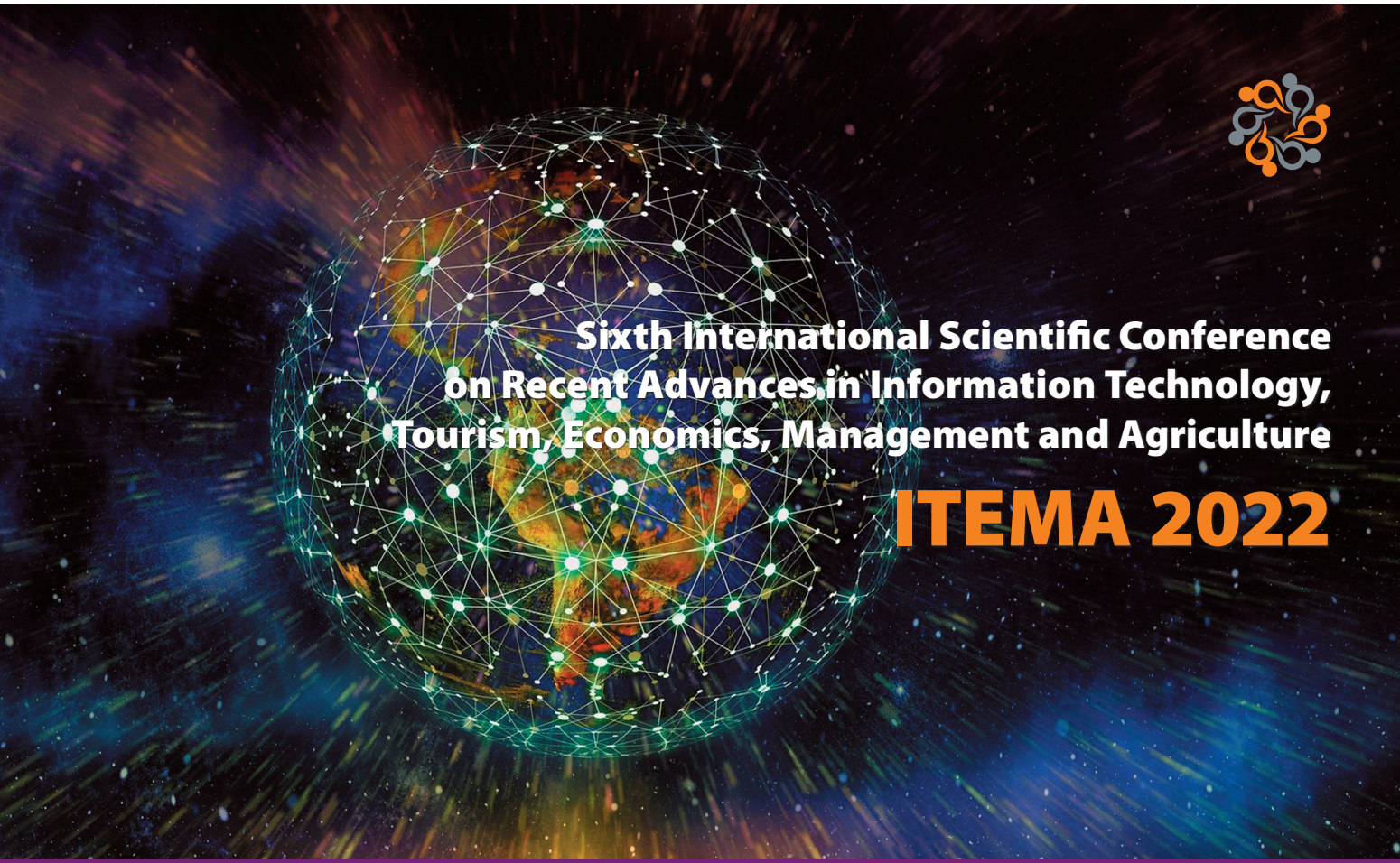

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Recent Advances in Information Technology, Tourism, Economics, Management and Agriculture

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Preface

The purpose of the annual ITEMA conference is to support the power of scientific research and dissemination of the research results with the objective to enhance society by advancing knowledge; policy-making change, lives, and ultimately, the world. Our objective is to continue to be the foremost annual conference on cutting-edge theory and practice of information technology, tourism, economics, management, and agriculture, encouraging advancement via excellence, and interaction.

ITEMA conference aims to bring together the international academic community (experts, scientists, engineers, researchers, students, and others) and enable interactive discussions and other forms of interpersonal exchange of experiences and popularization of science and personal and collective affirmation.

The annual ITEMA conference is committed to the highest standards of publishing integrity and academic honesty as ensuring ethics in all its publications. Conformance to standards of ethical behavior is therefore expected of all parties involved: authors, editors, reviewers, and the publisher. The conference organizer follows the Committee on Publication Ethics (COPE) guidelines on how to deal with potential acts of misconduct.

All received full papers prior peer review process are subject to plagiarism check with iThenticate by Turnitin software. Any identified plagiarism automatically disqualifies a paper. Afterward, all full papers are double-blind peer-reviewed by the reviewers drawn from the editorial committee or external reviewers depending on the topic, title, and the subject matter of the paper. Peer reviewers provide a critical assessment of the paper and may recommend improvements. Although the author may choose not to take this advice, we highly recommend that the author address any issues, explaining why their research process or conclusions are correct.

