchful eye of strangers

than intimates. Escape from the watchful eye of intimates is more often solitude, isolation or loneliness perhaps but not privacy" [12]. Most often, however, what we do not revel to intimates are secrets. "Escape from the scrutiny of strangers, is however, privacy" [13]. For confidentiality and privacy, the difference is explained aptly by The Belmont Report prepared by National Commission for the Protection of Human Subjects explained it in its report regarding human subjects in Bio-medical and Behavioural research' as "confidentiality is relating to an information that an individual has disclosed in a relationship of trust and with expectation that it will not be disclosed to others without permission. Therefore, in this sense, it is extension of privacy. Privacy is about people and confidentiality is about treatment to information or data" [14].

III. DEVELOPMENT OF THE CONCEPT OF RIGHT TO PRIVACY

The idea of privacy is as old as the history of mankind itself. Privacy was first used to define the possession and through possession the control over the material objects. It had started with the "land", which was the first possession of the person. After emergence of agriculturist society from the stage of wandering for food and shelter, man came into possession of land which was essential for self-reliance and selfacclamation. Locke (1689) in his "Second Treaties of the Government" explains "every man has a property in his own person this is something that nobody else has any right to the labour of his body and work of his hands, we may say, are strictly his. So, when he takes something from the state that nature has provided and left it in, he mixes his labour with it, thus joining to it something that is his own, and in that way, he makes it his property" [15]. Unlike western society, which puts impetus on "Individualism", the Indian society promotes interdependence and co-operation with the family. Indians do not have the same type of definition of Privacy as perceived by Americans or Europeans. Privacy is the notion which was more or less absent from the Indian society. People felt very weird in demanding the privacy in their personal and social life. In personal life due to the social culture which is highly dependent upon the agriculture, help of persons in the peer and neighbourhood was a precondition for smooth working. Every person and his family are connected to every person in the village, which was the smallest unit in society. Many villages

contained less than 25 to 30 houses which were huts. To lessen the dependency on the peers and to get the pecuniary support also there was evolution of joint family system. Majority of people live in hutments and they are so near to each other that right to privacy is unthinkable or impracticable.

While considering subsequent the development, since 14th to 18th Century people went to court for eavesdropping or for opening or reading of personnel letters. In 16th and 17th Century, there was development of the concept "sovereignty" and modern state. In this period, demarcation of public and private realms was nearly complete. There was increase in public realm. In public realm, duties of the State, regulation of social and economic behaviour of citizens were the elements present. For liberalism division of public and private sphere is essential. In 19th Century, there were separate parts between Public law (Constitutional law, Criminal Law, and regulatory law) and law of private transactions (Torts Contract, Property and commercial Law). If we follow this distinction, then we come to the inevitable conclusion that the privacy was related to property and personality of person. This personality consists some inner things like freedom, liberty in its core. With freedom and liberty, autonomy of will is achieved. Individual personality and identity are based on these core values which is the most intimate part of each one. This core is unique and based on privacy and flourished with the privacy.

IV. GLIMPSES OF INTERNATIONAL DEVELOPMENT

To have the glimpses of the International Development it is worthwhile to mention here that in colonial England, protection of right was not available under the term "privacy". Flaharty explained "religious beliefs and primitive physical conditions maintained the system of moral surveillance over the behaviour. But construction of more scattered and developed structures for residence, larger settlements, general waning of authority and control of family members contributed for more personal privacy by eighteenth century. There were only few instances of balancing the interests of privacy such as privacy of letters [16]. Frankly speaking, under English law there were no direct provisions for the protection of privacy in the Constitution or other laws. Right to privacy starts in English law with the concept of his right to

enjoy the property. As laws were not enacted for protection of privacy in earlier times, the protection of this right was sought through courts under the principles of Torts. The Right to Privacy and the power of the State to interfere-by search, seizure, interception in any way- have been the debate in almost every democratic country where fundamental freedoms are guaranteed. This takes us back to the case of Semayne (1603), where it was laid down that "Every man's house is his castle" [17]. But no general right to privacy was existed in England. Partial protection is existed through Torts remedies like trespass, defamation and breach of confidence. The latter two were dealing with the exposing or disclosing the personal information.

Like all other civilizations, privacy was first associated with the possession and ownership of property in USA. Government's power to search the property i.e. houses or business places and seizure of any offensive material without any restriction ignited the protest among people. In 1776 John Adams wrote that it had been the British right to search the houses without justification that sparked the fight for independence [18]. The state of privacy in early American society was elaborated by David Seipp [19]. He explained the development of concept considering the two situations. He had stated about the breach of privacy in respect of information regarding persons. In early America, two types of people, eavesdroppers and gossipmongers, these were considered as privacy breakers. These people try to get the information about people, to which they were not concerned. Because of them, the information privacy of people was compromised. They were punished through courts [19]

So far as Indian Sub continental is concerned the development of the right to privacy in modern era of India, still there are no direct reference in the Constitution of India. Moreover, the reference of right to privacy could not be found in any other law, though, implicit reference to this has been found and protected under civil law and the Penal Code, the Evidence Act and under the Constitution [20]. The Supreme Court has, in recent decisions, developed various rights, interests similar to privacy, i.e., right of free enjoyment, right to sleep, right to human dignity, right to justice etc, under the concept of personal liberty in article 21 of the Constitution [21]. The Indian Supreme Court, for the first time, considered the right to privacy in Kharak Singhvs. State of UP [22]; which was a case on

police surveillance and domestic visit at night by police personal. In Govind's case [23] the court established that the right to privacy is a fundamental right. As a source of this right, like early cases in U.S.A, the Court found the fundamental right to privacy as emanation from Article 19 and 21 [24]. However, Govind 's case firmly laid it down that Article 21 protects the right to privacy and promotes the dignity of the individual. Separate right to privacy should be developed through the process of case by case development [24].

V. CYBER SPACE VIS-A-VIS RIGHT TO PRIVACY

To deal with the term 'right to privacy' which got its acknowledgement under Article 21 of the Constitution could be taken to mean an individual's right to be free from intrusion or interference by others. The term, Cyber space as per above explanation is a non-physical terrain created by computers [25]. Most often, in recent times, majority of the people (also referred to as "netizens") have been increasingly making use of the cyber space to seclude themselves from their social circle. There is a general belief that these people are private and want to secure their privacy. In reality, it turns out that there is a serious threat of infringement of privacy of an individual in the cyber space.

However, it is to be noted that every act of infringement of privacy is not a cybercrime. irrespective of Therefore, the existing acknowledged offences, there is need for awareness about the privacy rights of an individual which are subject to infringement in the cyber space. The most common form of intruding privacy of an individual in cyber space is called spamming. All of us using the internet are always pleased with the capability of the web browser to remember the sites we have visited. Majority of us are unaware of the fact that each and every page we visit on the internet is tracked. In the internet browser, there is an option for use of an incognito window. The same is also called private browsing. It is observed that the Indian approach towards the right to privacy in shaping to cyber security and cybercrime is also evolving fast as the Data Protection Law is also coming very soon. In other words as the technology continues to advance at an unprecedented pace, the right to privacy has become more relevant than ever, as it forms the cornerstone for protecting individuals from unwarranted intrusion and misuse of their personal

information. India has come a long way in addressing cybercrimes and upholding the right to privacy, the journey is far from over. Constant vigilance, legislative refinement, and public awareness will remain essential elements in the ongoing battle against cyber threats while safeguarding the privacy and dignity of individuals in the digital age.

There is a great need for the specialized cybercrime courts and the training of judges and legal professionals to effectively handle cybercrime cases. It also examines the role of international cooperation and mutual legal assistance in addressing cybercrimes that transcend national boundaries. By shedding light on the significant role of the judiciary in the realm of cybercrime, there is a great need to highlight the importance of a robust legal system and the continuous adaptation of laws to combat the ever-changing landscape of cvber threats [26]. The advent of the digital era has transformed the way people interact, conduct business, and access information. While the internet has brought numerous benefits, it has also created new opportunities for criminal activities. Cybercrimes not only pose threats to individuals and businesses but also have serious implications for national security and global stability. The role of the judiciary in combating cybercrimes has become indispensable in safeguarding society and upholding the principles of justice. Judiciary is being acknowledged now a day to protect the right to against the cybercrimes privacy while interpreting the existing laws to address digital offenses effectively. Imperative to mention here that traditional legal processes and procedures may not always sufficient to address the intricacies of cybercrimes, which often transcend geographical boundaries and involve complex digital evidence. Judges may need specialized knowledge and training to understand the technical aspects of cybercrimes and evaluate digital evidence adequately. To tackle these challenges, some jurisdictions have established specialized cybercrime courts or designated judges with expertise in handling cyber-related cases. These specialized courts streamline the judicial process, ensure consistency in cybercrime adjudication, and facilitate the timely resolution of cases. In addition to handling domestic cybercrime cases, the judiciary also plays a vital role in international cooperation and mutual legal assistance. Cybercrimes often involve perpetrators and victims located in

different countries, necessitating cross-border cooperation for investigation and prosecution. Judges may have to navigate complex extradition procedures and coordinate with foreign authorities to bring cybercriminals to justice.

Moreover, the judiciary's role in cybercrime cases goes beyond merely prosecuting offenders. It also involves protecting the rights and interests of victims. Judges may grant compensation or restitution to victims of cybercrimes, ensuring that they receive appropriate remedies and support. In recent years, cybercrimes have emerged as a global challenge, affecting individuals, businesses, and even governments [26].

A. Futuristic Challenges

Cybercrimes involve sophisticated techniques and technologies, making it challenging for judges who may not have a technical background to understand the intricacies of digital evidence and cyber attack methodologies. Interpreting complex technical information and assessing its relevance in a legal context can be daunting. One of the primary challenges before the judiciary in the context of is the technical cybercrime complexity associated with digital offenses. Cybercrimes involve intricate technological aspects, ranging from sophisticated hacking techniques to encryption methods complex used by cybercriminals to conceal their identities and activities. Judges, who may not have a technical specialized background, face difficulties in comprehending the intricacies of digital evidence and cyber attack. Judges must stay updated with the latest developments in the cyber domain to effectively adjudicate cybercrime cases. Technical complexity presents a continuous challenge for the judiciary, demanding specialized knowledge and a willingness to adapt to the ever-changing landscape of cyber threats to ensure fair and informed decisions in cybercrime cases [26].

Undoubtedly, cyber criminals constantly develop new and sophisticated methods to exploit vulnerabilities in digital systems, making it challenging for judges to keep pace with the ever-changing landscape of cybercrime. Cyber threats evolve rapidly, and new cybercrime tactics continuously emerge. Staying updated with the latest cybercrime trends and methodologies can be a significant challenge for judges, as they need to adapt their knowledge to address emerging cyber threats effectively. One

of the most significant challenges before the judiciary is the rapidly evolving nature of cyber threats. New cyber attack techniques, such as ransom ware, advanced phishing schemes, and zero-day exploits, emerge frequently, presenting novel challenges in understanding the technical aspects of cyber offenses. Judges must continually update their knowledge and expertise in cyber law and digital forensics to effectively address these complex cases. Another very important technical issue before the international community about the Cybercrimes is transcend national boundaries, posing jurisdictional challenges for the judiciary. Jurisdictional issues pose significant challenges for the judiciary in handling cybercrime cases. Cybercrimes often transcend national borders, involving perpetrators and victims located in different appropriate Determining countries. the jurisdiction for prosecuting these crimes can be complex and time-consuming.

Another challenge before the international community is about the admissibility of digital evidence in court which can be challenging. Ensuring the integrity of digital evidence while considering the rules of evidence can be demanding. Digital evidence admissibility poses a significant challenge for the judiciary in cybercrime cases [27]. Judges must grapple with the complex task of determining the authenticity, reliability, and admissibility of digital evidence in court. While dealing with the cybercrimes the international community also faces resource constraints, such as a lack of specialized cybercrime courts, trained personnel, and technology infrastructure. Insufficient resources can hinder the efficient handling of cybercrime cases and delay justice. Resource constraints pose significant challenges before the judiciary when dealing with cybercrime cases. However, many judicial systems face limitations in allocating adequate resources to address these requirements. Efforts to overcome resource constraints may include establishing dedicated cybercrime courts or cyber divisions within existing courts, providing specialized training to judges and legal professionals on cybercrimerelated issues, and investing in advanced technology and digital forensics capabilities. Ultimately, addressing resource constraints ensures that the judiciary remains equipped to uphold the rule of law and provide justice in an increasingly digital and interconnected world [28].

Cybercriminals often operate behind layers of anonymity, making it difficult to attribute cybercrimes to specific individuals or groups. Identifying the true perpetrators and establishing their guilt can be a considerable challenge in cybercrime cases. Anonymity and attribution pose significant challenges for the judiciary in cybercrime cases. Cybercriminals often employ sophisticated techniques to conceal their identities and cover their digital tracks, making it difficult for law enforcement and judicial authorities to attribute cybercrimes to specific individuals or groups. The cloak of anonymity afforded by the online environment allows cybercriminals to operate with relative impunity, hindering the traditional methods of identifying suspects used in offline crimes. Judges must grapple with the complexities of tracing digital addresses, network footprints, IP and connections to establish the true identities of cybercriminals [28]. In addition to these, cybercrimes often involve perpetrators and victims from different countries, necessitating international cooperation for effective investigation and prosecution. Delays or lack of cooperation from other jurisdictions can hinder progress in cybercrime cases. International cooperation poses significant challenges and difficulties before the judiciary when dealing with cybercrime cases. Cybercrimes often have cross-border implications, involving perpetrators and victims in different countries. To effectively investigate prosecute cybercriminals, and cooperation between law enforcement agencies, legal systems, and governments across jurisdictions is crucial [29].

The most challenging task before the all the countries of the world is about the right to privacy. Balancing the need for cybercrime investigation with individuals' right to privacy can be delicate. Privacy concerns pose significant challenges before the judiciary in the context of cybercrime cases. As cybercrimes often involve digital evidence obtained from electronic devices, judges must grapple with balancing the need for effective investigation and prosecution with safeguarding individuals' right to privacy. The admissibility of digital evidence in court can raise privacy concerns, especially when it involves personal communications, online activities, or sensitive data. Striking a balance between preserving privacy and maintaining the integrity of the judicial process is crucial to uphold the rule of law and protect citizens' fundamental rights [29].

Another significant aspect to curb this menace is that the Judges require specialized training to understand the technical aspects of cybercrimes and relevant laws. By enhancing judges' technical knowledge and understanding of cybercrime complexities, capacity building programs can empower them to make informed decisions, correctly interpret digital evidence, and effectively adjudicate cybercrime cases [29]. In sum, the judiciary faces multiple challenges and difficulties in tackle cybercrime cases. From technical complexities to jurisdictional issues and resource constraints, addressing cyber threats in the digital age requires continuous adaptation, capacity building, and international cooperation.

VI. JUDICIAL RESPONSE TOWARDS RIGHT TO PRIVACY

The response of Judiciary over the right to privacy has evolved judiciously and shows its reflections in changing the landscape of the technology and society. In recent past, the concept of the right to privacy has gained prominence as advancements in digital technologies have raised concerns about personal data protection and surveillance. Courts around the world have grappled with striking a balance between individual privacy rights and the legitimate interests of governments, corporations, and law enforcement agencies. In many jurisdictions, courts have recognized the right to privacy as a fundamental human right inherent in the dignity and autonomy of individuals. Judicial responses often emphasize on the right to privacy as an essential tool for safeguarding the personal autonomy, protecting intimate relationships, and ensuring freedom of thought and expression. Courts have held that individuals have a reasonable expectation of privacy in their personal information and communications, and any intrusion without proper justification may constitute a violation of this right. On the other hand, some judicial responses have acknowledged the need for limited intrusions into privacy to uphold public safety, national security, and law enforcement interests. Courts have grappled with complex cases involving surveillance, data retention, and technological advancements that blur the lines between privacy rights and security concerns. In such cases, courts must carefully balance the necessity and proportionality of any intrusion on privacy to ensure it aligns with the rule of law and constitutional protections.

In Indian sub continental, the Supreme Court of India has also given the landmark judgement which has highlighted the importance of right to privacy under the Constitution of India. As per the judgement the right to privacy is the integral part of the Constitution and as fundamental right is acknowledged under Art. 19 (1) (a) and Art. 21 of the Constitution. Thus, in the case of Shreya Singhal v. Union of India [30], Section 66A of Information Technology Act, 2000 was declared unconstitutional and hence deleted from the Information Technology Act 2000.

It is pertinent to mention here that until 2012, it was debated in the various court cases that whether Right to Privacy is fundamental right or not. Supreme Court decided cases on the basis of this right holding that right to privacy is included in Art. 21, but the issue was not substantially and authoritatively decided. The controversy emerged again when government of India has issued uniform identity card scheme for delivery of benefits and subsidies to people. The scheme was opposed as personal information including biometric information was collected for issuing the cards. The Government has established Unique Identification Authority of India under Aadhaar (Targeted delivery of Financial and other Subsidies, Benefits and Services) Act, 2016 [31]. J. K.S. Puttaswamy (Retd.) challenged this collection of personal information under Aadhaar scheme. Many cases have filed in the courts all over India challenging this collection by State.

VII. CONCLUDING OBSERVATIONS

Thus, to conclude, the judicial response towards cybercrime and to protect the right to privacy has been critical in shaping the legal framework and upholding the rights of individuals in the digital age. As technology continues to advance rapidly, cybercrimes present unique challenges that demand innovative and adaptive approaches from the judiciary. Through landmark judgments and evolving jurisprudential dimensions, the courts have demonstrated a commitment in protecting privacy, promoting cyber security, and ensuring justice for victims of cybercrimes. The observations reveal that the judiciary has recognized the right to privacy as a fundamental right, essential for preserving personal autonomy and dignity. The judiciary has shown a willingness to address the complex technical aspects of cybercrimes and right to privacy. This technical proficiency has enabled the courts to

make informed decisions, assess the credibility of evidence, and ensure that cyber criminals are held accountable for their actions. The judiciary has played a crucial role in establishing cybercrime jurisprudence. The courts have recognized the need for proportionality and necessity when dealing with cybercrimes. International cooperation in cybercrime cases has been facilitated through the judiciary. Adherence to extradition treaties and mutual legal assistance requests has been instrumental in bringing cyber criminals to justice.

Therefore, to conclude, the right to privacy is a fundamental human right that has gained increasing significance in the digital age, particularly within the realm of cyber law. This paper tried to explore the evolving landscape of privacy in the digital era, highlighting the challenges posed by technology and the need for robust legal frameworks to protect individual privacy. In sum, the right to privacy remains a cornerstone of democratic societies, even in the face of rapid technological advancements. Cyber law plays a pivotal role in safeguarding this right, offering protection against unauthorized data collection, breaches, and invasions of personal space online. As technology continues to advance, it is imperative that lawmakers and society as a whole remain vigilant in upholding and adapting these legal protections to ensure that the right to privacy endures in our increasingly interconnected digital world. Balancing the benefits of technology with the preservation of individual privacy is an ongoing challenge, but it is one that must be met to maintain the foundations of a free and just society. Ultimately, the right to privacy in the context of cyber law is not just a legal concept; it is a reflection of our commitment to preserving individual autonomy and dignity in the digital age.

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Artificial Intelligence in Digital Marketing and Marketing Communication of Companies – Opportunities and Issues in Creating a New future of the Company's Business

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Abstract—Current business environment. characterized by fast changes, rapid development and spread of new information and communication technologies, internet users, and global competition, have raised the importance of digital marketing and marketing communication for all companies as a way to increase their online presence and competitiveness in the market. Efficiency of digital marketing in companies is highly dependent on latest technology trends. This implies the necessity of monitoring technological innovations and trends and their application in businesses, especially in marketing. Its implementation is a very demanding task and requires a lot of effort and resources. From the other side is an asset in strengthening the brand, online visibility, increasing the sales and thus success of the company. One of the top emerging trends in technology today is artificial intelligence (AI), which has become a dominant force that highly affects businesses and marketing. AI has brought numerous changes, opportunities, but also challenges and issues in managing marketing and marketing communication of companies. In the literature and practice, there is currently an open discussion with many questions and concerns about the AI topic and how it will influence and impact the business of the companies in future. This paper analyzes AI in marketing and marketing communication of companies as a driving force in creating and reshaping a new future of the company's business

and provides an insight into key opportunities and issues of its application in company business.

Keywords - Artificial intelligence, marketing, marketing communication, company, business

I. INTRODUCTION

Technologies today are developing and spreading incredibly quickly across the globe, which is accompanied by an enormous growth in the number of individual and business competition internet users and in the market with the needs of companies to better understand customer behavior in the virtual world. Such circumstances have brought many changes in managing business in the companies, especially in marketing and marketing communication, emerging the digital marketing trends and its importance. The goal of modern marketing is to satisfy customers with adequate products and services that have a high value for them and to increase the sales and profits of the company.

It is a very complex field of business whose integral part is digital marketing, within numerous activities such as a market research and analysis, planning, strategy development, creation and implementation of marketing plan, marketing mix, products and services, content, promotion, advertising, market segmentation, selling, distribution etc. Essential and important part of this process is integrated marketing communication and marketing information management.

Additionally, digital marketing is also a complex process of using digital media, data and technology to promote and sell products or services. In business practice it implies the management of various integrated forms of online communication, presence and advertising of a company including websites, social networks, e-mail, mobile applications etc. It includes diverse tools and strategies such as search engine optimization (SEO), content marketing, social media marketing and others.

Efficient management within systemic and holistic approach and integration of company operational systems is necessary in this process. This means that the entire marketing process, i.e. marketing information system has to be integrated and also linked with other departments such as the finance and the inventory and delivery management system. It is necessary to point out that rapid growth of information and communication technologies (ICT) transformed marketing of the companies positioning digital marketing and marketing communication as a pivotal function. Hence, all types of online communications are in rapid worldwide. among growth the people Customers now actively and directly participate in this communication, particularly in social media with a dominant role in influencing and creating the company business. This is also highly reflected on the company's market segmentation strategy, targeting and positioning in the market. Selection of proper strategy with optimal digital marketing mix and promotion instruments according to customer demands, with an emphasis on product branding and better positioning on the market are also required for all companies. In other words, digital marketing within promotional online activities and communications, supported by other marketing activities, has become key tool in creating favorable conditions on the market [1].

Therefore, active integrated two-way communication with the customers and development of customer relationships through customer relationship management (CRM) have become crucial for the companies in order to achieve customer satisfaction and their loyalty. This supports the company to reach and engage with the bigger audiences worldwide and to attract and retain customers and to attract and retain customers. In that way companies are advancing development of brand, visibility and global presence, competitiveness, customer loyalty with precise targeting in order to boost the sales and achieve business efficiency, better overall performances and profit [2].

Consequently, digitalization processes and digital transformation grow into basic business requirements for all companies in order to operate optimally. Thus, dynamic development of technologies has also emerged the new technological trends which have to be quickly adopted and implemented in business practice. Keeping abreast with new technology trends is the only way to respond properly to market requirements and achieve business success. This also refers to AI, as a top emerging trend which becomes the most powerful technology in affecting business of companies, especially marketing. AI offers many opportunities in advancing digital marketing. This particularly refers to the marketing automation and research towards gaining deep analyzes and insights about market trends and forecasting, behavioral patterns of customers and its prediction which today is an increasingly important tool to create appropriate marketing strategy in order to attain business advantages and success. AI has already become a part of digital marketing operations of many companies as a prominent force in achieving many benefits [3].

From the other side there are many issues and challenges of AI application in businesses. It is a controversial current debate topic in the academic and professional publics within high concerns and many questions, which will be discussed in the next chapters in this study. Influence of AI on businesses is expected to grow with predictions that it will reshape and create a completely new future of company's business which means that companies will be forced to apply AI in marketing business practice in order to survive in the market [4].