The conference program of the 6th International Scientific Conference on Recent Advances in Information Technology, Tourism, Economics, Management, and Agriculture - ITEMA 2022 held on October 27, 2022, combined presentations of the latest scientific developments in the field of knowledge management with blockchain, data-driven vehicle lifecycle management, AI-based website content generation, comparative analysis of protocol attributes, cryptocurrency evidence, electronic invoicing, genetic algorithms for job shop problems, risk management with automation, social networks in healthcare, e-platform usage in education, augmented reality learning, information security and cybersecurity, payment security in online commerce, tourism, COVID-19's economic impact, digitalization, strategic alliances, capital markets, healthcare financing, FINTECH, sustainability reporting, human resources, education strategies, agricultural analysis, and others. The selection of papers for presentation on the conference day was based on quality, originality, and relevance.

ITEMA 2022 keynote speaker was full-time professor Kornelije Rabuzin representing the Faculty of Organization and Informatics, University of Zagreb, Varaždin, Croatia with the topic *Using Business Intelligence*.

Within publications from the ITEMA 2022 conference:

- 12 double peer-reviewed papers have been published in the **ITEMA 2022 Selected Papers**,
- 48 double peer-reviewed papers have been published in the **ITEMA 2022 Conference Proceedings,**
- 106 abstracts have been published in the **ITEMA 2022 Book of Abstracts**.

Altogether ITEMA 2022 publications have more than 700 pages. All full papers have DOI numbers and ORCID iD integration.

Participation in the conference took **193 researchers** representing **20 different countries** from different universities, eminent faculties, scientific institutes, colleges, various ministries, local governments, public and private enterprises, multinational companies, associations, etc.

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Support for Knowledge Management Processes with Blockchain Technology

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Abstract: *Knowledge management facilitates the cycle of knowledge within organization through processes for knowledge capture/creation, storing, sharing and application. Various information technologies are already used to support those processes and their mechanisms, and new ones are continually emerging. The use of blockchain technology is lately suggested in many areas, including knowledge management. This paper aims to identify what are the most discussed benefits of using blockchain technology in knowledge management, considering their features, especially for specific processes. It also explores possible advantages and disadvantages of the use of blockchain technology, on which depends its real adoption in organizations as support for knowledge management processes.*

1. INTRODUCTION

Importance of organizational knowledge is indisputable today for the success of any business organization on a market that is continually changing and is, especially lately, disrupted by various events – diseases (COVID-19), natural disasters (earthquakes), wars (Ukraine), or logistic problems (truck drivers shortage, Suez Canal obstruction). Critical knowledge must be determined and obtained from sources within and without organization, as is accentuated in Quality management systems – Requirements standard, ISO 9001:2015 (Kahler et al., 2016), which was again confirmed in 2021 (International Organization for Standardization, 2015). For this reason, knowledge management should be an integral part of organization management, ensuring that knowledge management processes have the continuous support that they need.

The use of various information technologies to foster knowledge management processes has been investigated by various authors (Becerra-Fernandez & Sabherwal, 2014; Dalkir, 2017; de Carvalho & Ferreira, 2001; Lovrenčić et al., 2017) because it offers many possibilities for improvement of business processes that organization can benefit from and gain competitive advantage. It is not exaggerated to say that knowledge management can benefit from almost any information technology, and therefore this research continues with the emergence of new technologies, including blockchain technology.

The paper is structured as follows. In Chapter 2 is given an overview of knowledge management processes and well known technologies for their support, and in Chapter 3 are described the basics of blockchain technology. Chapter 4 investigates benefits of blockchain use for knowledge management processes, and Chapter 5 advantages and disadvantages of blockchain technology in general. Potential directions for future research are described in Chapter 6, and in chapter 7 the conclusion is given.

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2. KNOWLEDGE MANAGEMENT PROCESSES AND TECHNOLOGY

The flow of knowledge through organization is enabled by knowledge management processes that are part of knowledge management architecture, which also includes various mechanisms, technologies, systems and supporting infrastructure. There are numerous proposals for names and number of those processes. For example, Wei and Yeganeh (2013) list suggestions from six different papers and Dalkir (2017) gives a review of seven approaches to knowledge management cycle. In general, knowledge management processes can be divided into four phases:

1. **Knowledge capture/creation:** First phase of knowledge management cycle that is focused on obtaining new or existing knowledge, which resides within or without organization and is necessary for its business.
2. **Knowledge storing:** The phase in which different methods and technologies are used for processing, codifying and storing knowledge in various formats that are appropriate for sharing and using.
3. **Knowledge sharing:** Often mentioned as the most important phase, it ensures that knowledge is accessible in an understandable form and at the right time to employees that make decisions and perform actions.
4. **Knowledge application:** Last phase refers to the application of knowledge in business, whereby the knowledge that is applied can be one's own or someone else's.

Information technology is an integral part of knowledge management since it began to be studied as a scientific discipline. This is depicted in well-known Stankosky's (2005) four pillars of knowledge management: leadership, organization, learning and technology; where information technology such as e-mail, data warehousing, search engines, decision support and management tools are mentioned. During years many „traditional" and also emerging technologies were and are used for support of knowledge management processes, for example databases, content management systems, decision support systems, lessons learned systems, data mining, blogs, big data analytics, machine learning. augmented reality, natural language processing and semantic technologies. For a large number of emerging information technologies, the benefit for supporting knowledge management processes, and thus the organization's operations, is assessed. Blockchain is also one of those technologies.

3. BLOCKCHAIN TECHNOLOGY

It is considered that work on blockchain began when Haber and Stornetta (1991) described the procedure of secure time-stamping of digital documents, and then gained interest after famous mail and paper from Nakamoto (2008) that proposes a bitcoin as electronic cash with peer-to-peer network and proof-of-work chain. The first implementation of blockchain was in 2009 as the public distributed ledger for bitcoin transactions, meaning that a ledger is distributed over network (Chowdhury et al., 2019).

There are many papers that in detail explain blockchain technology (Belotti et al., 2019; Chatterjee & Chatterjee, 2017; Murray, 2019; Sahani et al., 2020; Yaga et al., 2018), which can be described in the simplest way as a shared distributed database. In the blockchain, content is stored on a decentralized public ledger that ensures tracking of history of all transactions and thus provenance of data, information and knowledge. Encrypted content, distributed ownership and distributed physical structure of the ledger ensure trust and security. Blocks in a ledger are connected into chains, and each block has a block header and block data. Block header contains information about block

number and size, time of creation, previous block hash value, block data hash representation and nonce value, whereas block data are stored transactions and ledger events (Yaga et al., 2018). There is no need for intermediaries and interactions can be trustless and permissionless. For example, blockchain enables use of smart contracts – certain actions (such as transfer of some asset) can be predefined and automatically executed when certain conditions are met, without a third party (Belotti et al., 2019), enabling automation of business workflow. Blockchain can also store non-fungible tokens (NFTs) that are unique and can identify something or someone, thus proving the existence and ownership over any digital asset which is the object of a smart contract (Wang et al., 2021).

On Figure 1 is depicted a simple representation of the process of creation of a new block. The important part of the process after initiation of a blockchain change is that transaction has to be validated by computers on the network with consensus protocols, such as Proof of Work (PoW) or Proof of Stake (PoS) (Sriman et al., 2020). Once verified and added to blockchain, block is immutable, irreversible and resilient. This is why its use is investigated in many domains beyond cryptocurrencies, and one of them is knowledge management.

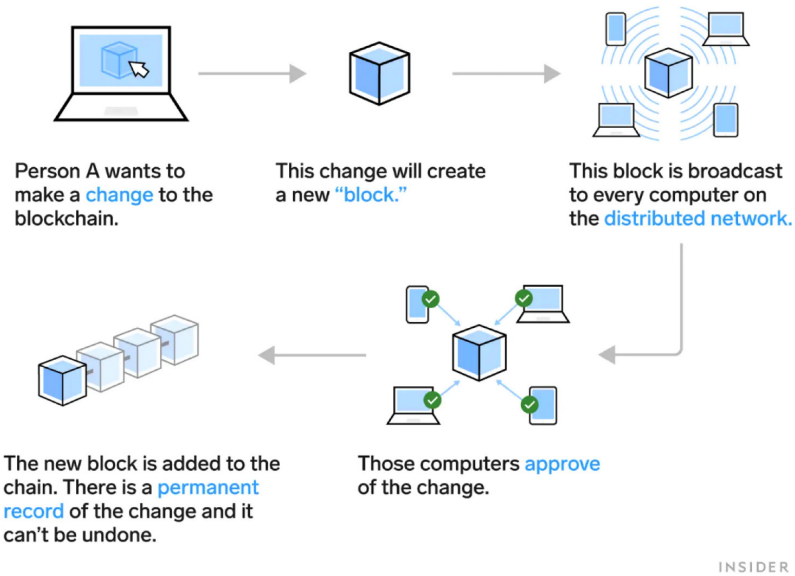

Figure 1. Creation of a Block in a Blockchain
Source: Houston, 2022.

4. THE USE OF BLOCKCHAIN IN KNOWLEDGE MANAGEMENT PROCESSES

Since knowledge management continuously makes use of new technologies to support its processes, there is also ongoing research and proposals of possible application of blockchain for this purpose. The aim of this research was not only to find scientific papers about the topic but also suggestions and ideas from professional perspective, such as business magazines and professional blogs, so that the scope of the interest and practical use in business organizations can be viewed from different perspectives. For this reason, only Google and Google Scholar were searched with keywords "knowledge management processes", "knowledge creation", "knowledge acquisition", knowledge storing", knowledge storage", "knowledge sharing", "knowledge distribution", "knowledge use" and "knowledge application" combined with "blockchain". Results directly connected to knowledge management processes in business organizations and blockchain features that would improve them were taken into account. For given conditions, only few papers described below and no relevant other sources were found.

Investigation of Scopus citation database papers about general use of blockchain for knowledge management was done by Frozza et. al. (2019) and the authors found nine papers in total and several proposals for blockchain application in all knowledge management processes, naming decentralization, immutability, traceability, anonymity, distrusting, transparency and smart contracts as its important features. Akhavan et al. (2018) argue that blockchain should be used in knowledge management because of various features: for knowledge creation because of collective verification and transparency; for knowledge storage because of transparency, decentralization, immutability and integration; for knowledge sharing because it ensures intellectual property rights; and for knowledge use because of security and access control. Yuman and Goyal (2022) propose model of enterprise knowledge management blockchain technology platform that ensures verification, security and anonymity of knowledge creation and transfer with the use of private keys, using distributed and decentralized knowledge base. Framework for knowledge acquisition system with secure, immutable and irrevocable blockchain-driven decentralized knowledge base is proposed by Majeed & Hong (2018), which will enable secure submission of rules with public and private keys. Decentralization, immutability and establishment of trust are also features that improve processes of knowledge storage and sharing (Adeleke, 2019). Other features that make blockchain technology useful for knowledge sharing are transparency and security (Hu et al., 2018; Philsoophian et al., 2022), as well as security, trust, immutability, distribution and traceability (Pastor et al., 2020).