II. ARTIFICAL INTELLIGENCE - TOP EMERGING TECHNOLOGICAL TREND

Artificial intelligence is a subfield of computer science and represents one of the advanced digital technologies. It consists of various techniques and algorithms used to process data and learn from data including machine learning, deep learning, natural language processing, robotics and others. AI refers to the simulation of human intelligence through machines that are programmed to think like humans and mimic their actions.

A key feature of AI is its ability to rationalize and take actions in achieving a particular goal. In other words AI is the ability of a computer or computer-controlled robot to perform tasks normally like a human beings [5].

In literature there are many definitions of AI. It can be summarized that AI is machine/computer based systems capable of performing tasks, making predictions, recommendations like human beings including decision-making, visual and speech observation and recognition and translation of languages.

AI systems can be purely software-based, operating in a virtual world, such as photo analysis software, internet browsers, speech and face recognition systems or it can be embedded in devices - hardware, such as advanced robots, autonomous vehicles and drones.

For example, machine learning techniques have the ability to predict future behaviors based on large data sets of past behaviors, i.e. availability of large amounts of data, advances in algorithm development, and increased computer processing capabilities. Another deep learning technique is used to describe a set of algorithms based on the concept of neural networks. These algorithms attempt to mimic the functionality of the brain's neurons, allowing them to effectively learn from examples and then apply the learning to new data. Thus, the problems in speech recognition and identifying the object in the image are solved by deep learning [6].

The development of artificial intelligence is advancing at a rapid pace. AI is becoming more present in businesses and people's lives, making daily tasks easier and bringing new development opportunities in different fields of businesses. It makes it possible to automate processes, improve business efficiency, and increase the precision and accuracy of decisions. According to the complexity of used devices, there are several types of artificial intelligence that are applied in business [7].

AI represents important tool that can help companies to achieve business goals particularly in marketing. That is why it is used in various fields of businesses and sectors such as finance, business consulting, healthcare, diverse industry sectors like automotive industry, traffic, public services, education and others [8].

III. AI APPLICATION IN MARKETING AND MARKETING COMMUNICATION OF THE COMPANIES

dramatically changed AI has digital marketing with further enhancement in the future. Its implementation in digital platforms has also revolutionized digital advertising (Fig. 1). AI today plays a very important role in marketing because of the extraordinary potential and opportunities for business development and operations [9]. In other words, there are many areas and ways of how artificial intelligence can be applied in marketing to support more efficient marketing operations and activities. Some key of them are as follows [10-12]:

- Advanced market analysis and market trends forecasting can predict future events, trends and periods of market crisis or emergence in the early stages;
- Advanced marketing research and competitive analysis- precise market segmentation and targeting; data about competition, its activities, comparison of strengths and weaknesses with the competition and how to adjust marketing strategy;
- Advanced analytics and Big Data Supply chain optimization- analyze large amounts of data, identify problems, provide solutions to optimize business which helps managers in effective planning and decision making;
- In-depth analysis of customer behavior with discovering their hidden patterns and predicting future ones including individual and group;
- Personalization of communication;
- Automated offer generation generate personalized offers for customers, which speed up the sales process and respond to customer requests;
- Automatic content generation generation of different types of content such as articles, messages, instructions, blog and social network posts etc., and personalized advertising messages or email campaigns tailored to the target

group; can create and improve the quality of content;

- Support in development of new products and services tailored to customer needs;
- Automation of some work processes and routine tasks such as sending the emails, answering user questions, customer support automation, invoice processing tools etc.;
- Keyword optimization and SEO strategy-contribute to SEO analysis, higher marketing quality content and setting of an adequate strategy;
- Optimization of advertising campaigns with more effective advertising and sales -integrate the entire search and all online activities of users on numerous platforms, conduct predictive analytics; reduce the campaign investing cost;
- Analysis of social networks and optimization of social media campaigns- automate the management of social networks, monitor activities, analyze the impact of marketing campaigns;
- Increasing customer retention rate;
- Marketing automation process based on a large amount of collected data with automatic performance of tasks which increases productivity, enables efficient targeted campaigns through multiple communication channels, ensuring a personalized experience for each user;
- Cost optimization optimize the costs of advertising, logistics, development of new products and services, after-sales service;
- Advanced CRM systems.

It should be underlined that AI has enormous potential for data collection, analysis and processing which greatly support companies to adapt and properly respond to the high customer demands. AI systems integrated into search engines, enable a large amount of user data to be quickly and easily accessed with establishment of personalized communication with consumers, i.e. the right message to the right person at the right time and on the right platform.



From the other side marketing research is carried out automatically with the help of various technological tools to reach target groups. AI advanced and predictive analytics facilitate the analysis of large amounts of data (Big Data) about customers. products. competition, market, environment, regulation, technology and others fields, in order to obtain quality knowledge and insights that will help companies in efficient marketing planning, strategy and decision making processes. This analysis cannot be carried out by one marketer (alone) or it will take a lot of time.

Based on such analytics, it is possible to analyze historical data on consumer behavior, identify the products and services that sell best, which customers often buy them, as well as the circumstances that lead to customer purchase and satisfaction. Additionally, these analytics can predict future customer purchase interests, behaviors, motivations and as well as market trends. Employees need to have specialized knowledge and developed cognitive skills in order to understand and apply the obtained data and insights [13].

Obviously, the use of AI can significantly improve marketing operations of the companies. All of the mentioned opportunities further on support companies to better position themselves in the market, strengthen their brands, competitive advantage to be a step ahead of the competition in contemplation of advancing their sales and overall business performance.

Apparently, it can be understandable why the companies decide to take advantage of all opportunities that AI offers and apply them to business practice [14].

IV. ISSUES OF AI APPLICATION IN BUSINESSES

Besides many opportunities, there are many challenges and issues in applying AI in business

practice of the companies. Also there are many questions and concerns about AI potential risks and downsides, as well as the fact that AI is controlled by a small group of private technology companies.

At first it should highlight the high cost and complexity of the AI process. Namely, implementing artificial intelligence in marketing requires significant financial resources which can be problem especially for small and medium sized companies. Currently, large tech companies and wealthy individuals have the most advanced artificial intelligence at their disposal and high power with the ability to influence the whole world [4].

Hence, AI technology is becoming more complex which means that AI systems are also becoming more complex to use with requirements of expert knowledge in this field and training of employees [15]. Lack of properly trained and controlled AI experts or employees can lead to the many issues primarily related to the quality of data. AI gives the best results when it works with quality data and well-placed algorithms (models) and must learn and be trained by us. Bad data as inputs will have bad outputs which can lead to wrong decisions and many problems such as a bias and discrimination.

Unfortunately, people including AI experts and employees are not devoid of prejudices. If an AI gains abilities from a biased data set, for example, in terms of race or gender, then it has the potential to spout inaccurate and offensive stereotypes. It can also enact hidden biases, preventing some people from accessing certain services or knowledge or to deliver false answers confidently as truth that people may accept [16].

Although AI is able to significantly support marketing in establishing more efficient operations, companies should also be aware of its limitations such as a lack of human interaction, poor adaptation to changes and limited creativity. This particularly refers to the fact that AI cannot completely replace human classic interpersonal relationships in the market. Customers still prefer to have direct communication with other human beings with the empathy [17].

Another important issue if fear of losing jobs. Even though some experts claim that AI will bring new job opportunities, there is no doubt that many routine jobs will be at risk, particularly related to the content writing, web analytics, managing social media accounts, telemarketing sales, and others. In the future AI will be able to perform most of the jobs that people do today which can lead to record unemployment and other social problems.

The ethical dilemma mainly arises with employers. If an employer could use AI to replace a human, which would increase efficiency and reduce costs, probably it would do it. Many businesses that make such decisions could face dangerous consequences. This primary refers to the question how they will control AI, especially AI super intelligence programs - systems that are much smarter than humans which are already under advanced development. There is no answer and solution how this program will be managed, controlled and prevented from getting out of control [6].

However, in literature and practice is underlined that the major issues and concerns of AI application in businesses are security, privacy, governance, ethical issues and equal access [18].

Like any technology AI can be misused. One level of abuse can be the unethical use of an AI system which already is discussed, while another level of abuse can be flaws in the security system. In the todav digital environment, there are various frauds and abuses due to the vulnerability of IT systems and their insufficient security which are also present in the field of marketing. Customers are also increasingly concerned about their privacy and security when it comes to AI applications with reason. Smart phones, speakers and other devices are always listening, collecting and recording all online data and searches from all users. If powerful technology falls into the wrong hands, it could easily be misused by one company or hacker for nefarious purposes, attacks or use of discriminatory algorithms that can cause significant harm to entire groups of people. This can lead to violations of user privacy and security, creation of false identities, harassments and assaults [19].

It should be underlined that every company and as well as country should have a high level of personal data protection. From the other side all governments have to create and implement legal regulation of AI and codes of ethics. Legal regulation of AI has to be at the highest concern of every country and could cover many issues including protection of personal data. AI technology is used for different purposes, and due to continuous development it will require proper and clear regulation and constant adjustment to changes.

Lack of ethical, privacy, security, operational policies and standards and legal regulation can cause serious problems to the businesses, customers and in general to all people involved at the platforms with AI applications.

All of these serious issues and problems should not be ignored. There are also so many questions, doubts and concerns. Solving the problems, answering the important questions should be the highest agenda of the whole society, primary key institutional drivers of the development of society and as well as in creating and applying AI legislation and ethical codes [18].

Obviously, AI will bring more changes in managing businesses and it will create a new future for companies. Companies are already forced to apply some AI systems. There is no answer to what this future looks like and how it will affect businesses [20]. That is why it is very important that companies should have right approach and see AI only as a tool that will improve marketing activities and be aware of issues and problems in order to avoid them and adequately apply AI in business practice.

V. CONCLUSION

The application of artificial intelligence in businesses can provide numerous benefits to all companies worldwide. Automation of routine tasks, data analysis, personalization of products and services, and development of new products and services are just some of the opportunities and the areas in which artificial intelligence can be applied to improve business process efficiency and marketing function, communication and activities.

With the right approach and further development, AI will continue to be a key driver of progress in the 21st century and in creating a new future of company business. Despite many complex issues and challenges, this technology will continue to support companies in achieving better sales, performances and profit. In order to gain the full potential of AI, it is necessary to have responsible discussions about the ethical, social and legal implications of its use. Finally, it is important to note that artificial intelligence represents a global challenge that requires collaboration and innovative thinking. Whole society, from the international community, local governments, academic and other institutions, businesses to all people, must work together to ensure fair, responsible and sustainable development and deployment of artificial intelligence. Issues such as privacy protection, equality and data security should be on highest alert.

AI today already has significant applications in marketing business practice. The question is not whether AI will more transform marketing in the future, but how and how much.

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Green Central Banking

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Abstract—The accomplishment of financial stability within the purview of macroprudential policy as well as price stability, which reflects the mandate of monetary policy, are the primary objectives of the majority of central banks today. In addition to the aforementioned, central banks are increasingly examining how climate change is affecting the financial system because it has an impact on inflation, economic growth, and financial stability. The threat posed by climate change has passed into the present, but its repercussions are becoming more tangible every year. Climate change can result in new financial system risks, two of which, in the viewpoints of central banks, stand out: physical risks and transition risks. For these reasons, central banks and financial regulators have started putting monetary and prudential policy measures into place to deal with the effects of climate-related financial risks. These measures include the use of climate stress tests and the active development of green financial instruments. In order to reduce the negative effects of upcoming climatic changes, central banks must continue to concentrate on maintaining financial stability with adequate coordination with macroprudential, monetary, and fiscal policies.

Keywords - Green central banking, climate stress test, green finance, climate change risk, regulation

I. INTRODUCTION

Given its effects on the level of economic growth and development, the rate of inflation, and the stability of the financial system, climate change currently poses an equally significant challenge for the real and financial sectors. Carbon dioxide levels have risen as a result of human activity, which has contributed to the development of extreme weather conditions like a significant rise in temperature and the melting of glaciers, as well as droughts that destroy infrastructure, put life at risk, and cause largescale migrations. There is a lot of uncertainty about how climate change will affect future lives. It is anticipated that it will lead to a shortage of drinking water, alter conventional methods of food production, and increase the number of deaths from storms, heat waves, and flooding. The biggest problem facing humanity in the twenty-first century is dealing with climate change. With their primary objectives of price and financial stability in mind, central banks play a significant role in this. The term "green central banking" refers to a relatively recent initiative by central banks to incorporate the risks posed by climate change into their mandates. These risks have the potential to have a significant material impact on both the short- and long-term prosperity and stability of the financial sector. In order to assess the climate risks to which financial institutions are exposed in the most efficient manner, central banks are in a position to create climate stress tests and green finance models due to their regulatory oversight over the movement of money, credit, and the financial system as well as their developed expertise. This strategy poses a significant challenge for central banks, but it also entails a duty to address the mounting concerns posed by climate change.

There are five sections in this paper. Following the introduction, the second section of the paper analyzes the concept of green central banking, and the third section gives an outline of green central bank activities. In the fourth section of the paper, we will discuss the National Bank of Serbia's experience with green central banking, and in the conclusion, we have outlined the most significant lessons learned from this paper.

^{*} The views expressed in this paper are those of the author and do not necessarily represent the official view of the Economists Association of Belgrade.

II. CONCEPT OF GREEN CENTRAL BANKING

The shift to a low-carbon economy is not an easy task, and environmental policy and climate change represent serious dangers to financial stability and economic growth today. Central banks, which are in charge of ensuring financial stability, are in a good position to use macroprudential tools to reduce those risks [1]. For the sake of the planet's health and the development of a sustainable future, combating climate change is a top priority on a worldwide scale. In order to maintain the level of the global temperature and support the green transition, which is anticipated by several international accords, countries must dramatically limit the production of dangerous emissions [2]. With the aim of achieving the traditional objectives of central banks of price and financial stability, green central banking refers to the process of considering environmental risks and other risks related to sustainability, such as risks related to climate change, when designing monetary policy and financial regulation. Thus, a distinction can be drawn between the central bank's reaction to environmental changes and its role in promoting a green economy [3]. Central banks became quite interested in this topic as they understood how climate change would affect their ability to achieve their primary objectives. In order to support societal efforts to establish a low-carbon economy, central banks expanded the scope of their work after the global economic crisis by incorporating additional sustainability objectives [4].

Climate change has increased the mandates of central banks today, but they cannot be the only entities in charge of mitigating these changes. For this reason, central banks' official mandates now include the principles of sustainable development. If, hypothetically, the economy becomes so "green" that central bank involvement in that area is no longer required, it is crucial to determine if green central banking constitutes a permanent or temporary change in policy. The involvement of central banks in the battle against climate change stems from two reasons. The first group of arguments contends that monetary policy decisions made by central banks are impacted by climate change. The typical inflation-output trade-off is complicated by the increasingly frequent climate changerelated shocks, which also limit the central bank's ability to implement monetary policy. The second set of justifications focuses on the role of the central bank in maintaining financial and

macroeconomic stability, presuming that climatic risks are a cause of systemic stress. In addition to this reactive action by central banks, proactive action is also recommended: central banks should support the green economy and facilitate a smooth transition to a low-carbon economy [5]. It takes a lot of work and dedication to address the risks posed by climate change, particularly from regulatory bodies and central banks, who must include these risks in their mandate. In light of climate change, it's critical to highlight potential physical and transitional risks. While transition risks refer to migration tactics (for instance, converting to the use of clean technology), physical risks refer to large economic losses, such as the cost of repairing infrastructure following significant climate change. Systemic risk in the financial sector can rise as a result of both physical and transition risks [6]. There are many difficulties involved in assessing and monitoring climate risks. First, the data required to perform climate stress testing is either lacking or not detailed enough. Second, because the modeling is based on the dynamic between interplay macroeconomics, microeconomics, other factors. and the integrated evaluation of climate risks cannot be relied on a static approach [7]. Existing macroprudential stress tests, which are designed to examine the solvency, liquidity, and resilience of a financial institution as well as the financial system as a whole, can serve as a starting point for the development of climate stress testing. Applying the solvency stress test assesses whether the financial institution or the system as a whole has enough capital to remain solvent in a hypothetical highly risky environment, while the liquidity stress test is used to assess the possibility of the bank's survival in conditions of a liquidity shock (for instance, a sudden outflow of deposits).

The cost of combating climate change is considerable, but it would be significantly higher if central banks and representatives of other financial institutions, such as commercial banks and international financial organizations, did not participate in a sufficient manner. The European Union decided in April 2021 to make climate neutrality a legally binding objective by 2050 and to cut greenhouse gas emissions by at least 55% from 1990 levels by 2030. This definition of climate neutrality indicates that the quantity of dangerous gases released into the atmosphere



should equal the quantity of those gases removed from it. The real gross domestic product would significantly decline if the specified objectives weren't met (Fig.1). In addition to the aforementioned, it is predicted that if the emission of dangerous gases increased as predicted, the temperature would rise by almost 5° C by 2100 [9]. The yearly cost of adjusting to climate change will be between \$160 billion and \$340 billion by 2030 and between \$315 billion and \$565 billion by 2050, according to a 2022 United Nations analysis [10]. This demonstrates the severity of climate change and the tremendous expense of its mitigation.

Many central banks are now advocating for financial institutions that are under their oversight and control to publish information about climate change and to strengthen their risk management in this area. In order to show how this is done, central banks are also urged to share information about the effects of climate change on their own balance sheets. Additionally, central banks can modify the collateral eligibility system to consider examples of climate change in the collateral system as well as the technique of reducing emissions of dangerous gases through a modified method of printing money [11]. In addition to the aforementioned, the green central bank can carry out asset purchase programs that consider the effects of climate change on bond issuers, implement refinancing schemes that would provide funds for sustainable investments, allocate direct credit for financing sustainable sectors, and coordinate activities with fiscal authorities. From the standpoint of prudential policy, the green central bank can perform stress tests, introduce capital instruments (determining the amount of capital that financial institutions must hold in order to cover losses from shocks caused by climate change), and liquidity instruments (it is necessary that the Basel Committee have an impact on sustainable funding and future environmental risk in the

liquidity instruments such as Liquidity Coverage Indicators Ratio and the Net Stable Funding Ratio) [12]. The European Central Bank, the Federal Reserve System, and the Bank of England will be used as examples to illustrate the actions of the green central bank in the following section of the paper.

III. GREEN CENTRAL BANK ACTIVITIES

For three reasons, central banks are crucial players in achieving the shift to a low-carbon economy. First, central banks are competent at managing the risks that the financial system and the economy as a whole are subject to and that climate change may exacerbate. Second, as central banks are active participants in the market, they can contribute to the funding of sustainable investments. Third, central banks can impart their knowledge in an effort to affect change. The term "green central banking" refers to all the actions made by central banks to address the aforementioned tasks [13].

The European Central Bank (ECB) highlighted the continued integration of climate change into its monetary policy framework in a new monetary policy strategy that was published on July 8, 2021. The ECB has demonstrated in its revised strategy that the two biggest global problems for the European Union are the fight against climate change and the shift to a lowcarbon economy. According to its mandate, the ECB is required to evaluate how climate change may affect its monetary policy and to understand how it could impact pricing and financial stability. A comprehensive plan for addressing climate change as part of the monetary policy framework has been created by the ECB's Governing Council, and it identifies critical areas for continuing and future action. The development of statistical indicators and the enhancement of analytical major and macroeconomic modeling are discussed in the first section of the activity in order to better understand the macroeconomic effects of transitional policies and climate change. In the second phase of the activity, the monetary policy framework will be adjusted in relation to data disclosure, risk assessment, the execution of the asset purchase program, and the collateral framework [14].

The ECB decided in September 2020 to include coupon bonds, which are tied to specific sustainable performance criteria, in the qualifying collateral that will be able to be used for lending facilities and for repo operations,

with effectiveness starting on January 1, 2021 [15]. The ECB subsequently adopted the same approach on the fundamentals of sustainable and responsive investments for the portfolio denominated in euros in February 2021. This strategy encourages the disclosure of climate change information and awareness of the risks related to climate change [16]. The fact that the ECB established a center for climate change in January 2021, which is directly managed by the ECB President and focused on financial stability and prudential policy, macroeconomic analysis and monetary policy, operations on financial markets, financial regulation, and corporate sustainability, is the best example of the importance of a proper response to climate change. Along with the aforementioned, the ECB has begun using macroprudential climate stress testing. The ECB and the European Systemic Risk Board (ESRB) jointly applied the first climate stress tests, and the findings of those tests were released in July 2021. The purpose of this stress test is to evaluate the financial system's exposure to climate risks in Europe as well as their potential future effects on banks, insurance companies, and investment funds. The following are characteristics of the climate stress test: (1) the stress test is centralized and based on a topdown approach (the top-down approach is based on the reports of individual banks on the basis of which regulatory bodies perform stress tests); (2) it is based on specific climate scenarios that enable the interaction between transitional and physical risks over a thirty-year time horizon; (3) it allows analysis at the level of individual companies; and (4) applies a set of models that include transmission channels between transition and physical risks to determine the effects of climate risks on companies and banks. The outcome of the climate stress test, which was conducted on 1,600 banks in the eurozone, demonstrated the necessity of taking immediate action. In particular, the early adoption of regulations that will help create a zero-carbon economy will help with sustainable financing and the adoption of more advanced technology. When transitional and climate risks are compared, the test findings show that the physical risk will be more noticeable in the long run, particularly if measures that will enable a greener economy are not put into place. The test also revealed that banks and the corporate sector are the most vulnerable to climate risks and as a result, they represent a sizable source of systemic risk, particularly for banks whose portfolios are concentrated in specific economic sectors and

corporate bonds, asset-backed securities, covered bonds, and collateralized credit operations, were included in the stress test. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) and the ECB collaboratively produced scenarios for the 30year climate stress test. The scenarios vary based on which climate policies (mainly the carbon price) are anticipated to be enacted and the various climate threats anticipated to manifest. The hothouse world scenario assumes that no climate policies are enacted and includes a high level of physical danger that will not result in transition risk. The adoption of climate legislation is put off in the scenario of a disorderly transition, which increases the risk of the transition but not the harm to the physical world. Employees at the ECB have created two additional scenarios: the flood risk scenario, which assumes a significant materialization of physical risk in the horizon of one year, and the short-term disorderly transition scenario (horizon of three years), which assumes a significant increase in carbon prices in a short period of time. Both categories of climate-related risks materially affect the risk profile of the balance sheet of the Eurosystem, according to the results of the performed stress test. The ECB's 2022 climate stress test was done to enhance the impact assessment of climate risks and is a very significant exercise that is equally essential for banks and supervisors. It is anticipated that the balance sheet of the Eurosystem would undergo regular climate stress testing in the future [18]. Given that the United States ranks among the nations with the highest per capita emissions of greenhouse gases in the world and is the second largest emitter of greenhouse gases in the world after China, climate change policy in the United States has a significant impact on climate change at the global level. In December 2020, the Federal Reserve System joined the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), which is regarded as a significant step in combating climate change.

The Board of Governors then established the

geographical areas [17]. In order to examine how

to include climate change in the monetary policy

strategy, the next climate stress test was

undertaken in 2022 using balance sheet data from

the Eurosystem. This stress test's objectives were

to examine how sensitive the financial risk

profile is to climate change and to enhance the

Eurosystem's capacity to evaluate climate risks.

Numerous monetary policy portfolios, including

Supervision Climate Committee (SCC) in the early months of 2021 with the intention of improving the ability to recognize the financial risks brought on by climate change and to create a suitable plan to provide resilience to such risks. For the Federal Reserve System to appropriately the economic and financial recognize repercussions of climate change, the SCC's mandate is to guarantee the safety and stability of financial institutions [19]. The Federal Reserve System announced in June 2022 that the nation's six largest banks (JPMorgan Chase, Bank of America, Goldman Sachs, Citigroup, Morgan Stanley, and Wells Fargo) will take part in a pilot project to conduct climate stress tests with the goal of coordinating the capacity of regulators and businesses to measure and manage the risks associated with climate change. Beginning in 2023, the pilot project was put into action. The stress tests are conducted separately from the climate stress test. While the application of climate stress tests examines the future trajectory of climate change for companies and supervisors and their comprehension of how climate risks can be reflected and how they can differ in relation to prior experience, the goal of conducting stress tests is to determine whether large banks have a sufficient level of capital to continue lending to the households and the corporates during a period of significant recession [20]. Federal Reserve System provided guidelines for participating banks to carry out a pilot climate scenario analysis exercise in January 2023. Pilot stress tests are being conducted with the intention of reviewing banking institutions' climate risk management systems and learning more about the difficulties they encounter when identifying, measuring, monitoring, and managing climate risks. By doing this, the Federal Reserve System will make sure that the institutions it oversees are managing all material risks, including those related to climate change, effectively. The Federal Reserve System created a pilot climate scenario analysis exercise to collect quantitative and qualitative data on large banking institutions' approaches to managing climate risk in order to accomplish this goal. A thorough description of practices for managing climate risk will be included, as well as an overview of the methodologies that have been used, restrictions relating to the availability of data, an evaluation of potential effects on a particular portfolio, and a presentation of the lessons that can be applied to future climate stress test exercises. By the end of 2023, the Federal Reserve System will release the findings

of the pilot climate scenario exercise analysis [21].

The Bank of England has so far engaged in a wide range of green central banking-related activities. Former Bank of Canada and Bank of England governor Mark Carney was one of the first to draw attention to the dangers of climate change in September 2015. He cautioned that unless developed nations take additional steps to ensure that companies use clean technology, climate change could cause a financial crisis and lower living standards [22]. The Bank of England was the first central bank and regulator to set supervisory standards for banks and insurance companies in the area of risk management brought on by climate change in April 2019. After that, in 2020, the Bank of England sent a letter to the corporations that it named the Dear CEO Letter, in which it provided them with comprehensive instructions on how to manage climate risk through 2021. The Climate Change Adaptation Report (CAR), which examined how well businesses were managing climate risks, was released in October 2021. In March 2023, the Bank of England, and the Prudential Regulation Authority (PRA) jointly released a report on climate risks and the regulatory capital framework. The Bank of England's most recent research on how much of the risk associated with climate change could be included in regulatory capital frameworks is examined in the study. The Climate Financial Risk Forum (CFRF), which was founded by the Bank of England and the Financial Conduct Authority (FCA) to develop the capacity to respond to climate risks, produced a handbook to assist the financial sector in developing best practices to manage climate risks in June 2020. The Bank of England is actively working on climate stress testing, just like the European Central Bank and the Federal Reserve System. The Bank of England released the main components of the Biennial Exploratory Scenario (CBES) in June 2021. This study applied three scenarios-early, late, and no additional-to examine the resilience of banks and insurance companies in the United Kingdom to the physical risks of climate change and the shift to a net-zero economy. The results of this climate stress test were released in May 2022 and showed that, if these risks are not appropriately handled, climate risk can most likely have an impact on the profitability of banks and insurance companies. The Bank of England is involved in forging worldwide collaboration in managing climate change. The Bank of England is a

co-founder of the Sustainable Insurance Forum, which represents a global network of supervisors and regulators of insurance companies. It actively participates in the work of the Basel Committee on Banking Supervision (BCBS) and the Financial Stability Board (FSB) in the area of climate change. addition to the In aforementioned, the Bank of England is a founding member and a member of the steering committee of the Network of Central Banks and Supervisors for Greening the Financial System (NGFS). The Bank of England has the chance to share its expertise within the NGFS, gain knowledge from other participants, and encourage suitable responses from central banks and regulators at the global level in the area of climate risk management [23].

IV. THE EXPERIENCE OF THE NATIONAL BANK OF SERBIA

environmental Major international agreements that Serbia has ratified include the UN Framework Convention on Climate Change (entered into force on March 21, 1994), the Kyoto Protocol (adopted on December 11, 1997), the Doha Amendments to the Kyoto Protocol (adopted in 2012), the 2030 Agenda for Sustainable Development (launched by a UN Summit in New York on September 25-27, 2015), and the Paris Agreement (entered into force on November 4, 2016). The Western Balkans leaders met in Sofia in December 2020 to adopt the Green Agenda for the Western Balkans, which is based on the objective of becoming carbon neutral by 2050 through the implementation of strict climate policy and changes to the transportation and energy industries. The Republic of Serbia then passed the Law on Climate Change in March 2021, which was an important development in the battle against climate change and a contribution the worldwide effort to stop those to developments. The Republic of Serbia became one of the first Western Balkan nations to implement this law, creating a mechanism for controlling the emission of gases that have a greenhouse effect. The Republic of Serbia also passed significant environmental protection measures in 2021, including the Law on Renewable Energy Sources and the Law on Energy Efficiency and Rational Use of Energy.

Given that the idea of green central banking has an impact on every social and economic component, the financial industry will unavoidably be impacted in a number of ways. In this regard, both the activities that participants in the domestic financial market engage in relation to this topic, as well as its development, and standardization structuring, at the international level, are closely watched by the National Bank of Serbia. It is acknowledged that central banks may play a significant role in the battle against climate change, in addition to corporates and investment banks. whose operations can stimulate the funding of sustainable projects and development. In this regard, eight central banks and supervisors founded the Network for Greening the Financial System (NGFS) in December 2017. By directing capital flows to projects that would aid in the transition to a sustainable economy, this group hopes to strengthen the international effort to meet the goals set down in the Paris Agreement. As of June 13, 2023, there are 127 members and 20 observers in the NGFS. The National Bank of Serbia joined the NGFS in July 2021, on its 137th birthday, expressing its dedication to stepping up and bolstering initiatives to increase the financial system's resilience to environmental and climatic threats. Members of the Workstream on Scaling Up Green Finance (WS3), a working group with a mission focused on four primary areasmonetary policy, portfolio management, central bank data disclosure, and market transparencyinclude staff from the National Bank of Serbia. Each of these topics has a representation from the National Bank of Serbia. In addition to the aforementioned, staff members of the National Bank of Serbia had access to webinars and virtual panels on the effects of climate change on investments, monetary policy, financial stability, and other subjects that were hosted by the Official Monetary and Financial Institutions Forum. The National Bank of Serbia has an observer role in the Vienna Initiative for Climate Change Working Group beginning in February 2022. This working group aims to bring together banks, other financial institutions, supervisors, and all interested parties for debate and capacity building in order to deal with the effects of climate risks and transition on the balance sheets of the financial sector. As far as monetary activities, the National Bank of Serbia has been investing a portion of its foreign exchange reserves in premium, secure, and liquid "green bonds" over the past few years, thereby assisting with environmentally friendly initiatives in the most open manner possible.

For the first time in its history, the Republic of Serbia issued a EUR 1.0 billion, seven-year

green eurobond in mid-September 2021. Investor demand for the green Eurobond during the auction was more than EUR 3 billion, and it was issued at a coupon rate of 1.00% and a yield rate of 1.26%. The Republic of Serbia was the sole European nation outside the European Union at the time this green bond was issued, making it one of very few European nations to do so. The green euro bond issue complies entirely with the International Capital Market Association (ICMA) regulations, and the money collected will be put to use in accordance with the guidelines set forth in the framework document for the issuance of green bonds.

The National Bank of Serbia provided an examination of the Republic of Serbia's banking sector's susceptibility to the effects of climate change in the Annual Financial Stability Report for 2020. The National Bank of Serbia examined the quantity of debt held by various economic sectors in relation to how much carbon dioxide they emit on a yearly basis. The analysis's findings indicated that the industries in Serbia with the highest carbon dioxide emission intensity are those that supply electricity, gas, steam, and air conditioning (0.14 kg/RSD), followed by the mining industry (0.02 kg/RSD) and the processing industry (0.01 kg/RSD), respectively. A transition to a green economy would have less of an impact on the economy and the banking sector because the electricity supply sector, which is the most significant emitter of carbon dioxide, only contributes a small portion of the gross added value and has a low exposure to banks. The mining and processing industries sector, however, occupies a different position. About 20% of the gross added value was produced by this industry, which greatly increases the risk of transition in that area of the economy. The mining and processing sector generates around 14% of domestic banks' loans, making it crucial for establishing the banks' risk profile with respect to the danger of climate change in the context of the shift to a green economy [24]. Regarding upcoming activities, the National Bank of Serbia intends to work with the National Bank of Austria in 2023 as part of the IPAREG project "Strengthening the Capacity of the Central Banks of the Western Balkans within the Process of Integration into the European System of Central Banks" with the goal of enhancing the evaluation, identification, and quantification of climate risks. Given that the National Bank of Serbia already conducts macroprudential stress tests of the solvency and

V. CONCLUSION

Climate-related risks are now being taken into account and even regulated by several international organizations in charge of the regulation and oversight of financial institutions, despite the fact that they do not immediately stem from banking operations and financial markets. As price and financial stability are the primary objectives of the majority of central banks, and climate-related risks have a direct impact on these objectives, it is essential that central banks play a large role in mitigating the impacts of climate change. In this regard, the idea of "green central banking" was developed, which suggests that central banks effectively manage climate change risks, particularly physical and transition risks, while also playing a role in the development of "green" instruments that help environmentally friendly raise funds for investments that will enable a green transformation.

The mandates of central banks are widened to encompass sustainable development as a result of climate change. These changes affect the level of inflation and thereby the achievement of price stability, but also financial stability because climate changes can cause systemic risk. It is advised that central banks take proactive action to promote the green transition and make the shift to a low-carbon economy as smooth as possible. Even though remediating the effects of climate change is expensive, it would be more so if central banks did nothing. The responses of commercial banks and other financial institutions, as well as those of the economy's sector and the general public, should not be overlooked at the same time. The major central banks have accomplished a lot in the area of green central banking thus far, but there is still more work to be done. In the next years, it will be crucial for central banks and financial regulators to work even harder together to support the growth of green finance and the creation of a green economy in each of their respective jurisdictions.

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The Use of Predictive Analytics in Political Science: Africa between the East and the West

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Abstract-In the aftermath of the World War II emerged a term *cold war*. depicting a state of geopolitical tensions between the East and the West, characterized by overt support of opposing sides in proxy wars, and almost half a century of struggle for global influence. Nowadays, the term is current again, in light of the ongoing Russian special military operation in Ukraine. Given the widespread presence of both Eastern and Western armies on the African continent, it was only expected that, in the race for armament and global influence, Africa would once again find itself caught in the middle – between aspirations of the former colonizers and the US, and interests of the new Russian partners. However, as there is no scenario in which both polarities can live in peace, it is obvious that one must prevail - not only in Ukraine, but in Africa as well. Were there specific indicators that could have served as early warnings of the fall of Western armies and the rise of respect for Eastern allies in Africa? In this paper, the author will distinguish specific indicators emerging in Africa since the beginning of the SMO, with an emphasis on its impact on African failing democracies.

Keywords – Predictive analytics, politics, media discourse

I. INTRODUCTION

As the 20th century was marked by the two great wars and a consequent *Cold War*, the 21st century will forevermore be remembered by revived mass polarization, depicted in the escalation of the Russo-Ukrainian crisis into a full-scale war, forcing the world to opt for the East or the West. As typical for a *cold war*, this conflict was not restricted to the territory of Ukraine, but affected political, security and economic stability of initially European countries, and then the rest of the world as well. In this sense, Africa was rediscovered as a profitable ground for balancing powers, having in mind that many African countries have already had major Western forces present in the field, whilst the East maintained its presence through the Private Military Company Wagner. Albeit, even though history has a tendency of repeating itself, the majority of prognosis since beginning of the conflict revolved around second-guessing the factors that would lead to the end of the war, or economic consequences and solutions for them regarding Europe, whilst the fate of other regions, deemed as less attractive, such as Africa, remained in the shadows.

The Cold War era was a contest between two superpowers over military power and strategic control, mostly centered on Europe' [1], lasting from 1945 to 1991. However, we argue that the power struggle, and especially armament powerplay, was not that much Europe-centered, but focused on inciting political and social development in the Third World, and especially Africa, stepping in as a substitute for colonialism. Namely, even though both Washington and Moscow 'remained opposed to formal colonialism throughout the Cold War, the methods they used in imposing their version of modernity on Third World countries were very similar to those of the European empires', especially in terms of 'inducing cultural, demographic, and ecological change in Third World societies, while using military power to defeat those who resisted' [1]. In this sense, Africa served the US and the Soviets as a fertile ground for proving that their ideologies can be

universally applied, thus claiming the world dominance. In this game, the US ended being the winner, the USSR dissolved, and African states were left alone. Namely, 'they were bequeathed a legacy of enormous debt, collapsed states; and, in many cases, deadly competition for the spoils' [2] that will soon push many African countries into an escalated spiral of coups d'état.

Nowadays, we are witnessing the peak of the *New Cold War*, incited with the launch of the SMO on February 20, 2022, whereas the Western bloc, led by the US, is determined to put a stop to the spread of interest and influence of Russia. This operation caused the West to rise in fear of global dominance of the Eastern bloc and provide support to Ukraine, as a token of appreciation and in promotion of democracy and freedom. As this was always the *excuse* of the West, and especially the US, and as the first *Cold War* did not include direct confrontation between the US and Russia, so was this this present-time scenario centered around supporting a *proxy* state – Ukraine, in its fight against Russia.

The notion of fighting for freedom and democracy was the common *leitmotiv* for broadening the race for global dominance to the African continent during the *Cold War*, as the period following the two world wars was, when speaking of Africa, marked with emergence of national liberation fronts. Given that the battle between the blocs was not only rooted in military power and strategic control, but also in presentation of each bloc's ideology as universal, soon enough the African continent was divided between supporting the East or the West, along with the *Non-aligned* countries that decided not to take sides in the *Cold War*.

In present times, we are facing quite a similar situation: the world is bipolar, divided between the East and the West, with the West gaining broader support. The battle for world domination is not direct, but lead via *proxy* state, and there is a new/old non-aligned-like group, depicted in the fast-spreading BRICS. As during the Cold War, the attention of the world is again centered around Europe, given that the Ukrainian battlefield is located on European soil. And once again, with all eyes directed towards Europe, Africa remained in the background, only to become the new playground of the two blocks since the fall of 2022. To this testify the fact that, since the beginning of the SMO, a spike in coups d'état and coup attempts has been recorded in Africa, whilst two coups occurred during the fall of 2022, and five coups were conducted or attempted since the beginning of 2023. These events, paired with a decline in Western influence on the ground, caused a shift of attitude towards Russia of many African nations, especially the ones rich in natural resources [3].

Even though the near failure of Western armies in Africa came as surprise, in this paper, we argue that specific analytical tools could have aided prediction of such developments in a timely fashion. Our main hypothesis is that application of predictive analytics algorithms creates opportunities for implementation of preventive measures and thus better positioning and reaction to different developments in *cold war*-like scenarios, such as the current situation in the previously mentioned African states is.

II. PREDICTIVE ANALYTICS AND POLITICS

Predictive analytics refers to the use of advanced analytics in predicting future events on the basis of current and historical data, through application of different techniques rooted in the use of artificial intelligence, such as statistics, data mining, machine learning, etc. [4]. Given that both the study of politics and computer science are rooted in the belief that patterns and repetition of same conditions provide the same or similar results, it was only natural that these two combined would prove to be quite a useful tool conducting research. However, until for nowadays, the majority of predictive analytics used in this context revolved around the study of political violence, notably in counterterrorism studies, though such practice raised some issues regarding its 'deleterious effect on human rights, generating specters of 'pre-crime' punishment and surveillance states' [5,6]. Thus, in this paper, the author will present other possible uses of predictive analytics in the study of world politics. For this purpose, the case of the rise of the coldwar behavior in Africa, as well as incidence of coups in African states, will be used for presenting the possibilities predictive analytics offers in terms of early warnings and application of preventive measures.

First of all, it is important stating that predictive analytics is not a *layman* science, and thus demands for a high level of computing skills. Due to that, tech analyst-political analyst *alliances* are more than welcome, given the multidisciplinary task before us. Namely, some phases of the predictive analytics process cannot be completed without the assistance of a skilled political analyst, and vice versa. The process itself is most commonly divided into six phases [9] as following: requirement collection, data collection, data analysis and massaging, statistics and machine learning, predictive modeling, and predictions and monitoring [9].

In order to develop a predictive model, one should define the aim of prediction, and in terms of political analysis, this process should be a task for a political analyst. On the example of our research, the task given should be defined as following: What African countries are prone to rapprochement with the Russian regime in light of the ongoing Russo-Ukrainian conflict, thus stepping back from previously forged alliances with the US or other countries of the West? Defining the task thus completes the first phase of the predictive analytics process.

The second phase revolves around data collection, which is conducted by tech analysts. However, on the presented case study, it is necessary that a political analyst defines the scope of data collection, given that terms *Africa*, *Russia*, *US*, *Western countries*, or *foreign army presence* might provide us with quite broad specter of results, thus crowding our data and clouding our future prediction. For the purpose of this research, let us limit our research and data collection to African countries with confirmed US military [7] and Russian PMC Wagner presence [8].

The most significant phase in predictive analytics is data analysis, which refers to the point when 'the unstructured data is converted into a structured form' [9]. This phase of analysis is commonly referred to as *massaging the data*, referring to the process of 'converting the raw data into a format that is used for analytics' [9]. This phase also includes verification of the use value of collected data, as well as their truthfulness. *In this research, the analysis will be conducted by hand, with presentation of possibilities, perspectives and benefits of implementing phase four of the predictive analytics process – statistics and machine learning technique application.*

Phase four of this process refers to application of statistical and machine learning techniques, and at some points, the probability theory and regression analysis as well [9]. At this point, some knowledge possessed by political analysts is applicable as well, given that statistical modeling has proven to be quite a fruitful tool for developing and testing hypotheses. In this research, unfortunately, this phase will be examined solely in theory, with high hopes of widening research possibilities and capabilities in the future and promoting interdisciplinary research of political violence.

The fifth phase of the predictive analytics process refers to predictive modeling, in which 'a model is developed based on statistical and machine learning techniques and the example dataset' [9]. At this moment, prior knowledge of the research field is necessary, and thus political science knowledge comes in handy. In our casescenario, this phase should result in provision of models of possible behavior of the countries in auestion. However, one should have in mind that this research is conducted retroactively and is thus directed towards proving the fact that certain unconstitutional shifts in power in the selected pro-Western or pro-Eastern countries could have been predicted and thus even prevented.

The final phase of the predictive analytics cycle is *prediction and monitoring*, and revolves around exploitation of possible scenarios and monitoring of development of the situation in the field. Notably, at this moment, scenario building is one of the most commonly used political analysis tools. However, one should have in mind that 'scenario is not the prediction of a specific future. Rather, it can be better considered as a plausible description of what might occur' [10]. Such scenarios can 'immerse decision makers in future states that go beyond conventional extrapolations of current trends, preparing them to take advantage of unexpected opportunities and to protect themselves from adverse exogenous shocks' [11]. In our examination of polarization of Africa and its division into pro-Western and pro-Eastern blocs, three scenarios will be provided: most probable, least probable, and median scenario.

III. AFRICA BETWEEN THE EAST AND THE WEST: RESEARCHING *OLD-SCHOOL*

While the *Cold War* era indeed caused significant cleavages in Africa, dividing it into pro-US and pro-Russian bloc, such behavior and such alliances did simmer down in the aftermath of the fall of the USSR, but still persisted until nowadays, thus providing a fertile ground for rising tensions and newly-found alliances with the West or the East in Africa. The emergence of the *New Cold War* after the launch of the SMO

called for re-examination of former practices and future perspectives in terms of renewed confrontations between the US and Russia in Africa, with a special emphasis on monitoring of *loose cannons*, that is, *coup-prone* countries.

We have previously defined our research question as following: What African countries are prone to rapprochement with the Russian regime in light of the ongoing Russo-Ukrainian conflict, thus stepping back from previously forged alliances with the US or other countries of the West? Initially, we have restricted our research to countries with previously confirmed strong US and/or Russian presence. After our initial examination, we have identified the following four countries as such: CAR, DRC, Botswana, and South Sudan/Sudan, whilst US presence was detected in South Sudan and Russian presence in Sudan. Besides the previously mentioned countries, strong US military presence was identified in Niger, Chad, Senegal, Burkina Faso, Ghana, Gabon, Cameroun, Uganda, Kenya, Somalia, Djibouti, and the Seychelles, while strong Russian presence was confirmed in Libya, Guinea, Guinea-Bissau, Ruanda, Angola, Lesotho, Eswatini. Zimbabwe. Madagascar, and Mozambique [7, 8]. However, this 27-countrieslong list still provides us with quite a broad data collection task, thus forcing us to consult developments from the most recent past of African states, dating back from the launch of the SMO, in search of countries in which a coup was attempted or conducted. Since we are basing our research retroactively, asking ourselves whether such occurrences could have been predicted, we have determined that three countries from the list indeed survived such events - Burkina Faso in September 2022, Niger in July 2023, and Gabon in August 2023, whilst the coup attempt in Sudan in April 2023 only escalated the conflict and drove the country into civil war. However, two more countries emerged on our *coup map*, which were not previously identified as pro-US or pro-Russian oriented – Sao Tome and Principe, with a coup attempt in November 2022, as well as Sierra Leone, with a foiled coup, that is, a coup conspiracy in July 2023. Upon first glance, the presence of these two countries on our list indeed surprised us. However, even though US presence was not confirmed in Sao Tome and Principe or Sierra Leone, both countries nourish strong cooperation with the US government [12].

This specific geographical definition of the research enabled us to conduct data collection in

a more proficient and timely fashion. Regarding this, it is worth noting that, in this case, data collection was conducted by hand, whilst the majority of data entries was acquired with the use of Google Analytics tools, especially the ones used for defining geographical and temporal scope of data collection and presentation.

Custom ranging our research to temporal scope of February 20, 2022 to September 30, 2023, and defining our research as 'Burkina Faso-coup' provided us with data regarding the foiled coup in this country, taking place on September 26, 2023, thus shedding a spotlight on our sideline hypothesis that coup activity is on the rise in Africa. This incident currently has no links with Russia, contrary to the coup occurring in this country only one month before the launch of the SMO, on January 25, 2022, when the main trigger for government overthrow was the refusal of the then-incumbent to employ PMC Wagner in the fight against Islamist militants present in the country [13]. Even though this incident happened prior to the SMO launch, and Wagner presence is still not recorded in the country, it is evident that, at the given time, this Russian PMC was deemed as respectful, and thus incited a change in the regime that did not share that opinion. It is worth noting that, in the aftermath of the coup, this US ally had its capital's streets swarmed with people waving Russian flags, thus proving that if not the government, then at least the people, were slowly stepping away from the US and approaching the RF [14]. The second coup of that year, occurring on September 30, 2022, was once again marked with strong presence of Russian flags, as well as insinuations that the first coup-maker was deposed due to his refusal to build closer ties with Russia [15].

Even the simplest search of the news coverage of the coup d'etat which took place in Niger on July 26, 2023, stress the Russian footprint. Namely, the coup in question took place soon after neighboring Mali and Burkina Faso severed their ties with France and turned to Moscow, and the overthrow of the government was once again greeted with Russian flags and people chanting 'Long Live Putin' in the streets [16]. Moreover, several political analysts have stressed that pro-Russian Telegram channels suggested Niger as the new playground for a coup after the government overthrow in Burkina Faso, thus confirming the existence of Russian interest in the change in regime in this country [16,17]. Namely, a tech company

Logically detected 11 pieces of content on Telegram channels affiliated with Russia or Wagner prognosing а coup in Niger beforehand [17]. Given that we are speaking of a country that is depicted as a known US ally, it is worth noting that the US remained silent and did not attempt to slander the newly-formed junta, reiterating the importance of diplomacy and democracy [18]. This can be explained by the fact that the US maintains several bases in the country, using it as a runway for their swarms of drones that conduct counter-terrorism operations, and with a growing anti-Western sentiment, felt the need to maintain its grasp on at least one country in the region, no matter its regime and its affiliation with Russia.