According to purpose of knowledge management processes, known features of blockchain and analyzed literature, most important benefits of blockchain technology that can be identified for specific processes/phases are:

1. **Knowledge capture/creation:** provenance of captured/created knowledge and trustworthiness of data sources,
2. **Knowledge storing:** distributed, decentralized knowledge storage and decreased possibility of knowledge manipulation,
3. **Knowledge sharing:** no intermediaries in knowledge sharing and facilitated sharing because of decentralized storage,
4. **Knowledge application:** self-execution through smart contracts and automation of business workflow.

5. ADVANTAGES AND DISADVANTAGES OF THE USE OF BLOCKCHAIN

In previous chapter are described many positive perspectives of implementation of blockchain technology. One of most mentioned advantages is security of stored data, information and knowledge, because of use of cryptography, decentralization and need for network consensus for any change in a ledger. The way in which each block is created ensures immutability of stored information, which becomes permanent and uneditable. The whole process brings even more advantages in form of transparency and trustless and permissionless interactions, but also ensures authorship and ownership of created knowledge (NFTs) and proof of knowledge.

When adopting blockchain in knowledge management, organizations should not be aware only of its benefits and advantages, but also of disadvantages in general. Important disadvantages that organizations have to take into consideration before implementation of blockchain technology in knowledge management and for specific knowledge management processes are:

- **Scalability:** The number of transactions per second (TPS) of blockchain technology is still low; according to various sources, Bitcoin has 7-14 TPS and Ethereum 20-35 TPS whereas Visa has 1700 TPS.
- **Cost:** Transaction fees can significantly vary, depending on various factors (Clarke, 2022) as well as mining and service fees.
- **Storage limitations:** Compared to standard data and knowledge bases, the size of Ethereum Blockchain (978 GB) and Bitcoin Blockchain (406 GB) is small, but largely affects the scalability. Up to date size can be checked at https://ycharts.com.
- **Sustainability issues:** Energy consumption depends on consensus method – Bitcoin has estimated energy consumption of 132.42 TWh/year (comparable to Argentina), and Ethereum 0.01 TWh/year (comparable to Gibraltar). Up to date energy consumption estimate and comparison with countries can be checked at https://www.statista.com.
- **Questionable future value:** As with any new technology, organizations may not see future value of use of blockchain when considering other technologies and blockchain advantages versus mentioned disadvantages, as well as possible contrary information in media.

6. FUTURE RESEARCH DIRECTIONS

Blockchain technology is continuously investigated for application in many domains and for various purposes. There is also research interest aimed at knowledge management in general and for specific domains, which was not in the focus of this paper. Surprisingly, there were only several papers that investigated the use of blockchain technology features specifically for knowledge management processes and no other relevant web sources were found. This points out that more thorough research should be made in several citation databases with carefully selected keywords to find out the nature of connection between blockchain and knowledge management that is currently in the main scientific focus.

Research aimed at blockchain features and knowledge management processes mainly took into account possible benefits. But, to enable organizations to make decision about implementing blockchain technology together with other technologies it already uses to support knowledge management processes, a framework that weighs all advantages and disadvantages for specific processes and their mechanisms should be established. The framework should take into account various factors, such as business strategy, importance of specific process and already implemented technologies, as well as extended use of blockchain technology beyond knowledge management.

7. CONCLUSION

Literature search and overview showed that there is ongoing research about blockchain and knowledge management, but mostly not focused on blockchain features and their potential to support knowledge management processes. Since continuous practice and research proves that many technologies can successfully be implemented into knowledge management systems, there is large potential also for blockchain technology. Organizations invest resources into areas that will be profitable, and knowledge management is not an exception. This is why consideration of use of blockchain technology depends on various factors and such investment would probably need justification of broader use. However, with advancement of blockchain technology, main disadvantages have potential to be reduced over time and influence less on profitability issues, making organizations more prone to implement blockchain as a support for knowledge management processes.

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A Proposed Blockchain-Based Solution for a Data-Driven Vehicle Lifecycle Management

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Abstract: *Vehicle lifecycle data and stakeholders' data related to it have a non-open approach to data access. The lack of accurate, reliable, transparent, and accessible data consequently leads to a lack of trust, but also a risk analysis that is not always relevant. This paper consists of analyzing the factors to determine if a blockchain-based solution could increase trust and collaboration between different stakeholders in vehicle lifecycle management and the insurance industry. The goal is to model a data-driven approach on a blockchain-based solution that helps reduce barriers to finding data on all vehicle transactions. The methods used are based on the analysis of the current systems and platforms of vehicle lifecycle management and insurance policies from the business model perspective and security aspects. The proposed technical solution consists of a general architecture for a permissioned blockchain-based vehicle lifecycle management used by manufacturers, insurance companies, and other stakeholders.*