The last successful African coup in the times of the Russo-Ukrainian conflict took place on August 30, 2023 in Gabon, an US ally. The strongest Western power on the ground was France, which was, at this point, forced to leave, thus leaving much space for the spread of pro-Eastern influences. This case of the Gabonese coup is that much peculiar, given the fact that both blocs - US and Russian, remained distant from both the deposed government and the junta, calling for stabilization, whilst the main winner on the ground was China. China's attempt to maintain presence in Gabon opens much space for future Russian activities on the ground, as Russia and China are perceived as allies, but also prevents the spread of any US interests, if such necessity arises in the future [19].

The coup attempt staged in Sudan on April 15, 2023 by the paramilitary Rapid Support Forces (RSF) against the current military junta leader al-Burkhan spiraled into a full-scale civil war, which is still ongoing. In this case, we need not search for many proofs of Russian fingerprint, given that it is a known fact that members of the RSF have been continuously trained by members of the PMC Wagner, present in the country since 2017. Moreover, the 'Sudanese gold' scandal shook the world since the launch of the SMO, given that this natural resource, found in abundance in Sudan, 'emerged as a way to bolster the Russian economy and build a war chest' [20]. Why did the coup occur, then? Namely, the *de facto* leader, Al-Burkhan, unconstitutionally took power by a coup in 2021, hand-in-hand with his second-in-command, the RSF commander Mohamed Hamdan Dagalo. Two years into the rule of the Transitional Military Council, al-Burkhan made several steps towards strengthening ties with the US and Israel, much to Dagalo's discontent, who is pro-Russian oriented [21]. Therefore, when Dagalo was faced with the possibility of his RSF being integrated into the Sudanese Armed Forces, thus losing their current power and independence, the opportunity rose for both Dagalo – to attempt a coup, and PMC Wagner – to put a stop to the spread of US and Israeli influence in the country.

In the night of November 24, 2022, the isles of Sao Tome and Principe were shaken by a coup attempt, which was nipped in the bud the same night. We must note that this country was not initially on our list of countries with evident military ties with the US and/or Russia. However, upon research, we have found proof that one of the coup-makers, Alercio Costa, was a former member of the South Africa's disbanded 32 Battalion [22], which took part in several anti-communist and thus anti-Russian fighting throughout the continent. This, hand-inhand with the current pro-US orientation of this country, point to possible wishes of distancing from the lurking Russian presence and reaapproaching the US once again.

The final coup incident took place on July 31, 2023 in Sierra Leone, and was foiled before any action could have taken place. This country has always been deemed as a US ally. However, since 2018, Russia has stepped up with leaving a footprint on Sierra Leonean people, not only through military agreements, but also through providing education for local professionals at Russian universities. As a token of gratitude, Sierra Leone has, on several occasions, supported Russian initiatives at the UN, especially since the beginning of the SMO. However, the Russian influence in the country remains weak, due to the fact that Moscow does not have a diplomatic mission in Freetown; moreover, Wagner presence has never been recorded in the country, even though several researchers have recognized this country as one of the next Wagner's targets in Africa [23]. On the other hand, it is clear that the US still has control over the situation, given that a month after the coup was foiled, the current administration hired a US Army Special Forces veteran Jerry Torres as new Sierra Leonean national security adviser, in order to deepen the existent ties with the US administration [24].

After examining our six cases of coup activity, we come upon certain patterns when speaking of the power play between the two blocs. Namely, when analyzing the coup occurrences chronologically, it comes to our attention that, after Putin's turn towards Africa in 2019, the Russian PMC Wagner has maintained a hold on several countries on the continent, with the goal of creating strong military and economic ties. These ties came in handy, especially given the current stance of the West towards Russia and introduction of numerous sanctions.

The beginning of the SMO did not shake significantly the political situation in African countries. However, eight months into the conflict, we identify certain Russian aspirations towards taking a harder grasp on their African allies. Namely, the first coup in the region, occurring in Burkina Faso, brought Russian flags to the streets of the capital, in celebration of the new regime. The second coup, attempted in Sao Tome and Principe, previously defined as a nonaligned state, did not show any significant Russian footprint, or even US reaction, given the lack of possibility for emergence of pro-Russian orientation of the regime. The third case, occurring in Sudan, ended up being a failure, given that pro-Russian RSF did not succeed in overtaking the government, thus pushing the current junta leader closer towards the US and Israel. The US clearly took notice of increased Russian interest in regime change in Africa, thus reacting more strongly the coup occurring in Niger, which had a possibility of growing into a full-scale foreign military intervention. That is why it did not come as surprise when the fifth coup on the continent, attempted and foiled in Sierra Leone, was treated much more seriously, and resulted in an US Army veteran being hired as a national security adviser after the coup, thus preventing any spread of Russian influence. Finally, the last coup, occurring in Gabon, did not leave much space for Russian or US maneuvering, so both blocs remained silent, in waiting of resolution of the situation and orientation of the new government, but silently opening the playground for increase of influence of a known Russian ally - China.

This concludes our *old-fashioned* analysis of coups in Africa that took place since the beginning of the SMO. *Could this analysis have been done better, with the help of statistical analytics and machine learning?* Let us examine perspectives of implementation of predictive analytics in the following section.

IV. THE PERKS OF IMPLEMENTING PREDICTIVE ANALYTICS TOOLS

Now, after presenting the research conducted by hand, let us ask ourselves: *What could have been done better and more in-dept through application of predictive analytics most potent tools – statistics and machine learning?*

As we have said, predictive analytics is 'a subfield of data science that analyses historical data and makes predictions about future events or outcomes using statistical algorithms, machine learning, and other techniques' [25]. It is most often used for identification of patterns, detection of anomalies, and forecasting future trends, thus completely complements our research topic.

In the previous section, we were limited to using just an excerpt of knowledge and information present on the Internet. With the use of predictive analytics, we would have been able to gather, access and analyze larger amounts of data, and base our predictions on a bigger collection of information. Such data modeling would have presented us with a wider scope of results, i.e., not only online media publications, but also comments made by ordinary citizens of target countries, as well as their postings on social media platforms. As we have previously mentioned the case of postings on Telegram pro-Russian and pro-Wagner groups in relation to the Niger coup, we must note that such occurrences could have been a great identifier of a coup risk and possible Russian involvement, if caught prior to the coup being executed. With this example, we stress the significance of following social media presence of ordinary people, given that people have a tendency of freely expressing their opinion online. Moreover, following and analyzing public opinion on social network, and thus identifying polarization or East-West cleavages in certain societies through the opinion of the people, cannot be done without the use of predictive analysis, having in mind the fact that it is estimated that about 4.9 billion people use various social media world-wide [25].

Statistical analysis is based on collection and classification of data, presented as a collection of numerical facts, directed towards finding statistical patterns, thus pointing to certain variables that impact the final result of any possible case scenario. In our case, let us imagine that we have been provided with several databases – one consisting of instances of all coup activities in Africa, one listing all known US allies, and the one consisted of all known

Russian allies. Then, let us imagine that an AIassisted tool conducted an analysis and crossexamination of all the data, singling out pro-Russian and pro-US African regimes with recent coup activity, and then putting this list to the, for example, Hebditch and Connor ten-point putsch prognosis test, checking whether said countries are currently deemed as suffering from high coup-risk. At this point, we would be instantly left with quite a shorter list of possible answers to the question – what countries in Africa are deemed as possible coup playgrounds. From this point, our analysis, paired up with knowledge on current state in such countries, would enable us to search for coup triggers, as well as examine the Russian and US footprint more proficiently.

Presence of such statistical data would enable us to efficiently dive into exploration of the use of machine learning processes. First of all, let us remind ourselves that machine learning refers to data analysis conducted by a machine imitating the way humans learn and think, whilst the results and accuracy are increasing with its use. Machine learning uses statistical methods in order to find logical patterns in vast amount of seemingly illogical data. In our case, the biggest contribution of the use of machine learning models would come from sentiment analysis, rooted in social media monitoring in search of opinions of the locals regarding Russia or the US, the current regime, or the army. Moreover, the use of machine learning algorithms would enable us to implement news and opinion analysis techniques, which would have provided us with an objective public discourse regarding many political issues related to this topic. Machine learning could also have been employed in search of hidden political ideologies of seemingly non-aligned incumbents, such as the cases of Sierra Leone and Sao Tome and Principe, thus helping us understand political leanings and possible shifts in alliances. Alas, for a simple practitioner of political analysis, such tools are still out of reach, though machine learning processes are slowly entering our lives without us noticing it. For example, even simple Google query is nowadays based on machine learning, given the autocompletion process present in our search. Many of us use virtual assistants, such as Cortana and Siri, whilst some have dabbled into exploring ChatGPT.

All these algorithms, as well as many more, could have given quite a contribution to our research, having in mind the possibility of a faster, more proficient and more comprehensive grasp over manifold bigger collection of data. Therefore, it can be said that doing research *by hand* is enough, but optimizing it through the use of artificial intelligence and predictive analysis would have made it more than enough proficient.

V. CONCLUDING REMARKS

The initial idea of the author was to create a thought experiment, in which a human political analyst would give it best to beat the machine in political prediction. This has been a battle of a man against the machine, and even though we do not have exact proof, we might conclude that the advances in IT have made the classical Aesop's fable about the tortoise and the hare irrelevant, given that the tortoise, depicted in a simple human, will never again steadily progress and reach the goal first, but the hare, depicted in a machine, albeit stripped of human vulnerabilities and thus arrogance, will always reach the finish line first. Thus, we must encourage researchers to pair up with machines, in the service of science and in search of responses to many questions that await in the future. Thus, in this final chapter, we choose to fulfill the last phase of the predictive analytics process, albeit not only regarding our initial research topic, but regarding the future of political analysis in light of emergence of artificial intelligence as well.

In terms of coup incidence on the African continent in the following period, we must note that Africa is currently in a rebel phase, which is well being used by both the East and the West for promotion of their own interests. Following the matrix of three scenarios - most probable, least probable, and the median one - it must be said that coup risk in African societies is here to stay, with a possibility of spreading in concentric circles around the countries that have already went through unconstitutional regime change. There is the least chance that Africa will be depolarized in the close future, given that both Russia and the US will tend to maintain their strongholds in the previously identified countries, without leaving much space for the spread of interest of the other. Finally, we can conclude that the power divide will not shift significantly, given that many countries deemed as pro-Russian or pro-US on the continent have spent decades building such alliances and thus will not be ready to abandon them just yet.

In terms of the future of the use of predictive analytics and other artificial intelligence-assisted tools, it is most probable that the trend of their implementation in other fields, and in political

science as well, will be on the rise. It is least possible that researchers will predominantly opt for conducting research by hand - every profession is being rejuvenated with young blood, and the youngest generations have already grown up with technology in their hands. Thus, it will be most logical to them to implement such practices in their professional work as well. Finally, the median solution to our Human vs. AI riddle would be that this merger between political and computer science will be slow but gradual, given the fact that academic curriculums would have to adapt and introduce such practices in academia, in order to familiarize future political analysts with the possibilities artificial intelligence has to offer to political analysis.

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The Role of Artificial Intelligence in Human Resource Management

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Abstract—The field of human resources (HR) managers is one of several areas of business that artificial intelligence (AI) is beginning to have a growing impact on. Finding and hiring the finest people for a position is the responsibility of the HR manager, and using artificial intelligence in HR can significantly affect the hiring and human resource management processes. Automation of mundane jobs like screening resumes and choosing people for job interviews is one of artificial intelligence's largest effects on human resources. The candidate selection process can be made more effective and less prone to human mistake by using software solutions that rely on machine learning algorithms and data analysis. The paper's goal is to investigate how artificial intelligence affects human resources, both from a positive and a negative side.

Keywords - Artifical intelligence, human resources, positive side, negative side, management.

I. INTRODUCTION

The study of machine intelligence that mimics human cognitive capacities, including language comprehension, learning, reasoning, problem-solving, planning, pattern recognition, and all other human talents, is known as artificial intelligence [1]. HR managers can use artificial intelligence to find and assess candidates based on particular traits and abilities necessary for success in a particular position. Software technologies that analyze language and emotions, for instance, can assist HR managers in evaluating a candidate's motivation and empathy, which can be crucial in choosing the best candidate for the team [2]. The application of AI in HR, however, can also present significant difficulties and issues. For instance, there might be bugs in the software tools that

cause candidates to be treated unfairly based on their ethnicity, gender, or other characteristics. In order to ensure a fair and impartial recruiting process, it is crucial for HR managers to become familiar with the ethical concerns surrounding the use of artificial intelligence in HR [3].

II. MORE ABOUT ARTIFICIAL INTELLIGENCE

A number of subfields have contributed to the development of artificial intelligence in the past, including robotics (intelligent control. exploration), computer vision autonomous (object recognition, image understanding), speech processing (speech recognition and production). natural language processing (machine translation), neural networks (brain modeling), evolutionary computing (genetic algorithms, genetic programming), expert systems (decision support systems, teaching systems), plausibility modeling, and quantum computing [4]. New trends that emerged at the start of the new millennium will eventually become necessary for the entire flow and growth of the population [5]. The idea of digitalization is



Figure 1. Artificial Intelligence.

one that is encountered by people on a daily basis in normal life (Fig.1) [6].

Despite the fact that artificial intelligence (AI) has already substantially taken over all aspects of modern life, many individuals are still unclear as to what AI actually entails. Artificial intelligence basically denotes technology's capacity to mimic human behaviors like organizing, learning, and reasoning, hence resolving user requests and predicting the user's next move. The use of AI concepts and tools can be seen in examples like voice commands on mobile phones (Siri, the digital assistant with iPhone technology), suggesting the next best product to buy for each individual customer, recommending the best travel route, excluding those with major delays, identifying people (Face ID), parking services (Smart Parking), and many others [7].

The usage of these current technological tools in daily life enables us to complete jobs much more quickly and easily with the goal of shifting task performance from humans to smart gadgets, giving users more free time throughout the day and so improving quality of life. By automating the process, it becomes less necessary for the human factor to be involved in a variety of operations, relying instead on the mechanism built by the user's regular and repeated performance. Additionally, it is unavoidable to bring up some of the most well-known terminology associated with artificial intelligence, such as the Internet of Things (IoT) and Big Data, when discussing this topic [8]. In Fig. 2, subsets of artificial intelligence are



Figure 2. Subsets of artificial intelligence.

shown, while a little more will be written about each of them.

Internet of Things (IoT) - With the use of sensors, software, or applications, the Internet of Things (IoT) is a concept that facilitates communication between people and smart equipment. What does this all imply? The simplest way to comprehend this phenomenon might be to use a smart watch as an example. This device has the capability of processing the obtained data and quick presentation of the results of the studied activity by gathering information on the user's movement speed. On modern smartphones, the use of different programs can be recognized from one another without much difference [9]. The user can receive reports updated in real time through precisely processed data by wirelessly absorbing data and processing it further. There are numerous more well-known instances of the application of IoT technologies that, in addition to this, include the identification of specific phenomena based on the concept of sensors and the sending of feedback, notifications, or the performance of certain actions as a result. Some of them are Smart TVs, Smart TVs, sensor systems, and various more gadgets from this famous technology category [10].

Big Data- According to the definition of the Big Data concept (BigData Vs: Volume, Variety, Velocity, Veracity, Value), the processing and analysis of data that can be in various forms or quantities is what enables artificial intelligence to predict and realize each next step of the user. Big Data is the most effective approach to gather and reroute a lot of data in a world where there is already too much of it, making it available for further processing and use by intelligent technology. Artificial intelligence, which is based on data gathered and tailored to a particular application, may be the next step in the development of digital daily life. Additionally, the very existence of technology that can interact in real-time with data from IoT devices and. based on that, suggest or automatically carry out tasks that, up until now, have mostly been carried out by people, is a significant step towards the future of digitalization [11]. Working with various data types, such as images, sound, or text, also creates new opportunities for application and, from a technological standpoint, offers the potential for a successful fusion of three ideas: BigData, IoT, and AI.

Business Intelligence - Speaking of cuttingedge technologies, business intelligence (BI), another well-liked trend that the modern corporate world is moving toward, must be mentioned. Businesses organized as larger businesses with a unique management system are the primary bearers of the new smart business segment known as business intelligence [12]. The volume of data available to these businesses increased as a direct result of the volume of operations that increased, and the use of BI tools is a must for future work and organizational development in order to maintain competitiveness on the market. For the sake of clarification, BI tools are a collection of techniques used to convert sizable, unprocessed databases into current reports containing data that may be used to alter the entire management decision-making process. Users who wish to take business and decision-making to a higher level might do so by using these technologies in their applications. However, the user must possess a certain level of database and Excel knowledge in order to fully comprehend this notion [13].

Microsoft's *Power BI* tool gathers data from huge databases, processes and analyzes it, and then turns it into the reports needed to enhance the company's management system. This tool also stands in for the most well-known service within the Business Intelligence framework, and both its use and effectiveness are growing daily. This application allows the user to create an overall picture of the business by pulling data from numerous sources, highlighting areas that require additional focus and activity.

III. HUMAN RESOURCE MANAGEMENT AS A PROCESS SYSTEM

To comprehend the extent of AI applications used in HRM, one must first establish HR processes in detail. While some processes are transactional or task-oriented, others are analytical, requiring data analysis to arrive at the best business judgments. AI can be used in both situations, but in different ways. As a result, the objectives and degrees of AI deployment within current human resource management systems (such as information systems, web applications, and big data systems) will receive special consideration [14]. By developing, executing, and overseeing policies that control employee interactions inside the business, human resource management aims to ensure the effective use of organizational human resources. The authors Comarkovic et al. explored the problem of using artificial intelligence in human resource management systems, and they hold the opinion that management in the development of artificial intelligence should be divided based on particular aims, specifically [15]:

- in accordance with social objectives as actions that address moral and societal demands, including legal concerns like equal access to opportunities and compensation, among others..
- based on organizational objectives guaranteeing corporate efficiency, including staff retention, equal labor distribution, and training.
- according to functional goals according to the guidelines used to maintain the proper functioning of human resources within the organization
- Depending on individual objectives and the tools utilized to advance each worker's career, such as sustaining employee engagement and fostering personal growth.

IV. DEVELOPMENT OF THE HUMAN RESOURCES MANAGEMENT SYSTEM

The information system (IS), in general, was the first sort of human resource management system that was widely employed in businesses. The fundamental elements that set IS apart from other applications are the database, procedures, interfaces, networks, technologies, and the people who create and maintain them [16]. Traditional information systems, which help the organization's daily business operations, were often constructed on a relational database (DB). This kind of enterprise resource planning system is frequently a component of larger information systems. (ERP) Planning systems. ERP is a comprehensive IS that unifies important business processes inside the firm, such as administration of the production process, human resources, finance, and marketing.

According to Gartner (2022), some of the top information systems in the market are SAP ERP, Microsoft Dynamics 365, Oracle ERP, Sage, and others [17]. The ERP system's human resource management module, in contrast, includes the majority of human resource management processes. Such sub-modules as organizational management, people management, time management, payroll, travel management, etc. are all included in SAP HCM (Human Capital Management). SAP is currently using artificial intelligence, particularly machine learning algorithms, to enhance its fundamental business operations.

With the development of analytical information systems known as Business Intelligence (BI) systems, human resource analytics have been integrated to HRM [18]. The backbone of HR analytics solutions is a data warehouse (DW), special form а of database [19]. Two activities that DWs are designed to tackle include the examination of historical data as well as Online Analytical Processing (OLAP) cubes and other multidimensional queries. IoT and Big Data have given rise to a new class of application software that can process large amounts of data in a variety of formats (text, audio, video, and picture) in real time. To process such massive databases, which are generated nowadays by IoT devices and the web, new technologies are needed. The term "HR Big Data system" refers to the kind of program used to process data for HRM, which has a database named "Data Lake" [20]. Big data's totality and power are evaluated by applying certain algorithms based on machine data in real time, from many sources, located in specialized computer clusters, to graphically show it to the end user. Data science therefore encompasses the entire collection, cleaning, and normalization of data as well as dimensionality reduction and the use of machine learning methods. On the other hand, the recently released machine learning-based HR online and smart applications often only target a specific HRM procedure [21]. A brand-new category of database called Data Fabric was developed in 2021, allowing any data to be processed, handled, and stored in line with user requirements. This was made possible by the most current advancements in machine learning algorithms, such as the so-called deep learning (a collection of artificial neural networks), and blockchain algorithms).

A. Advantages and Disadvantages of AI in Human Resources

The AI in HR has the ability to enhance hiring accuracy and efficiency while also assisting HR managers in selecting the most qualified candidates for a particular role. To maintain a fair and impartial hiring process, it is vital to be aware of the difficulties and moral dilemmas that artificial intelligence in human resources may present [22]. HR managers can also benefit from AI's ability to optimize worker scheduling. AI can forecast future labor management and hiring needs using workforce data, allowing for better resource allocation and cost-cutting [23]. Speed and efficiency are two of the major benefits of adopting artificial intelligence in HR. Large data sets may be processed fast by software tools, which can then give HR managers the information they require immediately. As a result, HR managers may make decisions based on pertinent information, which may produce better outcomes [24]. The process of staff training can also be made better by artificial intelligence. HR managers may determine the most efficient training techniques and customize them to the unique needs of their staff by employing data analysis software solutions [25]. Artificial intelligence can also assist HR managers in managing and monitoring employee performance. Software tools that analyze employee performance data can pinpoint areas that need to be improved and give HR managers the knowledge they need to create effective improvement strategies. The lack of human interaction during the hiring process or the lack of flexibility in the criteria used to pick candidates are only two problems that can arise when artificial intelligence is used in HR. Additionally, some workers can be worried about losing their jobs as a result of the automation of repetitive labor [26]. Therefore, it is important for HR managers to understand that artificial intelligence cannot completely replace the human factor in HR. Human contact and decisions are still necessary to make decisions that affect employees and their development in the organization.

Artificial intelligence can be used as a support, but it must not be the only way to make decisions [27]. In any event, as businesses seek to increase efficiency and cut costs, the use of artificial intelligence in human resources is increasingly inevitable. Therefore, it is crucial for HR managers to be aware of the benefits and difficulties of employing artificial intelligence in HR so they can create plans for effectively using this technology [28]. In order to employ artificial intelligence efficiently, HR managers need also educate themselves on the usage of software tools and data analysis. Additionally, they ought to concentrate on honing abilities like emotional intelligence, communication, and human factor decision-making that cannot be substituted by AI [29]. In the end, organizations can gain

greatly from the use of artificial intelligence in HR, but it is crucial that HR managers approach this technology with caution and wisdom. Human resource management is still a crucial position that necessitates communication with others and complicated decision-making [30]. Although artificial intelligence can be a helpful tool for increasing productivity, it shouldn't be the exclusive method of handling human resources. The implementation of AI in HR marks a substantial shift in the way that human resources are managed. HR managers can benefit from artificial intelligence by optimizing the workforce management, hiring process, development, performance employee and management [31]. It is crucial for HR managers to comprehend the advantages and difficulties of utilizing AI in HR and to be able to do so in the most efficient manner possible. Artificial intelligence can be a helpful tool for increasing productivity, but it should not take the place of humans when making decisions that have an impact on personnel and their advancement within the company [32].

V. IS THE ARTIFICIAL INTELLIGENCE A THREAT FOR EMPLOYES?

If we consider all that has been published about artificial intelligence, human resource management, and human resources in general, we may say that artificial intelligence has actually made significant inroads into the lives and work of contemporary man. In addition to the many advantages AI offers, it can also pose a threat to workers since, as more jobs are replaced by AI simultaneously, the necessity for human resources inside an organization will decline, at least in those areas [33].

Of course, the question arises logically for the manager of the organization, "why should the organization have costs, say five or more employees, when those jobs can be performed by AI, whose installation in the system will be shortterm, but very profitable in the long run?" AI will save time, employee expenses, overtime, health insurance expenses, and never get tired or make mistakes! An example, but also the absurdity of job loss due to the introduction of AI into the organization, is represented by the Microsoft Company. Namely, the news that the ethics and society team, which worked within the organization for artificial intelligence, lost its job, shocked the public. The layoff was part of a series of layoffs that hit 10,000 employees at the company in early 2023. The team even designed an RPG game called "Judgment Call", which helped them predict the potential consequences that could arise from artificial intelligence.

They also worked to identify the risks posed by artificial intelligence [34].

In 2020, the team was composed of about thirty experts - engineers and designers. Already in October 2022, the number of employees in this sector has decreased to seven people. The pressure from the chief engineer and director was immense, with orders to take the latest Open AI models, as well as those coming after them, and reach the mallet's customers immediately. Team members said that Microsoft was focused on delivering VI tools faster than the competition. Because of this, the company's management became disinterested in the long-term thinking that this team was engaged in.

Recommendations for the use of Artificial Intelligence in human resources are multiple. The effects of artificial intelligence on human rights are one of the most important factors that will define the period in which modern humanity lives. Technology driven by artificial intelligence is entering more and more aspects of every individual's life, and it is increasingly being used by public authorities to evaluate someone's personality or skills, to allocate funds or make some other decisions that can have real and serious consequences for the human rights of an individual. That is why it is urgently necessary to find the right balance between technological development and the protection of human rights. The recommendations build on what the Council of Europe has already done in this area, especially through the European Ethical Charter on the use of artificial intelligence in the judiciary, the Guidelines on artificial intelligence and data protection, the Declaration of the Council of Ministers on the manipulative possibilities of algorithmic processes, and the Study on the dimension of human rights in automatic data processing techniques and possible regulatory implications, as well as the report of the United Nations Special Rapporteur on the promotion and protection of freedom of thought and expression, where the implications of artificial intelligence technologies on human rights in the information environment are discussed. It is based on the existing universal, binding and legally enforceable framework created by the international system of human rights, including the instruments of the Council of Europe for the protection of human rights. The

recommendations are addressed to member states, but the principles they contain concern anyone who has significant influence - either directly or indirectly - on the development, use or effects of an artificially intelligent system. AI developed in the private sector should be subject to the same standards as that developed in the public sector, when there is any intention to collaborate with public bodies or public services [35].

VI. CONCLUSION

Bearing in mind that the only way for continuous growth in the social and business world is enabled by the application of modern technologies, a closer acquaintance with them and all the benefits they provide can greatly contribute to the application of these technologies, but in a smart and "human way". Artificial intelligence today already has a huge impact on the development of the economy and society and modern humanity, and it is logical to assume that this influence will increase over time. It brings many positive effects as well as dangers and risks. Human resources must face this challenge by creating mechanisms for controlling high-risk artificial intelligence systems with maximum respect for human rights.

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Job Satisfaction in Scrum Teams

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Abstract—In modern business, the Scrum framework is predominantly used for project management. Given that human resources are an important factor in the aforementioned framework, one should take into account what positively and negatively affects job satisfaction. The paper presents positive and negative items that affect the success of the project. The created model shows problems that were found from literature sources from scientific databases. The results suggest that it is desirable to take care to reduce job dissatisfaction, and to motivate team members to be even more satisfied. Special attention should be paid to this because it will greatly affect the success of the project.

Keywords - Job satisfaction, scrum teams, agile methodology, job characteristics, model

I. INTRODUCTION

Agile methods have become increasingly popular in the industry, SCRUM project management framework [1] is commonly used [2,3]. Considering that their focus is on people, the goal is to create a harmonious team that will strive towards common goals, where it is important that the team members are satisfied with their work and that they are motivated to continue with the work, because the success of the project largely depends on their work.

Agile methodologists have claimed that a key value proposition for the adoption of agile methods is that the methods' practices, processes, and philosophy make people more motivated and satisfied with their jobs [4]. The claim of agile practitioners is that people who work in agile teams are more motivated and satisfied [4,5].

We also believe that it is important to pay great attention to and deal with people's

satisfaction. This paper presents a model that shows what positively and negatively affects job satisfaction and emphasizes the importance of project success.

II. BACKGROUND

A SCRUM project is divided into iterations called sprints, which last from two to four weeks [4]. The backlog of things to do is the basis for planning. User stories are considered software system requirements, but can also be other tasks such as bug fixes. The team estimates the work needed to address the backlog, a subset of which is prioritized and scheduled for the next sprint. Developers select jobs to work on from a prioritized set of jobs and update the team daily on progress and obstacles meetings. At the end of the sprint, the team goes through a retrospective meeting, where they demonstrate the software, evaluate the progress of the team and its work practices, and suggest and decide on improvements to be tried [2].

The extent of positive emotional response to the job resulting from an employee's appraisal of the job as fulfilling or congruent with the individual's values [6].

Job satisfaction and motivation are claimed to be one of the main effects of using agile software development methods, and this is confirmed by Melnik and Maurer [7] in a comparison of agile and non-agile software developers.

III. JOB CHARACTERISTICS THAT AFFECT JOB SATISFACTION

The influential relationship of job characteristics on job satisfaction and work exhaustion is well established [8-12].

Author Tessem et al. [2] demonstrated that autonomy, variety, significance, feedback, and the ability to complete a whole task were factors prevalent in the project. They follow the model created by the authors Hackman and Oldham's [13]. Hackman and Oldham's [4,13] Job Characteristics Model (JCM) is one of the most tested theoretical models in social science. It defines five job characteristic perceptions that impact a person's attitude about their job.

Factors that will lead to greater job satisfaction are [4,13-16]:

- Autonomy: the ability to define and solve your own work tasks
- Variety: the ability over time to work on different tasks.
- Significance: The ability to influence the result of the work process.
- Feedback: The ability to get meaningful responses to your efforts.
- Ability to complete a whole task: The ability to work on a task until it is complete without being removed or reassigned to other work.

Author in study [4] finds evidence of the positive impact of agile method use on perceptions of job characteristics, and job satisfaction. They conclude that there are complex relations still to be discovered regarding the impact of agile method use on job perceptions, and that the use of agile methods has the potential to make non-trivial impacts on the well-being of software professionals.

Hemon-Hildgen et al. [17], reveals eight common job satisfaction factors for most of the five studied profiles, two DevOps-specific: Role to play, Role recognition, Feedback from the team and the client related to work, Richness of the collaboration (content) between roles, The collective ability to collaborate and group dynamics. Common and specific dissatisfaction factors for agile and DevOps are: Unfulfilled expectation of even closer collaboration, Geographical distance hindering collaboration.

The model of Pedrycz et al. [18], identifies two major causes of job satisfaction, communication and work sustainability.

Hemon et al. [14], are revealed ten job satisfaction factors for most of the five studied

profiles: Task variety, Freedom of action and autonomy to experiment, The role to play in a collective, A recognized role, Participation in a successful project, Feedback from the team and the client related to the work done, The richness of the collaboration between roles. The coverage of a market need and interest in projects, The collective ability to collaborate and group dynamics, The collaborative process, allowing swift continuous improvement. They also present results that identify six factors of individual dissatisfaction within teams: Administrative process red tapes, Reduced time and lack of depth of work, A geographical distance hindering collaboration, Roles exposed to criticism, Operator overload, Lack of feedback from the hierarchy.

Regarding the use of agile methodology and job perception, the researchers in study of Sun et al. [19] said that principles such as iterative and sustainable development could improve job satisfaction.

In the study by Kanwal et al. [15], the results showed that job characteristics such as job autonomy and feedback mediate agile PM practices and job satisfaction.

In the study by Melo et al [1], a systematic review of the literature found the following motivators and demotivators in an agile environment: Autonomy, Changing, Development Needs Addressed (e.g. training opportunities to widen skills; opportunity to specialize), Feedback, Good Management (senior management support, team-building, good communication). Work/life balance (flexibility work times, caring in manager/employer, work location), Identify with Task (clear goals, personal interest, know purpose of task, how it fits in with whole, job satisfaction; producing identifiable piece of quality work). Software process/lifecvcle (software development, project initiation and feasibility studies, and maintenance), Problem Solving, Recognition of work done (for a high quality, good job done based on objective criteria), Rewards and incentives (e.g. scope for increased pay and benefits linked to performance), Sense of belonging/supportive relationships, Teamwork, and Variety of Work.

Findings of Setor et al. [16], show that the impact of agile development methods on IT professionals' intention to stay through job satisfaction differs for different company sizes. Specifically, we found that the effect of agile methodology use on intention to stay through job satisfaction is weaker in large firms than in small firms. This is consistent with our argument that the risks that threaten to disrupt software projects are more pronounced in large firms. These risks can cause stress for IT professionals, which reduces their level of job satisfaction.

IV. DEVELOPMENT OF JOB SATISFACTION MODEL

Our model in Fig. 1 was created based on a literature review guided by Hackman and Oldham's [11] Job Characteristics Model (JCM). The figure shows items after which can be positive and *negative* (positive or negative job characteristics), where the emphasis is on job satisfaction. The positive characteristics are as follows:

- participation in a successful project,
- motivation,
- autonomy,
- variety of skills,
- feedback,
- importance of role in the team,
- ability to perform tasks,
- collective ability cooperation and group dynamics,
- quality communication,
- appropriate salary,
- good working environment,
- trust,
- good management,
- a sense of belonging,
- a successful company,
- recognized role,
- a good work-life balance,

The negative characteristics are as follows:

- insufficient salary,
- stress,
- bad communication,
- bad working environment,

- geographical distance,
- little time,
- administrative process of bureaucracy,
- team roles,
- exposure to external criticism,
- bad feedback/lack of information,
- unmet expectations.

All these items were analyzed in the previous Chapter 3.

V. DISCUSSION OF JOB SATISFACTION MODEL

According to this model, it can be concluded that the job satisfaction of the team



Figure 1. Model of job satisfaction in teams.

members is a very important factor for the success of the project. The success of the company/organization will depend on the success of the projects. We previously said that people are the key factor, and as people are the key factor and play a key role throughout the project and since success depends on them, great attention should be paid to the satisfaction of team members. The team will not work well if it does not have an appropriate salary, if it is constantly under stress, if there is a bad environment and communication. It can also have a negative impact if the company is geographically quite far away. It may happen that the team members do not have enough time to do their work activities, that they encounter criticism, that they do not receive relevant information and the like. All these items should be taken seriously and one should try to create such an atmosphere to prevent and reduce all these items because then the employees will be more satisfied.

As for positive things at work, such as: participation in successful projects, motivation, autonomy, different skills of team members, relevant feedback, quality communication, trust, balance with private life, etc., you should take care to have all these characteristics at work because it will lead to job satisfaction.

A. Research Implications

This model can be used by industrial practitioners. It can help practitioners understand what influences team member satisfaction, which greatly influences project success and beyond. This model can be helpful for practitioners so that when they look at the model, they can see the negative items that negatively affect job satisfaction and make an effort to prevent/reduce the satisfaction, as well as see what is good and make an effort to maintain and increase it even more positive things that affect employee satisfaction. Researchers were able to spot negative items that negatively affect team member satisfaction and conduct an even more detailed analysis. This is an important factor for the success of the project that is worth further attention.

B. Validity of the Research

This paper gives implications on the importance of team member satisfaction where the authors are aware that there are some limitations that affect the validity of the research. It is possible that we did not find some case studies that were published in digital libraries. We searched the most influential libraries. All authors of this paper participated in the discussion and development of the findings and finally agreed on the defined items in the developed model. In the IT industry, the most applicable Scrum methodology is with possible modifications, which increases the generalization of the presented model.

VI. CONCLUSION

The presented model emphasizes the importance of job satisfaction, because nurturing the good things at work and reducing the bad can lead to greater employee satisfaction. In the future, it could be investigated what all the team members are dissatisfied with because people are the key and they perform all the work tasks that should lead to the success of the project. Therefore, it is desirable to pay special attention to all the bad characteristics of the job that lead to dissatisfaction.

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The Impact of Mobile Cloud Computing on Entrepreneurship and Start-ups

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Abstract-Smartphones have been part of everyday life for a long time. Even children of lower grades enjoy all the advantages of smart devices and use virtual memory to store larger volumes of data. In the world, cloud technology is used as virtual memory, which means that without consuming the physical memory of a phone, computer or other smart device, people can store a huge amount of data for their business or private needs. Cloud technology has an increasing application in entrepreneurship, and above all in the so-called business. start-up companies. The largest number of entrepreneurs and start-ups use smart devices in their business, and it is often the only basic tool they own. Precisely because the use of mobile phones for business purposes has experienced an expansion in the past few years, the idea came up to create a new technology for mobile services, which will offer some features that were not so prevalent until then - additional virtual storage capacity for information and documentation, reliability, privacy, heterogeneity but also availability. Considering all the advantages that cloud technology brings with it, the aim of this paper is to present its impact on the business of entrepreneurs and start-up companies.

Keywords – Mobile cloud computing, entrepreneurship, start-up, internet, digital transformation

I. INTRODUCTION

The emergence of cloud technology and its application in business operations was preceded by the expansion of the availability and use of the Internet. Cloud technology rests on the existence

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and high speed of the Internet. At the time it appeared, the Internet began to experience its expansion. smartphones developed in accordance with the development and expansion of Internet technologies, so they could follow the development of new applications. The key goal of cloud technology when using portable devices, especially mobile phones, is to develop and improve the use of innovative applications, and the advantages are saving time and money, but also better performance for both application users and application creators and Internet providers. Mobile cloud computing has enabled mobile devices to perform complex operations with limited resources, which still require powerful computing configurations. Therefore, mobile cloud computing represents a link between the unlimited possibilities offered by modern information systems based on Internet technology and small limited mobile devices.

II. WHAT IS MOBILE CLOUD COMPUTING?

Mobile cloud computing is a technology that enables the use of portable devices (mobile computers, tablets, etc.) for the same purposes as traditional computers. In order to function, mobile cloud computing is supported by appropriate hardware. software. and communication, which is the basic feature of the phone. The emergence of mobile cloud computing was preceded by the emergence of a technology known as "cloud computing", which aimed to increase the capacity and capabilities of information technologies in a centralized manner [1]. The point is that users can access the



programs they use on the computer, that is, the applications on the phone, and in this way perform some business transactions, record some information, or do some administrative part of the work at anytime and anywhere if the Internet is available.

After such a plastic explanation of what mobile cloud computing is, the definition proposed by Forrester Inc can be cited, which is that it is a standardized opportunity offered by a software, platform or application that is delivered via the Internet in a way that pay based on usage and self-service [2].

According to NIST (National Institute of Standards and Technology [NIST]), cloud computing consists of three layers, has four development models and five basic characteristics [3].

The layers of cloud computing are different. They are used for different purposes and for different user needs (Fig. 1) [4]. The first layer of cloud computing is known as SaaS (Software as a Service [SaaS]). These are applications that are located on the provider's platform and are paid according to the volume of use. According to [1], there is no need to install the software, nor to update it, considering that during the use of this layer of cloud computing, the applications update themselves. The most famous representative of cloud technology in the Software as a Service layer is certainly Google Apps, and there are also Microsoft Office 365, Dropbox, and other applications from cloud technology without which the business of modern entrepreneurs and start-ups is unthinkable. The second layer of cloud

computing is PaaS (Platform as a Service [PaaS]), which implies that the platform contains appropriate tools that will allow users to create applications adapted to their needs. Examples of the second layer are Google App engine, Microsoft Azure, and others. The third and last layer of cloud technology is IaaS (Infrastructure as a Service [IaaS]), which allows users to access computing resources and operations. IaaS users can develop and improve operating systems, software, and manage other operations [5].

According to [1], cloud services can be used in four forms - development models: private cloud, community cloud, public form and hybrid form, and their mutual relationship is shown in Fig. 2 [6].

The basic characteristics of mobile cloud computing are:

- *On-demand self-service* the user using cloud computing provides all computing resources himself without interaction with suppliers.
- *Online presence* users use the Internet and based on that, have the ability to access computer resources from any device.
- *Consolidation of computing resources in the cloud* users can use this technology wherever they are; on the other hand, the same resources are used simultaneously by a huge number of users.
- *Great elasticity* in terms of capacity utilization, which changes depending on current user requirements.



• *The possibility of monitoring the use of computer resources* - users pay only for what they use (computer power, virtual memory, bandwidth, etc.).

Cloud computing is obviously an easy, cheap, and elegant way to perform everyday business and private activities. It is used by a huge number of people, as well as entrepreneurs, often without even realizing it. The first layer of SaaS cloud technology is certainly the most visible and easiest to use for end users, but all three layers as a whole lead to significantly better business efficiency for both large companies and small entrepreneurs.

III. ENTREPRENEURSHIP AND START-UP COMPANIES

In theory and in practice, entrepreneurship stands out more and more as one of the basic factors of economic development. It is not just an assertion without evidence, precisely in the most developed countries of the world, entrepreneurship has initiated a faster wave of economic growth and development.

The global market, the growing trend of regionalization, but also increasingly fierce competition based on innovation and knowledge are factors that constantly impose the need for the application of modern information technology. The use of the Internet and modern technologies has led to huge savings in business operations, but also to the networking of companies, so that information, as the most important resource, has become more accessible [7]. It is unthinkable that in such circumstances entrepreneurs and owners and workers of start-up companies do not have developed digital competences because without them they would not survive in the global market [8].

In less developed and underdeveloped countries, the process of transition from a socialist to a capitalist economy is still ongoing. Entrepreneurship has not taken root to a sufficient extent to say that it has a decisive influence on economic development. In Serbia, entrepreneurship began to develop only in the eighties of the 20th century, but to this day, the process of transformation of the economy is still not over. There are many factors that have influenced the slowing down of this process, such as the collapse of the former SFRY, through NATO bombing and the Global Financial Crisis, to the pandemic caused by the Sars-cov-19 virus and the Russian-Ukrainian war. Therefore, in Serbia as well as in other post-transition countries, an encouraging environment must be created that will have a holistic approach, and that will lead to the development of entrepreneurship and start-up companies, as in developed countries.

In such an environment, it is assumed that all elements of the entrepreneurial ecosystem must be in the function of encouraging entrepreneurship to initiate development. There are many of these elements, but Isenberg divided them into six groups: culture, politics, finance, human capital, market, and institutional and infrastructural support [9]. Isenberg's model is basic, and all later versions of the entrepreneurial ecosystem are upgrades of Isenberg's model.

In addition to creating a stimulating environment through entrepreneurial ecosystems, it is also necessary to support entrepreneurs in their early stages of development. This implies the establishment of various business incubators, accelerators, and other organizational forms, which, in addition to space and equipment, will offer consulting,





The assumption is that entrepreneurship can be done by creative people full of ideas, inclined towards innovative behavior, but very often the limiting factor in the realization of their ideas is precisely the lack of financial resources. Despite this, they often embark on a business adventure with only a tablet or a mobile phone as their equipment, with which they will complete all their duties, as well as store all the documentation needed for business. Since it is extremely difficult to obtain financial resources in a traditional way, recently the initial capital is increasingly being obtained through various crowdfunding platforms, which are also based on cloud technology. On these platforms, entrepreneurs present their business ideas and receive in return financial resources to start a business [10].

It is precisely here that the parallel between entrepreneurs and start-ups can be drawn. A start-up is a company in an early stage of development, which has not yet found an adequate business model. It is created with the aim of developing a new product or service for which entrepreneurs believe there is a demand. They start their business with huge expenses and little income, but they have a vision that their business will have a fast growth and a big reach, and therefore they are looking for a way to finance their innovative ideas. As it is extremely difficult to find investors, especially with ideas that are still unexplored, they often rely on alternative ways of financing. The application of cloud technology in the business of entrepreneurs and start-ups reduces the costs and time required to carry out business operations, and entrepreneurs who are digitally competent can achieve much better performance than those who do not use this form of modern information technology.

IV. MOBILE CLOUD COMPUTING AND ENTREPRENEURSHIP AND ETART-UP COMPANIES

Cloud computing is no longer a novelty. It is a technology that has created a more flexible work environment and has allowed entrepreneurs and start-up companies to grow without investing in expensive computer equipment or databases. The extreme flexibility of cloud technology allows businesses of all sizes, successful and less successful, to use this technology in an easy. accessible, and affordable way.

Mobile cloud computing is not only about large virtual memory that allows storing large amounts of documents and information. The fact that environmental pollution is reduced by reducing the amount of paper used is not the only advantage. On the contrary, cloud standard computing, or mobile. allows entrepreneurs and start-ups to reach the minds of potential clients, using marketing methods that are no longer innovative because they have been around for a while. We are talking about chatbots, virtual assistants, but also the ability to control and monitor traffic in terms of assessing business growth. This type of technical support facilitates the business of entrepreneurs in another way, in a way that reduces the use of computers and increases the use of mobile devices that are portable and work anywhere, where there is Internet.

It is not allowed to forget the digital marketing channels, which are generally present today and much more accessible than traditional marketing channels. Traditional marketing is mostly available to the big players in the market because of the excessive price that small entrepreneurs and start-up companies are not ready to accept. It has never been cheaper to create a website, as an identity card of a company [11], but also to start and manage social networks to promote business, but also to reach the awareness of clients - existing and potential, and in order to spread awareness of the existence of a new and better product or services. The media most often used for digital promotion are, in addition to the mentioned website and social networks, email and SMS.

According to data from 2022, digital business has brought enormous results, which proves that it is necessary to follow modern information technologies for entrepreneurs and start-ups to function successfully [12].

Otherwise, after the state of emergency that was introduced in all countries due to the spread of the Sars-cov-19 virus, it was realized that without digital business, business cannot continue. During that period, people accepted the possibility of being able to make various purchases, communicate with colleagues, clients and perform other operations that were traditionally tied to the office from the comfort of their homes. This is important to point out because it is also a part of cloud technology and that is the first layer, which is the most common in business.

Mobile cloud computing is just one of the technologies that have driven the digital transformation of enterprises (Fig. 3) [13]. Digital transformation implies the strategic management of the company's technological capacities with the aim of creating a competitive advantage on the market or significantly improving performance with increased efficiency [14].

V. ADVANTAGES AND DISADVANTAGES OF THE APPLICATION OF MOBILE COMPUTING IN THE CLOUD IN THE BUSINESS OF

ENTREPRENEURS AND START-UP COMPANIES

Based on all the possibilities that cloud technology offers, it is necessary to systematically list the advantages and disadvantages of this technology, with which entrepreneurs should be familiar [15]. When talking about advantages, it is necessary to emphasize ease of use, cost reduction, reliability, security, privacy, but also the possibility of sharing information and cooperation.

Ease of use. Employees of a company often work in the field or from home, and due to the need to perform their work, they need access to documentation, programs (applications) and information. Today, it is easily feasible thanks to the application of cloud technology in mobile computing, where in a few clicks, anyone can complete the desired transaction. Given that most administrative and accounting tasks have transferred cloud been to technology. entrepreneurs (managers and owners) have more time to deal with strategic issues [16]. The application of cloud technology, in this sense, helps to reduce administrative and travel costs because it allows access to business from any location using small powerful portable devices that have simple user interfaces [17].

Increasing business efficiency. Suffice it to say that the use of cloud technology does not require the possession of expensive computer facilities and programs, which consume a large amount of electricity. For a small monthly subscription, cloud technology allows entrepreneurs and start-up companies to reduce their costs. Companies that have adopted this technology have recorded large cost reductions because, in addition to reducing the cost of purchasing computer equipment and the electricity it consumes, they have also reduced the costs related to maintaining computer equipment and have gained the possibility of cheaper use of platforms for managing the company's operations [18].

Reliability, security, and privacy. The reliability of cloud technology in relation to entrepreneurs and start-up companies is reflected in the fact that applications, files, and all other information are available 24/7, regardless of emergency circumstances such as power outages and the like. This reliability is
important for entrepreneurs and start-up companies, but it is even more important for large corporations. If there is a failure in this technology, there is always the possibility of transferring the data of the end user, in this case the entrepreneur, to another cloud provider, which is very important in terms of the reliability of this technology [19]. And security is good in the cloud, considering that the authentication and encryption method is used to access the data and applications of each individual user [20]. According to [20] as many as 75% of managers are concerned about cloud security. But according to the same source, the loss rate of USB drives is as high as 66%, it concludes that cloud technology is still safer.