1. INTRODUCTION

This paper consists of analyzing the factors to determine if a blockchain-based solution could increase trust, and collaboration, and initiate a data-driven approach business model between different stakeholders in vehicle lifecycle management and the insurance industry. The possibilities that blockchain offers in addressing the problems of lack of data will be analyzed. A data-driven model, a solution based on blockchain, and "smart contracts" will be conceived. The proposal is to digitize all transactions in a decentralized, accessible, and distributed ledger which could initiate new initiatives in the insurance policies like the pay-as-your-drive or bonus-malus concept. Modeling and building a decentralized database of customers and products leads to a data-oriented business model and more concrete opportunities for analyzing those data. The current approach has risen issues that the blockchain-based solution must address because they continue to cost manufacturers, insurance companies, and customers a considerable amount of money. In this paper key issues identified are mileage fraud, accident fraud, IoT update vehicle usage, vehicle production, and usage location traceability, parts functioning and traceability, data analysis from manufacturers and other stakeholders, ownership traceability, insurance policies traceability, data-driven risk analysis, and predictive maintenance.

This paper presents a general architecture for permissioned blockchain-based vehicle lifecycle management. The proposed technical solution consists in a permissioned blockchain platform that helps break down border barriers to find data on manufacturers, vehicles, users, and all other stakeholders, following the entire product lifecycle. These data can be used by a range of users such as manufacturers, insurance companies, and other stakeholders. The main objective

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is to securely digitize and share vehicle lifecycle data. This will enable the stakeholders to securely collaborate over a permissioned blockchain network using vehicle data for different business model approaches. This could create a growing ecosystem of services around the proposed solution. The purpose is to store in a distributed ledger and provide evidence of all transactions committed for a vehicle from different stakeholders as needed while addressing the security concerns between participants in the network.

2. LITERATURE REVIEW

Relevant and accurate data about a vehicle impacts its value and the insurance policy related to it. Today's vehicle industry is spread over different manufacturers, dealership companies, vehicle repair services, and others. All this amount of data is not shared between different stakeholders. Issues and fraud related to vehicles rise, directly impacting their value and stakeholders. Zafar et al. (2022) underline the fact that due to a lack of records, insecure records, or lack of verified data, the purchaser of a used vehicle remains unaware of the maintenance and transfer history of the vehicle.

Willemarck et al. (2014) in their joint appeal to members of the European Parliament addressed the issue of vehicle odometer fraud which has become a growing problem internationally. Known more commonly as mileage fraud, it affects a considerable number of used cars in Europe - estimates go as high as 30%, costing European consumers approximately €5.6 to €9.6 billion. One of the reasons is the lack of unified vehicle life-cycle management. Vehicle data are currently spread across multiple stakeholders that do not trust each other or collaborate. Brousmiche et al. (2018) present another example of vehicle fraud that has great economic and societal impacts concerning rolling wrecks. Vehicles declared as wrecks by an insurance expert are put back onto the second-hand car market, with the help of corrupt professionals. These rolling wrecks are often the cause of severe accidents, involving injured people, and costing insurance companies and consumers a lot of money.

Pan et al. (2020) stress the need to introduce trust mechanisms in organizations to solve the problem of trust to improve information sharing. Lack of data transparency and trust arise since the only link to the information across different stakeholders is a paper-based vehicle logbook which in some cases, is corrupted or not updated with all transactions. Bringing all participating stakeholders under a common digitized platform is a challenge. Recently launched new initiatives for digitizing vehicle logbooks using blockchain technology, secure-by-design, and decentralized ledger. Abbas et al. (2020) explore the potential of blockchain technology in enhancing trust among the stakeholders based on blockchain technology's key attributes: distributed and sustainable; secure and indelible; transparent and auditable; consensus-based and transactional, flexible and orchestrated.

Casino et al. (2019) in a systematic review of blockchain applications emphasize that blockchain has found widespread applications including insurance, payments, asset management, supply chain, banking transaction, etc. providing security, scalability, reliability, and trust among stakeholders and participators in the network. Some notable work is presented by Brousmiche et al. (2018) addressing vehicle life cycle management and odometer fraud prevention through blockchain technology based on J.P Morgan Quorum. They consider the involvement of different stakeholders and emphasize the need and the efficacy for secure management of vehicle data over its life cycle with blockchain technology. The authors presented the idea of a

digital car logbook to prevent odometer fraud and provide a secure cryptographic protocol to provide access to vehicle data to interested stakeholders. Another notable work by Masoud et al. (2019) addresses information integrity with a framework called CarChain, a novel public blockchain-based history reporting system in used motor vehicles. CarChain provides vehicle owners, repair service companies, and insurance companies to register, add and store vehicle data in a distributed ledger that broadcasts transactions through a peer-to-peer (P2P) network. Addressing the cost issue Zafar et al. (2022) analyzed the memory and monetary costs of implementing Hyperledger Fabric a decentralized permissioned blockchain-based secure automotive supply chain and underline that memory and monetary cost are acceptable in their implementation and do not pose a challenge. Previous notable work addresses certain issues like digitizing, sharing, and controlling access to vehicle data but does not address the need for a comprehensive blockchain-based solution over the complete vehicle lifecycle management and fully integrated with manufacturers, insurance companies, dealership companies, and repair service companies.