Sharing and collaboration. Sharing business information and files has never been easier. With the spread of smartphones and social networks, entrepreneurs have improved their internal communication between employees and between managers and owners with employees. An excellent example of cloud technology that enables successful sharing of documents and collaboration among team members is Google, which with its numerous applications based on cloud technology enables complete business. Communication with external stakeholders was also improved [21].

Regarding the disadvantages and shortcomings, it is worth mentioning the unavailability of the Internet, high network load, security, the possibility of business control, the costs of increasing the bandwidth in cloud technology [22].

Network unavailability. This refers primarily to the unavailability of the Internet. Logically, the mobile application in the cloud can only be accessed when the Internet is available. Despite the high speed and wide distribution of the Internet, it is often the case that the Internet does not work as it should and traffic is stopped or slowed down for technical reasons.

Heavy network load. In situations where many users are connected to the same platform, delays, or the inability to perform an operation may occur despite the high speed of the Internet.

Safety and security. Due to numerous hacker attacks, businesses are often concerned about the privacy and security of their files.

Business control. Often, companies have different needs that cannot fully personalize a mobile cloud computing service. Therefore, the

mobile cloud computing service provider has full control of the business, while the clients have only partial control of the business.

Increasing bandwidth. Investments in modern information technology cost companies a lot, as well as consumed electricity and maintenance of computer infrastructure. But if businesses have many transactions and need a large storage capacity, they need to pay more to increase the bandwidth, so that all operations can be performed smoothly.

VI. CONCLUSION

Mobile cloud computing emerged a few years ago to overcome the spatial limitations of business operations. It was very quickly accepted by a huge number of individuals and legal entities. The advantages of using mobile computing in the cloud are numerous and they still outweigh the disadvantages, which contributed to the rapid spread and acceptance of this form of technology in business. What should be mentioned is the impact on the company's operations. The application of these technologies leads to a reduction in costs and an increase in performance with enormous flexibility in work.

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Value-semantic Concepts of the Text in the Formation of the Pedagogical Picture of the World among Graduate Students

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Abstract—The article presents the importance of the formation of a pedagogical picture of the world among graduate students, future teachers and researchers; the analysis of the problem of studying the value-semantic content of the text as a means of forming a pedagogical picture of the world among graduate students, presented in Russian science, is carried out; the technological aspects of the formation of a pedagogical picture of the world among graduate students are proposed.

Keywords - Pedagogical picture of the world, value-semantic concepts, technologies for the formation of a pedagogical picture of the world among graduate students.

I. THE URGENCY OF THE PROBLEM OF THE FORMATION OF A PEDAGOGICAL PICTURE OF THE WORLD

Today, the problem of forming a holistic pedagogical picture of the world among graduate students, future teachers, and researchers of higher education, has become acute. This is due to several significant trends of modern pedagogical science and education:

• Modern media and communication technologies form a "clustered society", clip (mosaic) consciousness, where reasoning is not required from a person, "hypertextual spatial content has supplanted linear narration", students are not able to establish cause-and-effect relationships and chronology of events [1].

- It is noted that "the gap between the pictures of the world, the intentions of the addressee and the lack of understanding of these intentions by the recipient leads to communicative failures or a distorted perception of information" [2].
- The requirements for the profession, ideas about a person and his future professions, ways of self-realization in the profession are changing [3].
- •Other requirements are imposed on the modern teacher (to have a scientific worldview, a critical and selective approach to new theoretical information, an understanding of the variety of concepts and aspects of pedagogical reality, an adequate understanding and interpretation of the text and the real picture of the world) [4].
- Future teachers-researchers are required to be able to put forward new ideas and knowledge, insight, non-linear ways of obtaining knowledge, to integrate into the information space of modernity, the reproduction and transformation of texts as a branch of knowledge of values and a person, modeling, designing, and forecasting the vector of development of personality, education, and science [5].
- The requirements for teacher education (to become "education plus") aimed at involving students in the general cultural space of Russia (creative, aimed at creating/translating

cultural texts, projective, including the development and implementation of cultural and pedagogical technologies, representing the integrity of the content (cultural, didactic, professional, systemic-structural, technological, psychological) are changing [6].

II. THE PEDAGOGICAL PICTURE OF THE World is an Object of Scientific Knowledge

The current stage of training highly qualified teachers requires a revision of the positions of teachers in the formation of a pedagogical picture of the world of graduate students based on the creation of development and scientific pedagogical texts, which is due to the frontiers of new pedagogical research, the digitalization of education, the transition to an on-line mode of training and the use of digital means of independent search for the necessary scientific information. The formation of a pedagogical picture of the world of students is one of the necessary conditions for the formation of the professionalism of future teachers, a good look into the future of the development of pedagogical science. According to Sagitdinova T. G., the picture of the world is a holistic system of knowledge and ideas about the world that a person is guided by. "The pedagogical picture of the world, as the researcher notes, implies the formation of the foundations of a professional worldview, value professional orientations, professional motivation and a holistic attitude to professional traditions and customs, skills and abilities to follow professional norms and patterns of behavior, pedagogical culture and tact" [7].

We share the position of the scientist that the pedagogical picture of the world reflects values as ideals, activities, personal and creative aspects that determine the professional identification of a person as a teacher. In our study, the pedagogical picture of the world, formed by graduate students, is understood as an integral system of related concepts (value-semantic, contentinformational, scientific-methodological, technological, creative-evaluative) that determine the quality of research activities, the nature of communications in the scientific community and the image-ideal of pedagogical activity. The importance of cognition of the pedagogical picture of the world by future teachers-researchers is urgent since it reflects the connection between language and cognition,

language and thinking. Knowledge of the scientific totality (national, global, ethnic, linguistic, value-semantic, pedagogical, etc.) in pedagogical texts makes it possible to expand the pedagogical horizons of the future teacherresearcher, to develop an evaluative and critical picture of pedagogical reality. For a teacher whose activities are aimed at forming the image of a Russian, at educating a citizen and patriot of his homeland, it is significant to know and comprehend the worldview of their people, the codes for educating the younger generation, indicated in the "recipe texts" - national and cultural tradition, social restrictions (professional, family, etc.). It is the texts that are informative for graduate students and valuesemantic for the formation of a pedagogical picture as the heritage of the people about their forces (natural, hereditary, social, pedagogical, and cultural, etc.).

Based on this thesis, in the process of training graduate students, the need to change the technologies of working with new educational realities and scientific research, pedagogical and linguistic texts that reveal a new pedagogical picture of the world on an interdisciplinary basis is actualized. The formation of a pedagogical picture of the world among future teachersresearchers is provided on an interdisciplinary basis: pedagogical, activity, linguistic, valuesemantic, cultural approaches. Concepts, which, according to A. N. Prikhodko, being fixed in the language, receive the status of an evaluation code, and determine the behavior of the individual, create a value picture of the world as a cognitive construct of the people about the desired structure of the world and the qualities of people [8].

An interdisciplinary approach to the preparation of graduate students to work with texts - perception, reading, interpretation, understanding, comprehension, judgments, etc. creates new opportunities to ensure the quality of postgraduate training, starting from the first year, which leads to the development of critical thinking of the future teacher-researcher, "epyIIIK" holistic pedagogical picture of the world and worldview, which is based on value-semantic concepts.

III. VALUE-SEMANTIC CONCEPTS AS UNITS OF TEXT

The text of the scientific article, which is studied by a graduate student, provides him not only with the necessary information, but

according to A. V. Kozachina creates "pedagogical discourse as a space in which there is not only the transfer of knowledge, skills and abilities, but also the transfer of values and moral guidelines, which are most often dictated from above" [9]. When it comes to the formation of a pedagogical picture of the world among graduate students, it is important for the teacher to create conditions for them to understand the target significance of the text of the article, its valuesemantic concept, to establish compliance with the goal and the results formulated by the author of the article, to realize the step-by-step logical description by the author of the article of progress in the study from the goal to the expected scientific result. Comprehension of the texts of other authors allows graduate students to form holistic ideas (patterns, relationships) about the object and subject of research under study, to encourage them to search for contradictions and the vector of their research, to determine the tasks and hypotheses of the study, etc.

Starting to work with scientific texts of articles using the method of content analysis, graduate students clarified the concepts of "values" and "meanings" as units of the text, the distinctive characteristics of knowledge and values, the process of cognition and the discovery of values and meanings, which are significant for the future research scientist, teacher-researcher of higher education. In the works of V. V. Krasnykh, it was emphasized that it is in the units of the conceptual sphere of the text that the deep meaning, motive, judgments of the author are hidden, which provided him with the creation of the text - semantic structure, logical and compositional organization. communicative orientation. It is the concept of the text that is the "explosion point" that arouses interest in the phenomenon presented, making it vitally significant [10].

IV. PURPOSE AND METHODS OF RESEARCH

The purpose of the study was to find technologies for the formation of a pedagogical picture of the world among graduate students and to develop the skills of understanding and creating scientific texts with the value-semantic core of the author's research. The research methods were content analysis of scientific texts according to specified conditions, theoretical analysis and comparison of the structures and value-semantic concepts of a scientific text and the value-semantic expectations of a graduate student from the article after reading it, independent design of structural and logical components of your own article on a given topic.

V. TECHNOLOGIES FOR THE FORMATION OF A PEDAGOGICAL PICTURE OF THE WORLD

AMONG GRADUATE STUDENTS IN THE PROCESS OF WORKING WITH SCIENTIFIC TEXTS

In the process of studying the discipline "Methodology and frontiers of scientific research", the formation of a pedagogical picture of the world among graduate students was carried out by communicative, dialogue and modeling technologies that qualitatively change the educational space of educational activity. At the indicative stage of studying the discipline, the method of content analysis of scientific texts was used, which allowed graduate students to identify, analyze, compare individual elements of the article: the relevance of the topic, the validity of the problem and the indicated reasons for its appearance; accuracy of the topic, goals, objectives and research methods identified by the author; consistency, phasing of the stated content of the article; value-semantic concepts and repetitive units of the text; features of the author's judgments, assessments (positive/ stvle. negative); own assessments of the author's text of a scientific article.

At the value-oriented stage, the method of conceptual analysis (language tools expressing value-semantic concepts, the cognitive structure of the text, the reconstruction of the concepts of the linguistic picture of the world) was actively used as part of content analysis or as an independent method of analyzing the definition of a value concept in the primary or secondary reading of the text of the article. This method was presented in the form of a pictogram (method of indirect sign study). To determine the valuesemantic concept of a scientific article, discussion situations were created as a test, reflection, self-assessment of the elements of the pedagogical picture of the world discovered independently as guidelines for future research activities.

At the stage of updating our own research experience, the method of graphic modeling was used to create a draft of my future article. The method of graphic modeling is aimed at developing the ability of graduate students to visualize reasoned relationships in the description of the pedagogical picture of the world, the object being studied, to independently construct individual elements of the pedagogical process under study and express them with signs, to interpret the value-semantic meaning of the created graphic text. Creative discussion as a method created an environment of scientific comprehension, meaning making of the pedagogical picture of the world, the search for an individual communicative and textual style. In the process of creative discussion, graduate students exchanged judgments about the understood value-semantic concepts, established the identity of the author's positions and the judgments of graduate students.

VI. CONCLUSION

The formation of a pedagogical picture of the world among graduate students as future teachers-researchers is due to the modern challenges of pedagogical science and educational practice as a way to rethink a new vector of development of scientific thought; as a mechanism for actualizing the scientific, professional, personal, value-semantic and evaluative resource of the individual: the formation of communicative, research, social experience, a stable system of value orientations.

Methods of achievement (the goal-the formation of a pedagogical picture of the world among graduate students) ensured the effectiveness of this process due to an interdisciplinary approach (activity, linguistic, axiological), a balance of mental, graphic, discussion activities, actualization of the scientific and personal position of graduate students in the creation of scientific texts.

Based on the foregoing, we can assert that the formation of a pedagogical picture of the world among graduate students, which develops in the process of preparation, is due to the valuesemantic constructs of the text of a scientific article, a model of the world (scientific, mental, ideal, humanistic, etc.) reflected in it.

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Risk-Based Thinking in the ISO 9001:2015 Standard

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Abstract-Unlike the ISO 9001:2008 standard, where risk-based thinking was given implicitly, in ISO 9001:2015 risk is presented explicitly in the planning chapter. Accordingly, it is required for the organization's management to define risks and opportunities as a basis for planning and to understand the external and internal context in which it operates. Answers to questions of what, who, how, and when to undertake to prevent or reduce adverse effects, achieve planned results, and continuous improvement are given in the planning process. Instead of preventive measure concept from ISO 9001:2008, the ISO 9001:2015 standard presents the risk-based thinking concept. Besides being a proactive approach, which is more understandable and effective that the preventive measure from the previous standard, it significantly reduces the need for corrections and corrective actions. The focus here is the *planning* chapter from ISO 9001:2015, which relies on requirements defined in the standard chapter context of the organization. The paper discusses two concepts not specifically addressed in the standard:recognizing risks and opportunities and planning measures related to risks and opportunities. ISO 9001:2015 is more flexible than ISO 9001:2008. It allows management to freely decide on the application of a narrower or broader risk management methodology compared to the standard requirements. In line with this freedom, the standard emphasizes the organization managemnt's responsibility for applying the riskbased thinking concept, as well as measures it takes to deal with risk. Management also has to prove that it has identified, analysed, and where necessary, take measures to address all risks and opportunities.

Keywords - Thinking, planning, risk, opportunities, management.

I. INTRODUCTION

Organizations that implement the ISO 9001:2015 standard are essentialy using a

management tool that is internationally recognized. Out of the thirteen changes in this standard compared to the previous ISO 9001:2008, the focus of this paper is on one particular amendment: *risk-based thinking*. Since the measures related to risks and opportunities are not specifically singled out and titled in the ISO 9001:2015 standard, they are addressed here. These measures pertain to *recognizing risks and opportunities* and *planning actions concerning those risks and opportunities*.

A primary purpose of the Ouality Management System (QMS) is to serve as a preventive tool. Hence, the concept of a preventive measure is omitted in ISO 9001:2015. This concept is expressed by applying risk-based thinking found in Chapter 6 of the standard-planning. This chapter clousely relates to the requirements defined in Chapter 4 of the standard-the context of the organization. In other words, Chapter 4 provides the input for a significant portion of Chapter 6, which covers requirements related to measures for addressing risks and opportunities, quality objectives, and planning for their realization. Measures regarding opportunities can also encompass considerations of risks associated with them.

From Chapter 6, it's evident that riskbased thinking is the central concept in ISO 9001:2015. It's an addition to this standard, having a significant impact on the application of the Quality Management System. Moreover, compared to the 2008 standard, an improvement is seen in emphasizing opportunities. In fact, the organization's management is required to plan and implement processes for addressing risks and to leverage existing and/or anticipated opportunities. As a basis for writting this paper, the book by Nikola Vujanović was used, which is given in the references under serial number [1].

II. RISK-BASED THINKING

In the ISO 9001:2015 standard, there is no concept of preventive measure. Instead, it speaks of risks and opportunities. Additionaly, the essential concept of identifying and resolving potential problems and errors before they occur is retained. Measures to address risks and opportunities are primary drivers of the Quality Management System. The risk-based thinking concept was implicit in ISO 9001:2008. In other words, it was presented through the standard's requirements for planning, review, and ISO 9001:2015 improvement. states requirements for an organization's management to understand the organization's context (section 4.1) and determine risks and opportunities as a basis for planning (section 6.1). This means that an organization's management applies riskbased thinking in planning, as well as in the implementation and improvement of the QMS processes (Section 4.4).

From the standpoint of an organization's management's ability to achieve objectives, not all QMS processes carry the same level of risk. According to the requirements in section 6.1 of the standard, management is responsible for applying its risk-based thinking and for measures it takes to address risk. Also, management must demonstrate that it has identified, analysed, and where necessary, taken actions to address all risks and opportunities. Additionally, management should plan and apply measures related to risks and opportunities to ensure the organization's alighment with ISO 9001:2015. In this manner, a foundation is established to enhance the effectiveness of Ouality Management System, preventing negatives and achieving improved outcomes.

Opportunities may arise as a product of circumstances conductive to achiving a planned result. For instance, a set of circumstances that allows an organization's management to develop new products and services, incresase productivity, reduce waste, or retain existing an acquire new customers. Measures related to opportunities may also encompass consideration of risks associated with them. Risk is the effect of uncertainty. Every uncertainty can have positive and negative outcomes. A positive deviation resulting from a risk can provide opportunities. However, not all positive outcomes of risks lead to opportunities. The riskbased thinking applied in ISO 9001:2015 has enabled a reduction in prescribed requirements and their replacement with performance-based requirements. Also, it faciliates the determination of scope of documented information.

A. Application of Risk-Based Thinking Concept

In the Quality Management System, this concept can be applied as follows:

- Firstly, management needs to recognize risks and opportunities depending on organization's context and the scope and field of application of the QMS. If risks and opportunities aren't adequately identified, they cannot be integrated into process development.
- After recognizing and understanding the risks and opportunities, management should evaluate them, differentiate between what is acceptable and what isn't, and plan measures to address these risks and opportunities.
- The organization's management should make appropriate decisions concerning risk reduction factors and the necessary steps in that regard.
- Following that, management should take measures and incorporate them into business processes, as well as execute the strategy defined during the planning phase.
- Lastly, the organization's management must assess the effectiveness of this measures processes for continuous improvement.

III. MEASURES RELATING TO RISKS AND OPPORTUNITIES

These measures aren't specifically isolated and titled in the ISO 9001:2015 standard. They relate to the requirements of *recognizing risks* and opportunities and planning measures concerning risks and opportunities.

A. ISO 9001:2015 Requirement: Recognizing Risks and Opportunities

The ISO 9001:2015 standard requires the organization's management, during the planning

of the Quality Management System, to analyze the rquirements from section 4.1 (*understanding* the organization and its context) and 4.2 (understanding the needs and expectations of intersted parties). After that, it should recognize risks and opportunities that must be addressed to ensure the effective realisation of desired QMS outcomes, enhance beneficial effects, prevent or reduce undesired effects. and achieve improvements. The purpose of this requirement is to prevent non-conformities, including those from output elements, and to identify opportunities to incresase customer satisfaction or achieve the organization's quality objectives.

Always present is the risk that the QMS doesn't achieve its goals. This happens when the organization's processes, products, and services don't meet set requirements or when the organization, for some reason, fails to meet customer expectations and/or causes their dissatisfaction. Opportunity examples include the potential to recognize new customers and market-driven needs for new products and services, as well as increasing efficiency by reviewing or redesigning processes using new technologies.

B. How to Recognize Risks and Opportunities in an Organization?

It's crucial to understand that not all risks and opportunities are the same. For instance, some risks can pose a serious threat to human lives, put the organization out of business, or simply be a minor inconvenience. Also, some opportunities can yield long-term positive results, while others provide immediate benefits. Initial considerations in recognizing risks and opportunities are based on sections 4.1 and 4.2 of the ISO 9001:2015 standard. While the standard doesn't require the use of SWOT and PESTLE analysis, it's recommended to use these tools at the strategic level for understanding the organization and its context. Here, SWOT refers to the analysis of strenghts, weaknesses, opportunities, and threats. PESTLE stands for the analysis of political, economic, social, technological, legal, and environmental factors. Weaknesses and threats represent internal and external risks for the organization, while strengths and opportunities symbolize internal and external benefits. This approach faciliates recognizing internal and external issues crucial for the strategy impelmentation of the organization.

A highly important factor for the analisys of risks and opportunities is the interested parties mentioned in section 4.2 of the ISO 9001:2015 standard. In other words, management cosiders what these parties seek and expect from the organization. It's essential to understand that every requirement from these parties can represent an opportunity, a risk, or a combination of both. The third crucial tool used in this endeavour is corrective actions. The goal of these actions is to eliminate non-conformity causes, leading to a substantial risk reduction.

While there's no need for management to address all risks nad opportunities, they also lack the time and resources to do so. The ISO 9001:2015 standard states that the organzation's mangement should recognize the risks and opportunities it will deal with. In other words, it's not necessary for it to address all risks and opportunities but only the most significants ones. This is enabled by the evaluation process.

TABLE I. EXAMPLE OF POSSIBLE EVALUATION OF RISKS.

Potential Impact	Likelihood of Occurrence
Small	Low
Limited	Possible
Noticable	Noticable
Significant	Significant
Large	High

It is common for risks to be evaluated quantitatively. Opportunities are most often assessed qualitatively, that is, in a subjective manner. In this process, management must adapt the evaluation of risks and opportunities to their own organization.

The Table I shows two risk evaluation factors (*potential impact* and *likehood of occurrence*). Multiplaying these provides a risk priority ranking (RPR). After evaluating the risks and calculating the RPR for each risk, a RPR value is determined, above which appropriate measures need to be taken. For instance, the organization will take action for all risks with a value above RPR 10. On the other hand, by addressing the most critical risks and opportunities, the organization significantly enhances the efficiency of using its resources.

C. How to Implement the Requirement: Recognizing Risks and Opportunities?

Compared to the 2008 standard, the ISO 9001:2015 standard (section 6.1.1) introduces a requirement for new the organization: recognizing risks and opportunities that have the potential to impact the operation and performance of its Quality Management System. This impact can be both positive and negative. Each organization's management decides on the utilization of the most favorable approach (systematic) or risk menagement methodology. The former implies that each organizational unit is viewed as part of a lager whole. This viewpoint examines the dynamics, i.e., changes over time in all phenomena within the organization and its environment. In the latter case, if no specific approach or risk management methodology is prescribed, the organization can apply the ISO 31000:2018.

D. ISO 9001:2015 Requirement: Planning Measure to Risks and Opportunities

The ISO 9001:2015 standard requires the organization's management to plan measures relating to the risks and opportunities previosly identified (as per requirement 6.1.1 of the standard). It also outlines how an organization should integrate and implement these measures within its Quality Management System processes and evaluate the effectiveness of these measures. The standard also emphasizes that actions taken concerning risks and opportunities must be proportionate to the potential impact on the conformity of products and services.

The paper introduces risk-based thinking as a valuable addition to the ISO 9001:2015 standard. It significantly improves this standard in terms of flexibility and it focuses on identifying and addressing opportunties in organization management. Since these measures can be simple or complex, short-term or longterm, costly or less expensive, it's the organization's management that decides how to address risks and opportunities. However, the measures must meet the following four requirements:

• *Measures must be planned*: This implies that wating for something to happen before taking action isn't advisable. Instead, potential events should be anticipated, recognized, and measures should be planned accordingly. This might involve detremining the number of specifically qualified employees needed, timing of the activities, and require resources. It might also involve planning for external professionals to be engaged based on the plan and rquirements.

- *Measures must be integrated into QM processes*: All management within the QMS should apply to these measures. For instance, document control can be applied if the measures are manitained as documented information. Calibration requirements can be applied if measurement equipment is utilized.
- *Measures must be proportionate*: The most critical risks are associated with the most significant actions. Opportunities with the most substantial effects are linked with detailed plans.
- *Effectiveness of measures must be evaluated*: After the measures have been implemented, management must detremine whether they achieved their goals. Objectivity in assessing their effectiveness should be maintained at the higest possible level.

The ISO 9001:2015 standard doesn't explicitly require that risks and opportunities be retained as documented information. However, considering the importance of this standard requirement, any commited and responsible organization's management will document the process of identifying and evaluating risks and opportunities and maintain records about the learnings from this process.

E. Relationship of Risk and Opportunities with Other Parts of ISO 9001:2015

To accurately implement the requirement of planning measures related to risks and opportunities, it is essential to undrestand its relationships with other parts of the standard:

Clause 4.1: Understanding the Organization and its Context

Given that this is the most crucial input for considering risks and opportunities, is of paramount importance to comprehensively define both internal and external context of the organization and track changes in this context over time.

Clause 4.2: Understanding the Needs and Expectations of Interested Parties

Everything that employees, customers, suppliers, regulatory bodies, and other significant stakeholders require from the organization is a significant input in identifying risks and opportunities.

Close 10.2: Nonconformity and Corrective Action

Whenever a nonconformity is resolved through a crorrective action, risk is reduced. Therefore, this always feeds into considering risks and opportunities.

Clause 9.1.3e: Analysis and Evalution

The effectiveness of measures taken to address risks and opportunities must be evaluated. Anything learned from this evaluation might contribute to changes in the taken action. Analysis and evaluation thus serve as both inputs and outputs in the identification of risks and opportunities.

Clause 9.3.2e: Management Review

An input element for management review is the evaluation of effectiveness of measures taken to address risks and opportunities. This closely aligns with the requirement in clause 9.1.3e. By recognizing it in the management review, this requirement is addressed in both clauses. Management review, in turn, serves as both input and output for identifying risks and opportunities.

Clause 5.1.1d: Leadership

The top of management is tasked with promoting risk-based thinking, implying that identified risks and opportunities are communicated within organization. This represents output from identification of risks and opportunities.

Clause 5.1.2c Customer Focus

Management is required to recognize risks and opportunities related to the conformity of products and services and customer satisfaction. Therefore, this serves as an output from the identification of risks and opportunitis.

Clause 4.4.1f: QMS and its Processes

When defining the processes of the Qualty Management System, the organization's manangement must address the risks and opportunities arising within these processes.

These relationships and interconnected requirements highlight the integral approach of

the ISO 9001:2015 standard. Understanding the interdependences of these clauses will ensure that organizations implement an effective and efficient Quality Management System that address both risks and opportunities holistically.

F. How to Implement the Requirement: Planninig Measures in Realtion to Risks and Opportunities?

In clause 6.1.2 of the ISO 9001:2015 standard, it is required that the management of an organization must be plan measures related to risk and opportunities that it has previously identified (requirement 6.1.1 of the standard). In orther words, management must take measures to address risks and opportunities. The standard requires that the scope of these measures be proportional to given risks or opportunities. This means that grater risks and opportunities demand more extensive measures. Subsequently, management must evaluate the effectiveness of these measures.

The measures that an organization's management can undertake concerning risks depend on the nature of the risk. For instance:

- Avoiding risk: The process where the risk might occur is no longer carried out in the organization.
- *Eliminated risk*: Using documented procedures to assist inexperienced employees.
- Assuming risk to pursue an opportunity: Investing in new capital equipment with an uncertain return on investment. Examples of measures for management to address opportunities include the adoption of new technologies and finding new users and/or markets.
- *Sharing risk*: For example, when faced with uncertain production levels, working with customers to enable the procurement of raw materials in advance.
- *Taking no action*: The organization's management accepts the risk based on potential consequences and/or the costs of necessary measures.

Requirement 6.1.2 (*planning measures related to risks and opportunities*) should always be considered alongside requirement 6.1.1 (*identifying risks and opportunities*). Management must demonstrate that they have implemented this requirement.

IV. ADVANTAGES OF RISK MANAGEMENT

Many managers are often reluctant towards risk management, viewing it as complex and costly to implement. However, the investments in this process are considerably less than the costs and time rquired to manage a crisis, which inevitable arise as a consequence of poor risk management or its absence in the organization. Below are some of the benefits of risk management:

- *Grater employee awarness od risks.* Employees begin to think daily about risks. In this way, they become involved in the resource utilization and success of organization, thereby increasing their satisfaction. This positively impacts customers as well, for without satisfied employees, there can be no satisfied customers.
- Focus on the most important matters. Effective risk management enables the identification and ranking of the most dangerous risks and the exploitation of the best opportunities.
- *Creation of a preventive culture.* Over time, risk management influences a change in the employees' mindset, leading to a more positive organizational culture. In this context, favorable conditions for understanding risks and opportunities enhance decesion-making within the organization.
- Support in achieving organizational goals. The outcome of implementing a risk management system is the realization of organizational objectives and most often, the prevention of problems. Therefore, crisis mostly occur in organizations where risks and opportinities are inadequaltely managed,

as well as in those lacking a risk management process.

V. CONCLUSION

The ISO 9001:2015 standard emphasizes strategic planing. Risk-based thinking is the most significant single addition to ISO 9001:2015. When correctly applied, it can become the most potent process in an organization. In terms of organizational responsi bilities, processes, and documented information, the 2015 standard is more flexible than its 2008 predecessor.

The ISO 9001:2015 standard does not introduce the concept of preventive action. Instead, it speaks about risks and opportunities. A significant improvement compared to the previous standard is the focus on identifying and addressing opportunities. At the same time, the core concept of recognizing and addressing potential problems and errors before they occur has been retained. Additionally, the application of risk-based thinking has allowed for a certain reduction in the number of requirements, replacing them with preformace-based criteria.

The ISO 9001:2015 standard offers organizational management more freedom concerning the application of narrower or broader risk management methodlogies in relation to its requirements. Management is responsible for applying its risk-based thinking and for the measures it takes to address risks and opportunities. Furthermore, management must demonstrate that it has identified, analyzed, and, where necessary, acted upon all risks and opportunities.

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Does the Capacity for Artificial Intelligence in Developed Countries Significantly Differ from that in Developing Countries?

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Abstract—In this paper, we examine whether the capacity for artificial intelligence in developed countries significantly differs from that in developing countries. The results suggest that developed countries have a significantly greater capacity for artificial intelligence than their developing counterparts.

Keywords – Artificial inteligence, capacity, developed country, developing country

I. INTRODUCTION

Artificial intelligence (AI) affects almost all aspects of life, both positively and negatively. Since the introduction of ChatGPT by OpenAI in November 2022, AI has become a hot topic in economics [1-6]. Since then, economists have debated whether the United States has a significantly greater capacity for AI than its competitor, China [7]. And what this means for its economic growth and development [8]. In this paper, we contribute to that debate by examining whether developed countries like the United States have a significantly greater capacity for AI than their developing counterparts like China.

In this paper, we compare the capacity for AI between developed and developing countries competing in this field. We conclude that developed countries have a significantly greater capacity for AI than developing countries, which puts them in a better position.

The rest of this paper is structured as follows. Section II reviews the literature on the capacity for AI. Section III describes the methods used in this study. Section IV presents the results of this study. Section V discusses the findings of this study. And section VI concludes this paper.

II. LITERATURE REVIEW

Since the introduction of ChatGPT, there has been a growing body of literature on the capacity for AI. It has been shown that both developed and developing countries have different capacities for AI [9,10], which is understandable given their different levels of development. According to reference [9], capacity for AI rests on three implementation, pillars: innovation, and investment. The Global AI Index published by Tortoise Media shows that the United States performs better than other countries in all three pillars. This is due to its ecosystem for AI. According to reference [9] the United States is followed by China, Singapore, the United Kingdom, Canada, South Korea, Israel, Germany, Switzerland, and so on (Table A in the Appendix).

III. METHODS

In this paper, we compare the capacity for AI between two groups of countries: developed countries and developing countries. Group 1 consists of 34 countries (Australia, Austria, Belgium, Canada, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States) and Group 2 consists of 28 countries (Argentina, Armenia, Bahrain, Brazil, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, Kenya, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Poland, Qatar, Russia, Saudi Arabia, South Africa, Sri Lanka, Tunisia, Turkey, United Arab Emirates, Uruguay, Vietnam).

We use the Kolmogorov–Smirnov test (K–S test) and the Shapiro–Wilk test (S–W test) to test the variables for normality. The variables relate to the sub-pillars of the Global AI Index: talent, infrastructure, operating environment, research, development, government strategy, and commercial ventures.

We also use the t-test, a parametric test, and the Mann–Whitney–Wilcoxon test (M–W–W test), a non-parametric test, to test for differences between the groups.

IV. RESULTS

First, we present descriptive statistics (Table I) and then the results of the *t*-test and the M–W–W test. The results of the K–S test and the S–W test for the variables *overall*, *talent*, *infrastructure*, *operating environment*, *research*, *development*, *government strategy*, and *commercial ventures* are as follows:

- Overall: W(62) = 0.14, p = 0.00; D(62) = 0.77, p = 0.00.
- Talent: W(62) = 0.16, p = 0.00; D(62) = 0.83, p = 0.00.
- Infrastructure: W(62) = 0.16, p = 0.00; D(62) = 0.92, p = 0.00.
- Operating environment: W(62) = 0.10, p = 0.20; D(62) = 0.97, p = 0.10.
- Research: W(62) = 0.18, p = 0.00; D(62) = 0.75, p = 0.00.

TABLE I. DESCRIPTIVE STATISTICS.

	Μ	Mdn	SD	σ2	Min	Max
1	25.9	22.9	13.8	191.8	8.3	100.0
2	27.4	23.5	17.1	291.1	3.5	100.0
3	57.8	58.7	16.5	271.1	5.0	100.0
4	80.8	81.2	11.2	125.5	53.8	100.0
5	15.5	11.4	16.3	266.0	0.2	100.0
6	9.7	2.4	18.0	324.3	0.0	100.0
7	57.6	66.0	30.3	917.2	0.0	100.0
8	8.7	4.8	14.4	207.3	0.7	100.0

Note: 1 – Overall, 2 – Talent, 3 – Infrastructure, 4 – Operating environment, 5 – Research, 6 – Development, 7 – Government strategy, 8 – Commercial ventures.

- Development: W(62) = 0.30, p = 0.00; D(62) = 0.54, p = 0.00.
- Government strategy: W(62) = 0.16, p = 0.00; D(62) = 0.90, p = 0.00.
- Commercial ventures: W(62) = 0.30, p = 0.00; D(62) = 0.48, p = 0.00.

		Group				
Variable	Statistics	Developing countries	Developed countries			
	Ν	28	34			
	Mean Rank	18.77	41.99			
Overall	Mann- Whitney U	119	.50			
	Asymp. Sig.	0.0)0			
	Ν	28	34			
	Mean Rank	21.79	39.50			
Talent	Mann- Whitney U	204	.00			
	Asymp. Sig.	0.0	00			
	Ν	28	34			
	Mean Rank	22.66	38.78			
Infrastructure	Mann- Whitney U	228	.50			
	Asymp. Sig.	0.0	00			
	Ν	28	34			
	Mean Rank	18.05	42.57			
Research	Mann- Whitney U	99.	50			
	Asymp. Sig.	0.0	00			
	Ν	28	34			
	Mean Rank	17.77	42.81			
Development	Mann- Whitney U	91.	50			
	Asymp. Sig.	0.0	00			
	Ν	28	34			
a	Mean Rank	26.13	35.93			
strategy	Mann- Whitney U	325	.50			
	Asymp. Sig.	0.0)3			
	Ν	28	34			
	Mean Rank	18.71	42.03			
ventures	Mann- Whitney U	118.00				
	Asymp. Sig.	0.00				

TABLE II. M-W-W TEST.

The results of the K–S test and the S–W test show that only the variable *operating environment* is normally distributed. Therefore, in this case we use the *t*-test to test for differences between developed and developing countries. In all other cases, we use the M–W–W test. The results of the *t*-test show that developed countries have a significant higher score in *operating environment* (M = 85, SD = 9.93) than their developing counterparts (M = 75.84, SD = 10.77), t(60) = -3.45, p = 0.00.

The results of the M–W–W test for the variables overall, talent, infrastructure, research, development, government strategy, and commercial ventures are shown in Table II.

V. DISCUSSION

It turns out that, on average, developed countries perform better than developing countries in terms of their capacity for AI, which we had expected given the constraints that developing countries face. Action is needed here, otherwise the gap between the rich and the poor will widen. These findings are consistent with those of other studies [9,10].

VI. CONCLUSION

The findings of this study show that developing countries need to build their capacity for AI if they are to advance their development and narrow the gap between the rich and the poor. This is especially true for those countries that lag behind comparable countries.

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APPENDIX

TABLE A.

THE GLOBAL AI INDEX (SCORES) [9]

	1	2	3	4	5	6	7	8
Argentina	17.5	17.5	52.5	80.9	2.6	0.4	56.7	1.4
Armenia	14.5	21.6	47.8	71.5	1.6	2.0	0.0	2.3
Australia	30.9	34.2	54.3	53.8	34.4	11.7	83.3	7.0
Austria	27.7	27.6	57.0	94.7	21.3	7.4	63.1	5.8
Bahrain	13.5	4.4	56.2	77.2	2.0	0.1	0.0	3.6
Belgium	26.6	27.4	55.3	84.8	21.9	5.1	57.0	6.6
Brazil	22.1	29.3	55.8	75.7	8.5	1.9	71.4	3.3
Canada	40.3	46.0	62.1	93.1	34.0	18.9	93.4	18.9
Chile	20.2	15.0	67.5	71.6	3.8	0.6	76.3	5.2
China	61.5	30.0	92.1	99.7	54.7	80.6	93.5	43.1

Colombia	17.8	17.1	52.2	69.4	2.0	0.6	87.7	1.4
Czechia	22.1	20.8	53.6	80.4	11.4	2.7	81.2	2.8
Denmark	30.5	30.6	67.5	100.0	19.4	8.8	75.0	8.3
Egypt	16.9	18.5	42.7	66.6	4.7	0.3	74.8	1.5
Estonia	26.0	22.0	57.2	88.3	8.5	2.9	78.8	17.5
Finland	34.9	34.5	73.0	97.7	27.4	13.1	82.7	9.5
France	32.8	41.5	68.9	84.2	21.4	8.9	87.3	10.8
Germany	39.2	57.0	68.2	90.7	29.3	19.5	93.9	10.3
Greece	18.3	26.7	46.5	60.5	13.3	1.8	15.4	2.9
Hong Kong	22.5	14.4	69.3	80.2	7.0	0.4	15.4	19.2
Hungary	20.7	19.0	59.1	83.1	8.1	1.5	59.1	3.4
Iceland	20.6	16.2	56.1	74.8	15.6	1.7	13.9	8.1
India	31.4	86.2	34.7	91.1	12.0	7.6	56.0	8.9
Indonesia	18.2	28.1	40.9	80.0	3.9	0.3	55.0	2.5
Ireland	28.8	31.8	60.8	88.0	13.6	19.2	71.7	8.6
Israel	40.0	45.5	60.5	85.1	24.8	22.2	31.8	40.5
Italy	26.5	28.5	56.6	93.7	16.5	3.2	89.8	3.7
Japan	33.9	38.0	80.8	92.4	18.6	22.2	80.3	6.8
Kenya	8.3	10.6	13.5	59.3	1.3	0.1	9.0	2.1
Lithuania	19.7	19.2	56.1	80.2	5.3	2.2	61.0	3.5
Luxembourg	29.2	24.0	74.9	90.4	19.4	7.5	66.8	8.8
Malaysia	19.6	19.4	65.3	72.2	6.8	0.7	48.1	2.4
Malta	22.4	17.3	56.3	87.7	6.5	12.8	72.6	4.3
Mexico	16.9	20.2	43.8	78.2	4.2	0.4	53.5	1.1
Morocco	13.6	9.1	52.7	73.1	2.4	0.1	16.4	0.7
Netherlands	34.5	45.2	65.7	90.3	27.1	15.7	71.8	7.9
New Zealand	21.6	23.0	58.3	74.8	14.4	4.0	25.3	4.9
Nigeria	9.3	16.6	5.0	64.6	3.5	0.1	13.9	1.3
Norway	26.4	27.7	62.1	82.4	16.5	8.1	55.8	7.8
Pakistan	10.1	22.9	9.0	55.7	3.9	0.2	13.4	1.3
Poland	24.8	31.9	59.0	87.8	10.1	2.2	89.1	2.7
Portugal	23.7	20.3	56.4	92.6	11.4	2.2	72.6	6.6
Qatar	19.8	3.5	61.0	73.1	19.9	0.5	39.2	1.5
Russia	23.7	25.1	64.1	80.7	7.9	6.7	91.3	1.7
Saudi Arabia	23.3	14.3	63.3	88.1	8.2	1.3	100.0	6.0
Singapore	49.7	56.9	82.8	85.7	48.8	24.4	81.8	26.2
Slovakia	17.1	13.6	54.1	84.1	3.4	0.6	43.5	1.9
Slovenia	21.5	10.9	59.7	79.9	13.3	2.5	74.8	2.7
South Africa	14.1	11.4	41.4	81.5	3.8	0.3	0.0	5.4
South Korea	40.3	35.1	74.4	91.4	24.3	60.9	91.9	8.3
Spain	27.7	31.5	65.2	90.2	14.5	4.3	93.4	4.7

Sri Lanka	10.0	11.8	34.9	56.0	0.2	0.0	4.9	1.5
Sweden	30.3	33.7	62.2	99.9	22.4	11.4	47.0	8.6
Switzerland	37.7	44.5	68.0	81.9	41.3	24.9	9.0	13.3
Taiwan	25.4	24.5	71.3	71.4	13.6	16.3	51.4	4.3
Tunisia	13.7	17.8	43.8	70.9	3.9	0.3	4.9	0.8
Turkey	20.6	25.0	45.5	93.6	6.9	0.3	72.5	2.0
United Arab Emirates	23.9	16.9	80.8	77.8	9.4	1.7	72.8	5.3
United Kingdom	41.8	53.8	61.8	79.5	38.1	19.8	89.2	20.0
United States	100.0	100.0	100.0	82.8	100.0	100.0	90.3	100.0
Uruguay	16.3	13.3	60.8	79.7	0.8	1.1	31.5	2.1
Vietnam	18.0	21.5	56.2	64.5	3.2	0.7	65.1	1.9

Note: 1 - Overall, 2 - Talent, 3 - Infrastructure, 4 - Operating environment, 5 - Research, 6 - Development, 7 - Government strategy, 8 - Commercial ventures.

The Attitude of Preschoolers to Monster Toys

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Keywords

Videogame, play activity, preschool age, monster toys, media content

Summary

In the research of the last years many authors emphasize the growing popularity of monsters in contemporary media narratives oriented both on adults and children [1,2]. Monster characters appear in fairy tales, cartoons, video games. Contemporary monsters are presented by various images, many of them elicit sympathy and evoke a desire to be like them (Shrek, Mike Wazowski from Monsters Inc.). Their differences from humans do not have any negative connotation. On the contrary, they usually have superpowers, which they use for the sake of other people (Teenage Mu tant Ninja Turtles, Spider-Man). Being a monster has become culturally acceptable and does not hamper monster characters to become superheroes of modern time [3,4].

The fact that monster characters appear in children's subculture and are presented as positive characters is a concern for parents. Parents are anxious about the possible negative influence of monster characters on their children's development.

Most contemporary authors consider that the main function of a "scary" toy for the child is nowadays connected with the necessity to «flee from the boredom of everyday life», to acquire new impressions and to learn how to cope with the fears [1,5]. At the same time, a number of authors have stressed the tendency of devaluation of "the scary", which is often referred to post-modernist culture. Monsters, who are traditionally regarded as scary creatures, become attractive for children, which might make it difficult for the child to shape the concept of good and evil. On the whole the problem of children's interaction with Monster toys remains today very little studied and requires further theoretical and experimental elaboration.

In November 2022 Center for Interdisciplinary Research on Contemporary Childhood of Moscow State University of Psychology and Education conducted an empirical research aimed at studying the peculiarities of perception of monster toys by contemporary preschoolers. The research was conducted on the example of Huggy Wuggy — a monster toy, which has gained extreme popularity in Russia after the appearance of the game "Poppy Playtime".

The sample included 298 children aged from 4 to 6 years. The following research methods were used: conversation with children, picture of Huggy Wuggy, nonparticipant observation of children's free play in kindergarten. The results obtained testify that the majority of preschoolers y bring it to kindergarten and playground, demonstrating it to their friends, while they rarely interact with the toy in the process of play (including episodes of role play). While being aware of the videogame "Poppy Playtime" most children do not use its plot in the play process. Generally, play with Huggy Wuggy does not differ much from preschoolers' play with other toys.

Most children, familiar with the plot of the video game, had learned about it from the videos on YouTube and did not play the game itself. Thus, the perception of the image of Huggy Wuggy in these children was based on the videos, which had little in common with the original plot of the video game. The analysis of pictures allowed to reveal the majority of children do not demonstrate specific anxiety connected with the image of Huggy Wuggy. The revealed negative emotional charge, connected with the image of Huggy Wuggy, in most cases relate to videos on Youtube that children have watched, and where negative information both about the videogame and its main character is presented in the most affective way.

The data obtained echoes the data of similar research, devoted, particularly, to the toy Monster High [4]. Possessing this Monster toy affirms a certain status of the child, which in turn helps them to hold a particular position in group. Thus, being, first of all, a fashionable toy, Huggy Wuggy is likely to quickly give way to another monster toy.

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Students' Attitudes towards Entrepreneurship as a Contributing Factor of Economic Change

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Keywords

Attitudes towards entrepreneurship, economic change, education, Serbia, students

Summary

The labour markets of the transition countries of Central and Eastern Europe relied on stronger growth of the corporate sector as a mechanism that would incorporate the growing number of laid-off workers. The Serbian labour market had a similar experience. Decades after the start of economic reforms, however, the role of entrepreneurship as an inclusive employment mechanism has not increased in importance. This is best illustrated by statistical data. Looking at entrepreneurship as a factor which contributes to the growth of self-employment, statistical data show that the share of self-employment in the total employment structure is decreasing. However, these are not only relative indicators, but also absolute ones. As the labour force and the total number of employed persons increase, the number of self-employed persons decreases, which affects the fact that the gender gap in the self-employment rate remains high. The theoretical literature and empirical research suggest that there are other mechanisms that could predict the dynamics of entrepreneurship. The conclusions in these studies are mainly based on the entrepreneurial intention that could be realized in the near future by starting a business. Of course, there are numerous constraints, both external and internal, that may reduce the expected impact. Therefore, the objective of this paper is to examine the differences in attitudes towards entrepreneurship

among college graduates in order to gain ideas for developing better programs to promote entrepreneurship, especially among young people who are driving economic change.

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Assistive Technology for Elderly People in Long-term Care Settings

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Keywords

Long-term care, ageing, assistive technology, assistive robotics

Summary

Population ageing is a global trend, observed in nearly every country. By 2050, this number of people aged 65 or older worldwide is expected to reach 1.5 billion, and one in six people globally will be 65 or older [1]. The increasing problem of an ageing population has shown the importance of long-term care, while advancements in artificial intelligence (AI) and the shortage of caregivers make robocare started to be taken into account.

Age-related diseases such as hypertension, osteoporosis and dementia are still prevalent despite advances in medical technology and increased life expectancy. The ageing demographics not only increase the pressure on the healthcare system, the shortage of caregivers and the poor quality of care but also increase the cost of care and significant socio-economic pressures. The use of assistive technology in the long-term care system is becoming increasingly important in order to provide continuous support to the elderly in their daily lives [2,3].

On May 26, 2018, the World Health Organization (WHO) Member States adopted a resolution affirming that access to assistive technology (AT), including assistive robotics (AR), is a fundamental human right essential for equal opportunities and participation [4]. It emphasized the universal need for AT, particularly as individuals age [5].

The aim of this presentation is to explore the significance of and challenges to the use of

assistive technology by elderly people in longterm care settings. The following research questions will be examined: 1. How assistive technology could impact the quality and quantity of care for elderly people in Long-term care settings? 2. What barriers are preventing the elderly from accessing assistive technology?

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Sustainable Human-computer Interaction

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Keywords

Sustainable development goals, sustainability, human-computer interaction, sustainable HCI

Summary

Sustainability and HCI are scientific disciplines in their own right. Technology development led to the fact that we have started dealing with the unified scientific field of HCI responses in the last two decades. The spectrum of areas covered is numerous because both areas are individually multidisciplinary. Therefore, the unified area is also multidisciplinary. United Nations defined the goals of Sustainability in 2015 [1]. Since 2016, a report on progress in achieving these 17 goals has been available yearly. It is planned that all of them will be fulfilled by 2030. However, due to the coronavirus pandemic and the crisis caused by the war in Ukraine, the deadline for achieving the goals can be justified and expected to be extended.