3. METHODOLOGY

The approach used is the analysis of the current systems and platforms of vehicle life cycle management and insurance policies, highlighting the problems of the actual solutions not only from the point of view of the system and security but also from the business model side. After identifying the current problems, blockchain technology is proposed to address them while considering information security. Concluding on the conception of a blockchain-based solution for the creation of a data-driven business model. The aim is to increase transparency, trust, and collaboration, to enable pay-as-your-drive insurance policy initiatives, price determine mechanism based on risk analysis, predictive maintenance, vehicle and supplier part traceability, and data-driven new initiatives. This is achieved by proposing a decentralized distributed ledger with users, manufacturers, vehicles, and transactions generated from the moment of production and the entire life cycle of the vehicle, and the history of user transactions related to them. The analysis of security aspects from the part of identity management and access privilege is taken into consideration in this paper.

4. USE CASE OVERVIEW

In this blockchain-based vehicle lifecycle management, several actors are contributing and sharing data in a secure blockchain network. The major actors in this network are the manufacturer companies, providing digital vehicle logbooks and embedded IoT devices, insurance companies, dealership companies, and vehicle repair garages. The solution will provide flexibility, scalability, and ease of participating in the blockchain network for new actors.

Vehicle life cycle processes proposed in this solution, presented in the figure 1 schema, highlight some main steps. The schema presents a real-life scenario for a vehicle. The vehicle begins its journey to a permissioned blockchain when a manufacturer/authorized service provider creates a digital logbook in the blockchain containing all vehicle details. Manufacturer/Authorized service provider may choose to install embedded IoT devices that will perform updates of mileage and maintenance warnings in the blockchain as configured. During step two vehicle is sold and vehicle ownership is updated in the blockchain. The current owner has access and can securely share temporary access with third parties (such as insurance companies, garages, and other participants in the network). In step three insurance companies based on historical data of

vehicles provided in the blockchain issue an insurance policy considering a bonus-malus system or the pay-as-your-drive approach since data are transparent, auditable, and with high integrity. In step four based on warnings and incidents reported by IoT devices and sensors vehicle owner securely shares vehicle data with a vehicle garage. Maintenance report is stored in the blockchain network and vehicle data are updated in-vehicle digital logbook. In step five vehicle is resold and ownership changes. Access to the previous owner is denied, and the current owner is granted access and ownership of the vehicle. An insurance policy is reissued by the insurance company and based on previous data stored in blockchain risk analysis is more accurate and price more realistic to performance. In step six an accident occurred, and data are stored in the blockchain. Considering that the insurance company decides after an analysis from an insurance expert if the vehicle will be repaired or will be asked for vehicle wreckage, thus ending the vehicle's life cycle. These steps in a real vehicle life cycle scenario are repeated many times and traceability of transactions for vehicles is transparent, and accurate and resolves issues like mileage fraud and rolling wrecks that are present in the current system.

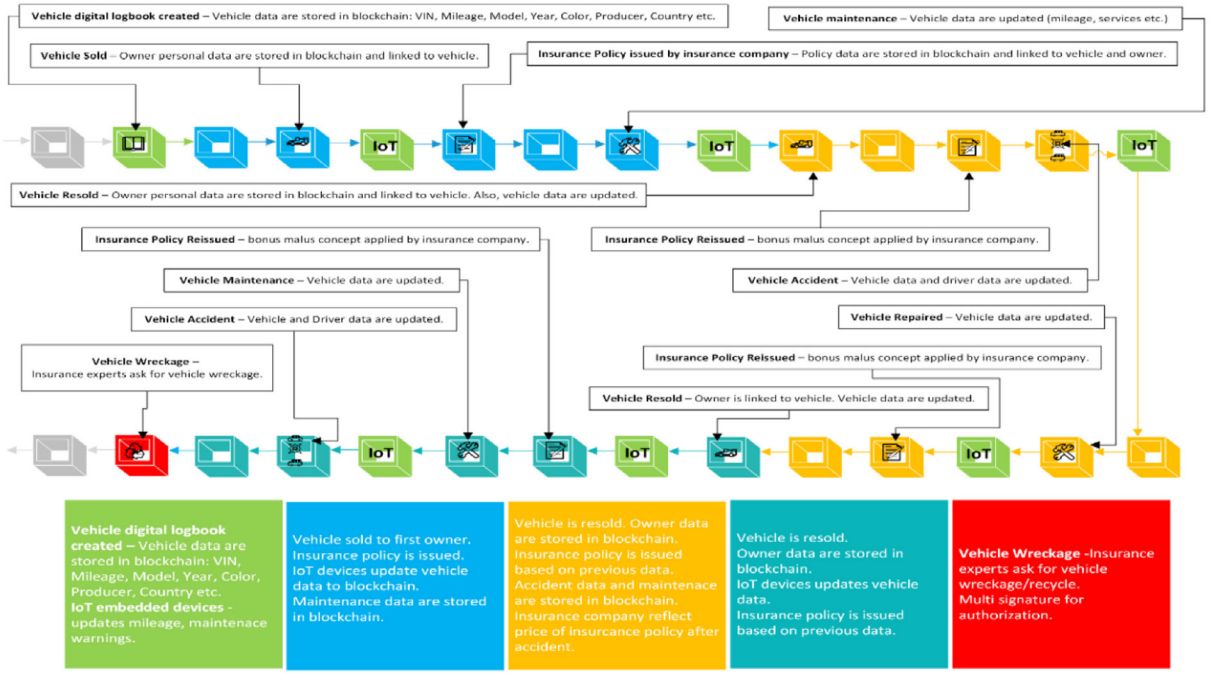

Figure 1. Blockchain-based vehicle life cycle

5. TECHNICAL SOLUTION PROPOSAL

Architecture for this blockchain-based system for vehicle life cycle management will be modeled from a business-level perspective. The architecture of the system will be modeled based on Hyperledger Fabric technology which is an enterprise-grade distributed ledger platform that offers modularity and versatility for a broad set of industry use cases. Working with Fabric directly involves modeling applications using Chaincode. The system will be modeled considering three main business levels: assets, participants, and transactions. There will be considered two main assets which are vehicle and insurance policy. The blockchain-based solution is scalable and in a real-life scenario, stakeholders will be able to agree to add more assets and participants to the network if needed. Assets are modeled in the form of key-value pairs. These key-value pairs represent the current state of the asset. The assets are stored in a state database, and individual fields of an asset can be updated by updating the corresponding key-value pair. In this

technical solution focus will be on the higher-level abstractions that are specific to the business use case by modeling resources whether they are participants in the network, the assets that are transferred, or transactions that are executed, and defining resource permissions.

A map representation of the main *assets* is presented in figure 2. Assets are modeled as objects with their attributes and may contain other objects as attributes. Vehicle as the main asset is modeled with attributes such as Digital logbook, IsSold, Insurance Policy, IsMaintained, and IsAccidented. Each of these is an object with its attributes. The focus of this asset is the digitizing process of the digital logbook, the history of insurance policies related to vehicles, and all vehicle issues and maintenance reports. All assets are subject to change if other assets and participants enter the blockchain.

Figure 2. General map of network assets and their attributes.

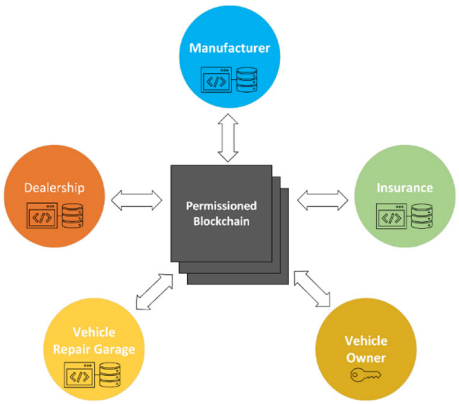

Figure 3. Participants in the Hyperledger Fabric network.

The main *participants* in the network are Insurance Companies, Dealership Companies, Vehicle Garages, Manufacturer companies with embedded IoT Devices, and vehicle owners. The system is modular and flexible for further development and changes for different participants. The blockchain network will be run into these participants and an access control list will be defined to determine roles and access right for each participant and for each channel. Every company which represents a major participant uses its applications and stores information in its databases as presented in figure 3. The proposed solution consists in sharing that information in a blockchain network accessible by all participants by integrating communication from participants' applications to the proposed blockchain Hyperledger Fabric network. Data are encrypted and only participants who have access and have the key or are provided with a valid key may view or write the data.

Transactions will be modeled as Read, Update, and Create access rights based on assets and participants. The read access of one participant is not allowed without providing the access key of the other. All transactions are encrypted. The transactions are not displayed in a detailed form in this paper but are displayed as what access rights have participants in table 1:

While defining the assets, participants and transactions are imperative to determine the relationship between participants and assets. Below are presented the main relationship between participants. Relationships in the Hyperledger Fabric network could be more detailed, elaborated, and subject to change based on new participants that join the network.

Table 1. Participants access rights

Assets\Participants	Insurance	Dealership	Garage	IoT devices (Manufacturer)
LogBook	Read	Create	Read	Update: Mileage, Consumption, Issues Detected
IsSold	Read	Create, Update Status	Read	No access
Insurance Policy	Create	Read	Read	No access
IsMaintained	Read	Read	Create	Read
IsAccidented	Create Update Status	Read	Read	Read

The main relationships are presented below:

- Insurance Company can issue one insurance policy for one vehicle. Until one insurance policy is valid, no insurance company can issue another one. Thus, the relationship between the insurance policy and the vehicle is one-to-one.
- One vehicle must own one digital vehicle logbook. Vehicle logbook fields are updated based on vehicle maintenance, embedded IoT devices, and further updates.
- One owner can have multiple vehicles. The owner is provided with access keys for each vehicle and may choose to grant temporary access to interested stakeholders.
- Vehicle Repair Garage can offer services to multiple vehicles and vehicle owners can choose between different vehicle repair garages.
- Vehicle Dealership Companies can offer services to multiple vehicles and vehicle owners can choose between different vehicle dealership companies.

The *identity management* process will be in a form of a chain of trust formed by a root certificate authority (CA) and intermediary CA. Fabric provides a built-in CA component that allows the creation of CA in the blockchain.

6. CONCLUSION

In this paper, a permissioned blockchain-based solution implemented with Hyperledger Fabric for vehicle lifecycle management is presented. Considering the lack of data and lack of collaboration between different stakeholders in the automotive and insurance industries we believe that blockchain technology could build trust and collaboration. There is a need to digitize vehicle lifecycle data in a secure and temper-prof technology. Blockchain key features such as immutability, decentralization, sustainability, security, and consensus-based provide an opportunity for a mutual agreement between participating stakeholders to share their data and integrate their systems with the blockchain network. In this blockchain-based proposed solution, the manufacturer enters into the blockchain each vehicle produced, or the authorized service provider enters into the blockchain each used vehicle creating a digitized vehicle logbook. During the vehicle lifecycle, the data is entered into the blockchain, and its usage is traced. All transactions through the vehicle lifecycle are stored in the blockchain network resolving issues like:

- Buying and selling a vehicle: the potential buyer verifies the property, and the doubt of buying a vehicle from a false owner in the case of a stolen vehicle is eliminated; it eliminates the possibility of duplicating the chassis number.
- Odometer fraud: it is possible to follow the kilometers traveled by the vehicle, avoiding that is illegally lowered by a dealer.
- Accidents fraud: they are all recorded, and this helps to determine a more accurate value in the market, reducing the information asymmetry that can occur when crashed cars arrive and the buyer is not informed.