Sustainability was established by the Brundtland Commission of the United Nations in

1987 as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [2]. The study of human-computer interaction (HCI) focuses on how computer technology affects human labor and activities [3]. The HCI research community has recognized Sustainability as vital and concerning [4-5].

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The Ethics Gap in Adolescents' Online Communication

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Keywords

Adolescents, social media, online communication

Summary

Today adolescents are growing up online. Social networks mirrow personal qualities of their users and the way they transform with time. The results of the latest online communication studies often conclude that the Internet environment contributes to formation of such attitudes and behavioral patterns as aggressive behavior, verbal abuse, fraud, trolling, bullying and etc. [1,2]. To describe this phenomenon C. James uses the term «the Ethics gap» and refers to it the loss of sensitivity to the moral and ethical aspects of behavior [3]. Adolescents perceive the Internet as a space for playing games and entertaiment, therefore they do not support anything immoral, even when they play cruel jokes or deceive a stranger on social networks.

How widespread are these forms of ethical violations in the adolescents' online communications ? What trigers them? These questions and others were in the focus of an empirical study on the specifics of digital socialization of adolescents. It was conducted on the basis of MSUPE from March to June, 2022, and included 539 participants, aged 12-18 years old. Besides the questionnaire, aimed at figuring out the goals, preferences, potential threats and consequences of adolescents' online communication, the study included The Problematic Social Networks Use Scale. Due to the scale results, two groups were determined and compered - 180 and 175 adolescents with low and high levels of problematic use accordingly.

When analyzing the social factors that determine or influence adolescents' problematic behavior, it was noticed that adolescents with a high level of problematic use most often come from single-parent families. Indirectly, this data indicates that these adolescents lack support, they need to establish more trustful relationships with their parents. Otherwise the lack of constructive assistance significantly affects their well-being, triggering behavioral manifestations.

The data also demonstrated that the majority of adolescents comply with ethical norms of behavior while using social networking sites. However, violations of moral principles are more common among adolescents with a high level of problematic social media use. They practise obscene language and offensive jokes twice as actively. They are more likely to become victims to online derogatory actions and abuse. More than a half of them experience negative emotions (anger, irritation, pain and annoyance) when they are criticized. At the same time, a third of them listen to others' opinions and try to work on themselves.

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Public Health and Population Perspective of COVID-19 as a Global Pandemic

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Keywords

COVID-19, risk group, community quarantine, population dynamics, social distancing

Summary

COVID-19 appeared as an infectious disease of global health emergency and the highest public health concern of the 21st century for this world due to its high-speed spread across the globe. The disease started as one single case to a cluster of cases in Wuhan, China (Dec 2019), and within a few months with its continuous upsurge of cases spreading globally [1-2]. This disease caused high-risk Group mortality, high morbidity, health care services burden, panic anxiety, mental trauma and tension, and social and economic insecurity, which also collectively surfaced by a diverse range of social reactions and political pressure across the world [2-3].

The appearance of new and unknown pathogenesis of the disease has created the most significant attention and concern for the scientific community and political leaders as well. The disease also varies much with its pattern of the virus, signs, symptoms, and characteristics including its epidemiological and public health response (like prevention strategy, diagnoses, case management, and treatment pattern) across the countries [2-4].

The basic public health prevention interventions are directed to frequent hand washing, wearing face masks, maintaining social/physical distancing (2-6 meters in between), individual isolation, and community quarantine for suspected exposure and lockdown community areas where cases in are identified [4]. The progress of the disease with its diverse categorical appearance of signs and symptoms which are uniquely portraying this disease as more of a kind of COVID-19 syndrome than as COVID-19. Moreover, various factors including socioeconomic status, health status, population dynamics, health system and health behavioral patterns, infrastructure. nutrition and food habits, and access to information and knowledge made this viral disease one of the historically most expensive diseases of the modern world to fight for [2,4].

The case fatality rate distinctively varies with the population dynamics and the health system infrastructure and ability factors which have already created clear evidence as explained in this paper how these factors are uniquely distinguished and different from country to country [5-6].

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Strategic Planning for Green and Innovative Regional Development

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Keywords

Green economy, innovation, region, strategy, assessment

Summary

Strategic regional development planning following a "green" economy and innovative development principles is complex. In this process, the content of the concept of a "green" economy, the principles, mechanisms, and tools of its implementation, as well as the innovative "greening" basis of of the economic development, ecological innovations, and institutional regulation of these processes at different levels are linked into a single system [1].

This study aims to determine the methodological foundations of developing and implementing an innovation-oriented strategy to ensure the "green" development of the regional economy.

Implementation of the systemic character of innovative processes is ensured in the regional dimension. Eco-innovations are no exception. It can be argued that multicomponent, complexity, spatial-temporal integrity, manageability. interdependence of elements (organisation in space and time), natural-resource determination (interdependence) of economic, social, and ecological development - these essential characteristics of the region determine the potential for the implementation of "green", sustainable development of the economy and, in particular, form a territorial and spatial unity for the effective systemic implementation of innovative processes [2].

The regional innovation system (RIS) is a set of economic agents and types of activities, resource provision, and institutions, as well as connections between them, necessary for increasing the efficiency of the innovation process in the region.

One of the main components of the regional innovation system is the institutional one. The role of institutions in the management system of innovative processes of the region is the main one. It consists of determining goals and priorities, programs, procedures, methods, incentives. and restrictions regarding implementing innovative activities at the level of business units and the region. From the point of view of the implementation of the "green" economy, the institutional regulation of innovation processes should be transformed both substantively and organizationally in the direction of ensuring mutual coordination of the goals of innovative development with the goals of "green" development of the regional socioecological and economic system.

While implementing a "green" economy, the goals of implementing innovative processes in the region also acquire "green" characteristics, and the ideal option for developing RIS is a complete and comprehensive ecologisation of innovative processes. Therefore, monitoring the peculiarities of the implementation of innovative processes in the region and assessing their development should form the basis for developing a strategy in the transition to a "green" economy.

Areas of diagnosis of the eco-innovative potential of the region (EIPR), which can form the basis of an integral assessment, are based on the evaluation of the environmental friendliness

of the following components of RIS [3]: market, production-infrastructural, scientific. institutional. The latter involves the assessment of the next: reflection of the goals of green development in the regional development strategy and program documents; share of ecologically oriented public projects and initiatives in the total number of implemented measures; share of "green" projects financed from a regional budget; actions to support ecoinnovations; impact of innovative processes on the country's economy; international comparisons.

The division of regions according to the level of eco-innovation potential can be carried out based on a comparison of the integral assessment of the EIPR of a specific area with the average values within the country. This, in turn, makes it possible to group regions and recommend a particular type of strategy according to the EIPR values.

Regions with a low EIPR value can apply the strategy of adapting innovation processes to the goals of the "green" economy (orientation on anticipatory rates of economic growth due to innovations, which, however, do not belong to the group of ecological ones). Strategic goals in the field of nature management are formulated as preventing the growth of the integral ecodestructive impact of production processes on a unit of the social aggregate product.

Regions with an average EIPR value can choose a strategy of developing "green" models of production and consumption in specific, most competitive industries through the stimulation of the regional authorities' eco-innovative activities of business units. The result of implementing this strategy is to promote the broader spread of ecoinnovations in the economic sphere, ensure the region's investment attractiveness, increase its competitiveness, and strengthen the components of the EIPR.

For regions with a high EIPR, the regional development strategy can be formulated as a strategy of "green", sustainable development of the area. This strategy is characterised by the orientation of the development of all industries to the introduction of radical eco-innovations, clean and energy-saving technologies, and new business models that ensure the dematerialisation of economic growth. At the same time, efforts are expected to be focused on forming new "green" markets, industries and business models and spreading eco-innovation to all country regions through interregional interaction and cooperation.

The transformation of institutional regulation also requires a corresponding innovative change in the principles of its organisation. These changes should include decentralisation, spreading partnership models of cooperation, and promoting grassroots innovation.

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Role of Financial and Digital Inclusion on Economic Growth of Asian Countries

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Keywords

Financial inclusion, digital inclusion, economic growth, Asian countries

Summary

Countries around the globe are making concentrated efforts to increase the digital and financial inclusion [1,3]. Different studies are conducted in various parts of the world to assess the role of financial and digital inclusion in increasing or decreasing the economic growth of countries [2]. Financial inclusion is basically the availability and provision of financial services at affordable prices to common man. Similarly, digital inclusion is access of digital financial services to all individuals [3]. It is essential to investigate whether financial and digital inclusion has some role to play in enhancing the economic growth of country. Relatively less work is done in Asian countries to see the impact of financial and digital inclusion in the economic growth [1, 4]. Therefore, this study is an attempt to fills this gap. The main purpose of this study is to investigate the impact of financial and digital inclusion on the economic growth of Asian countries. In addition, we also investigated interaction whether term (Financial inclusion*digital inclusion) also play а significant role in enhancing the economic growth of Asian countries or not.

Panel regression analysis is used to investigate the relationship between financial and digital financial inclusion and economic growth of Asian countries. The control variables used in the study are population growth, human capital, remittances, and economic openness. Timeframe of the study is 1999-2020. The findings reveal a significant relationship between financial and digital financial inclusion and economic growth of Asian countries. The findings further reveal that interaction term (Financial inclusion*digital inclusion) is also significantly related to the economic growth. The findings are helpful to the regulatory authorities and policymakers to further pathways to enhance the financial and digital inclusion which in turns lead to increase in the e economic growth of countries.

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Leaders and Followers: A Check Against Reality

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Keywords

Leaders, leadership, followers, followership, organizations, management, systems structures

Summary

Most people today, scholars, practitioners, leaders, and non-leaders alike have learned and assumed that there are leaders and there are followers, who follow their leaders. Almost every management thinker writes about followers. Even the most prominent management gurus, like Jaques [1-9], Deming [10-11], Maccoby [12] speak about leaders and their followers. However, closely examining this paradigm of leaders and followers doing anything together, it becomes obvious, to any casual observer that the paradigm does not correspond to reality. First, there are no such entities called followers. The paper briefly examines various real-life scenarios, including families, management organizations corporations, organizations of the government, universities, churches, neighborhood communities, hospitals, clubs, schools, athletic teams, and other organizations of the modern society.

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Digitalisation of Public Services in Hungary

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Keywords

Public administration, customer-friendly services, front-office system, back-office system, government window

Summary

The European Union member states are modernising their public administrations by introducing digital public services. Modern and efficient public administration must ensure fast and high-quality services to citizens and favorable environment for business. The basis of e-government are systems for electronic customer support (i.e. front-office systems) and systems responsible for supporting internal processes and administrative procedures (i.e. back- office systems).

It has been an important strategic goal for Hungary to modernise its public administration and increase the use of modern information and communication technologies (ICT) in interactions between government institutions and between government institutions and citizens. The strategic objectives of the government are consistent with the expectations and challenges of the European Union in modernising Hungary's public administration.

The Hungarian administrative structure composed of three levels: central, territorial (county), and local level. As part of the operational and organisational renewal of the public administration, the capital and county government offices were established on January 1, 2011. They integrate a wide range of special and general administrative services and are strictly controlled by the central government. The establishment of a physical single point of contact system was an important step toward less bureaucratic and more user-centric public administration.

The next step in the evolution of userfriendly public services was the setting up of the Government Windows, a network of service contact centres on January 3, 2011. The total of 19 county government offices are located in the county seats and, in the case of the capital, in Budapest.

How does the digitalisation of public services change the interaction between citizens and civil servants in the Government Windows? The onestop-shops started to operate as the front-offices of Government Offices. They provide information and public services to citizens in 2.500 different types of administrative case, from initiation through processing to completion.

However, the settlement structure of Hungary is very fragmented. Out of the 3,155 settlements of Hungary 346 are towns (1 of which is the capital and 23 are towns of county rank), and 2809 are villages. How to deliver services to settlements located far from the county government offices?

This challenge was faced by the central government which responded by organising mobilised government window customer service buses in the counties and in the capital. The buses reach remote small villages, and they provide to the citizens the same services that can be arranged at the Government Windows.

The Central Government Service Bus is an interoperability platform that aims to ensure standardised connection between the national basic registers and the various specific information systems of the public administration by unifying the communication methods. The service buses provide personalised customer service to all citizens and businesses which is further step to strengthening the userfriendly digital public services in Hungary. The Hungarian case could be a good practice for countries facing the need to increase the efficiency of digital public services, and to implement one of the e-government's priority, the user-centricity.

As for the methodology, in addition to EU documents and regulations of the Hungarian public administration, the empirical work is supported by evidence from EU and Hungarian databases (Eurostat, Hungarian Central Statistical Office), Digital Economy and Society Index (DESI) and the eGovernment Benchmark (2017) reports.

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Dynamics of Emotional State by Senior Adolescents in the Text Reading and Video Games Conditions

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Keywords

Emotional state, emotion experience, videogames, text reading, senior adolescents

Summary

The present study is focusing on the influence of video games on the emotion experience by senior adolescents. The relevance of the research is defined from the practical perspective. Video games seem to be one of the most popular parts of leisure and entertainment activities by young generation nowadays. They boost enthusiasm and can elicit a variety of different feelings. Many researchers study the negative outcomes of competitive and violent video games which are often correlated with aggression [1]. However, some psychologists revealed positive effects of video games indirectly associated with such factors like wellbeing, motivation, and social interaction [2]. Thus, the present contradictive data stress that the impact of video games on the emotional state of players needs to be further examined.

Forty participants at the age range of 17-18 participated in this study. The main sample was divided into two groups where the first group (Group 1) played one video game at first, and then read several literary texts whereas the second group (Group 2) did opposite actions by reading the texts and playing video game after that. As for video game the "Fall guys" action type of game was used where a player in a form of a "game hero" had to run a distance as fast as he can. Participants did two game rounds where each was lasting for 10 minutes.

A special questionnaire for the emotions estimation was elaborated. Participants had to judge the extent of their emotions by using a 5point Likert scale. 25 types of emotions were estimated and factorized into 5 factors which included "negative emotions", "positive emotions", "calmness", "anxiety", and "rest". Students were enforced to make the emotions judgment several times - after the first game round, and after the second game round. In the case of texts participants also judged their emotional state during the reading process (after 10 minutes) and at the end of the procedure. Moreover, all students make a judgment at the beginning of the whole research, before they were involved in any experimental condition. Thus, emotions were estimated five times. The group 1 did the questionnaire in the following sequence: 1) before the research, 2) after the first game round, 3) after the second game round, 4) after the first 10 minutes of text reading, 5) after the second 10 minutes of text reading. The group 2 followed the same procedure, but started with texts. So, they estimated their state: 1) before the research, 2) after the first 10 minutes of text reading, 3) after the second 10 minutes of text reading, 4) after the first game round, 5) after the second game round.

We used the 2x5 repeated ANOVA measures ANOVA with the Group (first reading/first playing) as between subjects

factor, Time (five time points) as within subjects factor and Emotion intensity as dependent variable. The results showed the significant decrease of the negative emotions, such as irritation, dissatisfaction, anger, chagrin, rejection by those students who were playing first, and the striking increase of these emotions by the change of activity from reading to playing (p=0.001). Furthermore, the emotions associated with high activation - excitement, arousal, fun and joy - were decreasing when participants change their play activity to reading, and increasing when they were done with reading going to play as well (p<0.001). Calmness and relaxation, on the contrary, increased by switching activity from play to reading, and decreased while beginning playing (p<0.001). These results demonstrate that video games evoke strong emotions independent on their modus whereas reading activity seems to

be more connected with the calm emotional state.

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Right to Work in Digital Environment (A Perception of Increasing Digi-technological Unemployment)

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Keywords

Right to work, digitalization of the labour market, digi-technological unemployment

Summary

Apparently AI has already reshaped our lives and will continue to do so [1]. It supports the societies in many ways, however there are important concerns regarding the negative correlation of it on employment and labour market [2]. On the contrary AI will hopefully create new jobs [3], reinforce the need for existing areas of expertise, require new skills of a modern workforce [4].

The disappearing jobs by AI and robots directly deteriorates the human work and increase the probability of an eternal digitechnological unemployment (DTU) and ultimately undermine the right to work as a basic human social right [5,6].

The aim of this presentation is try to answer some basic research questions: 1. Is there empirical evidence that AI and robotics could increase unemployment [7]? (If yes, what is the possible impact of digi-technological unemployment to the right to work and how to provide derived rights for income security for the disadvantaged persons, former employees.) 2. How should AI oriented countries and policymakers - workers/citizens, as well - think today about the nature of a possible Post-work World of tomorrow, which implies industrial, sectors service and public without employees [8,9]. What is notion and content of the right to work in AI-driven labour market [10].

Based on the above mentioned research questions the following hypothesis were revealed.

1. Transitionally it can be expected a positive correlation between robots and the unemployment rate of the least educated workers, and a negative correlation between robots and the unemployment rate of those with a high level of education [11].

2. Using AI and robots, first step is increasing productivity instead of human replacement [12]. Supposedly, the next steps the productivity further develops, and in line with it the number of employees will decline and the cost of human resource will decrease as well.

3. Widening the sector applies AI (horizontal expansion) [13].

4. Replacements of the robot generations (vertical expansion) within workplaces. The improved capabilities are allowing robots to be programmed for more-complex tasks requiring a mixture of strength and nimbleness. Gradually cobots will replace industrial robots.

These hypothesises imply that the nature, content and necessity of human work gradually is changing therefore the function of the leading human rights (right to work) is persistently changing and becoming, in a certain sense, meaningless. Since the industrialised societies almost everything based on human work, more precisely the remuneration of the work, therefore the vanishing of the right to work influences several other human social rights (e.g. social security, etc.) and might be ceased the work-based income security and human dignity [14].

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Pros and Cons of Being Digitally Involved

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Keywords

Information and AI technologies, digital content management, threats and prospects

Summary

The increasing involvement of both individuals and social groups in the areas whose existence is supported and directed by information and AI technologies is radically changing both the way of life of a particular person and the functioning mechanisms of society as a whole. Such large-scale rapid changes initiate public debate. The number of publications and assessments is growing exponentially, dividing the expert community into antagonists and protagonists of AI [1-3].

The antagonists are represented by teachers, doctors, psychologists, artists, whose attention is focused on the threats associated with the valeological well-being, cognitive health and social hygiene. By valeological well-being the authors understand the human right to somatic health and psychological safety; cognitive health is interpreted as a person's ability to successfully manage digital-data streams and use them in different activities; by social hygiene the authors mean a person's satisfaction with his/her position in society, interpersonal interaction, public safety, preservation of privacy in the conditions of global, so far uncontrolled, digitalization. The antagonists not only note individual threats and challenges, but insist that expanding of information and AI technologies now and in the near future poses an existential challenge.

The scale of current and future threats is confirmed by the examination carried out by IT specialists under the patronage of leading scientists: I. Musk, E. Sharp, S. Wozniak, who published an open letter addressed to the whole world. In the letter they propose a moratorium on the developments in AI sphere in order to control and manage digital content and its influence.

The protagonists are most often represented by IT specialists, new digital programs developers and other beneficiaries who vote for widespread introduction digital the of technologies into economy, business, healthcare, public administration, which have indeed shown the high efficiency of recent using neural networks and artificial intelligence. This group express confidence that digitalization contributes to the creation of new high-tech jobs; to the transfer of routine professional operations to artificial intelligence and robots; to the creation of a more open democratic society with maximum opportunities for the manifestation of essential human qualities.

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Assessing the Influence of Artificial Intelligence on Knowledge Management in Educational Institutions: A Comparative Study of India and Poland

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Keywords

Artificial intelligence, knowledge management, administrative optimization, inclusive approach and perspectives, responsible AI integration

Summary

The overarching aim of knowledge management practices within an organizational context is to ensure all personnel have access to pertinent information when required, to optimize aggregate performance levels [1]. Amid the swiftly changing scenario of technology, the integration of Artificial Intelligence within educational institutions is fundamentally reshaping how knowledge is managed [2-4]. This research aims to provide a thorough analysis of how AI influences the creation, distribution, and utilization of knowledge in educational settings in both India and Poland. To achieve this, we have synthesized a relevant set including existing literature, of sources, conducted in both countries, shedding light on the multifaceted dimensions of AI's role in education.

First and foremost, AI is found to be a milestone in the educational journey through intelligent tutoring systems and adaptive learning platforms. This adaptation involves

student engagement as well as offers personalized feedback.

However, the introduction of AI in educational institutions brings to the forefront important ethical considerations that are becoming increasingly crucial, particularly in data governance. An inclusive approach is essential in the pursuit of responsible AI integration, acknowledging the diverse interests and concerns of those involved in the education sector.

In conclusion, to ensure a comprehensive understanding of the impact of AI on education, we have sought to incorporate various perspectives, including those of students, educators, administrators, and policymakers.

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Network Analysis of the Relationship between Personality Traits and Online Behavior in Adolescents and Young Adults

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Keywords

Computer games, play activity, virtual reality, adolescence, network analysis.

Summary

Given the growing popularity of video games, recently there has been a significant increase in the number of research works studying the effects of video games on various aspects of physical and mental development particularly, in children and adolescents, who represent more than one fourth (around 27%) of the world's gamers [1]. An interesting area of research is represented by scholars studying the connection between personality and behavior in video games [2]. As reference [3], playing video games should be perceived as a conscious activity, which requires a sizeable commitment. According to [4], the conscious effort to partake in any kind of behavior is influenced not only by situational constructs, but also by consistent constructs, such as personality. Thus, there are strong grounds to believe that decisions made about video games represent a reflection of personality and its traits. In this regard, contemporary research aimed at studying the possibility of using video games to diagnose cognitive abilities is of great interest [5].

From the methodological perspective, research in this area requires adequate tools for examining video game behavior and, more specifically, for revealing the criteria that could be associated with certain traits of personality. It should be taken into account, that given the variety of the existing video games and the diversity of behavioral patterns, which they offer, it may be difficult to generalize the results of research.

The aim of our research was to reveal the existing connections between personality traits and behavior in the video game «Dota 2» («Defense of the Ancients 2»). "Dota 2" is played in matches between two teams of five players with each team occupying and defending their own separate basis on the map. Each of the ten players controls a powerful character - a "hero", having unique abilities and a particular style of play. During a match players collect experience points and items for their heroes in order to defeat the other team's heroes in playerversus-player combat. A team wins by being the first to destroy a large structure located on the competing team's basis, called the "Ancient". An important part of the analysis consisted in considering the choice of heroes by the players throughout the history of matches. In the framework of the research all of the indicators listed above were downloaded and analyzed for 70649 matches.

The participants for the current study were 203 Dota-2 players from Russia, of which 100 participants were excluded because they had failed to fill in all the questionnaires offered in the study. Of the 103 participants included in the analysis, 98 (95.1%) were male. Participants ranged in age from 14 to 25, with a mean age

of 18.3 (SD = 2.9). The majority of participants (79; 76.7%) were under the age of 21.

On the basis of correlation analysis, small statistically significant relationships between personal psychological and game factors were revealed. In order to identify other and possibly more significant relationships between gaming and psychological indicators, it seems necessary to increase the sample of subjects.

The possible relationships identified on the basis of correlation analysis show that the need for role-playing experience generally increases with the age of the players. At the same time, players with more gaming experience are less sociable psychologically, but they are more politically interested and ready to help other players in the game. On the one hand, this suggests that these players are more dependent, and on the other hand, that they are less focused on themselves. It is clear that players who help less are more independent and self-centered. Willingness to help is also associated with a greater difference between "I-real" and "I-ideal".

It can also be argued that players with more kills during the game tend to be more focused on an imaginary rather than on a real audience.

The factors of normal and highly skilled players seem to be related to the poor compatibility of these players with the roles that they have to try on in the game. As a result, the difficulty of combining roles is negatively correlated with the level of skill required from the player. In the group of very experienced players, this dependence is not observed.

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