- Maintenance services traceability: any maintenance performed on the vehicle is recorded in the blockchain by the service repair garage providing a higher level of transparency. This also helps to determine a more accurate market value in a trade and a price comparison between similar models.
- Data-driven model of the lifecycle of a vehicle: the existence of a platform with data on each type of vehicle, helps manufacturers and others to analyze the lifecycle of their product, and the quality of production since it tracks each event of how the vehicle responds in terms of safety and performance. This information is used by manufacturers to identify their production, advertising, and sales strategies.

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Dynamic Generation of Website Content Based on User Segmentation Using Artificial Intelligence

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Web 4.0;
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Abstract: *The aim of this work is the segmentation of website users on the basis of artificial intelligence with the aim of dynamically modifying the content of the website for users, in accordance with the objectives of Web 4.0, and in this way enabling quick and optimal display of content following their needs. User classification will be based on click events on categories/subcategories and articles. Based on that information, using Kononen's neural network, the user will be classified into one of the n categories to which the neural network was initially trained. Based on the detected type of the user's classification, the content of the site is dynamically changed to the user, and the categories and products for which the majority of users of that type of classification have expressed greater interest are initially displayed and offered. The goal is to adapt the content of the site to the needs of the user and in this way the user can easily and quickly find the desired product.*

1. INTRODUCTION

Modern Internet users are increasingly basing their needs on searching for information and products as well as purchasing products through websites and web applications. In the process of searching for desired products or services, we often find and buy those that we were not initially looking for. The goal of every site that offers services or products to the user is to attract the user, keep them on the site, place as many different products as possible and finally sell its product to the user (Gutama, 2021). To that end, websites often have large amounts of pages, with as many products as possible, often the same product presented in multiple images, in multiple colors, from multiple angles, multiple variations, and all with the aim of finding the best solution for the user's needs. Such large amounts of information, data, pages, texts, and images often lead to the complete opposite effect, which is burdening users with a large number of unnecessary details, which can make users feel uncomfortable and leave the site. This effect is even more emphasized with sites that have a large number of interactive elements (sliders with a large number of images, large-sized images with a large number of objects in them, pop-ups that appear frequently and in large numbers, advertisements, imposing the opinions of other customers, etc.). Although both developers and website owners have created their applications to offer the user a product or service, and in addition for the user to come, find and buy that product, the great competition on the market and the desire for dominance can often drive users away from certain websites due to excessive information burden on users (Rosário, 2021).

As both sellers and buyers want to be in a win-win situation, websites intended for advertising and sales have been constantly changing and adapting to the specific needs of users. Thus, a

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significant number of websites began to remember the user's previous behaviour and to offer the user goods from the same or similar product categories in advance, with the desire to increase the user experience. The second group of sites started by including different algorithms for recognizing the needs of users and defining a certain group of products as a suggestion to the user. In many different ways, sellers try to segment the items they offer to the user with the aim that the user finds the desired products as soon as possible and buys them (Punj, 2012).

Research has shown that user behaviour, user needs, expectations and wishes can be classified in certain ways. Psychology, as a science, has developed a large number of specific disciplines that analyse user behaviour in different ways and the various effects that lead to the final opinion, attitude and impression of the final product. So today we have a large number of works and researchers dealing with mass psychology, psychology of design, psychology of colour, psychology of optimal experience (Sharpe, 1974; Csikszentmihalyi, 2014). All this research shows that user experiences, behaviours and characteristics can be grouped and classified. In addition, the correct choice of colours, designs, shapes, etc. increases user experience, which contributes to better placement and sale of goods and services.

Psychology also indicates that users can be classified into certain logical groups that gather users with similar interests, desires and needs. This classification of users enables web applications to perform user segmentation. The goal of segmentation is to recognize the type of user and offer them products that correspond to their expected needs (Tu, 2010). In this way, the users will not be overwhelmed by a large amount of information and can quickly find what they need.

The era of Web 4.0 indicates that the goal of future web applications is based on the implementation of artificial intelligence and finding information that suits each user and their specific needs (Cioffi, 2020). Starting from that, in this paper, a solution for the segmentation of site users is proposed, based on clicks on individual target parts, ads/products, and based on artificial intelligence. For the purposes of artificial intelligence, self-organizing artificial neural networks were used, namely its representative Kohonen's neural network (KNN) (Kohonen, 2012). KNN aims to dynamically classify users (Müller, 2022), to provide the website code with information that is further used to dynamically modify the content of the website and display products to the user following their expectations. Such a dynamic system has a constant phase of learning and training, and with each new input it further improves the way of classifying the user experience.

This paper is organized into five chapters. After the Introduction, the basic principles of Kohonen's neural network are given. In the third chapter, there are suggestions for the use of KNN for the purposes of user classification and the proposed logic for changing the content of the site. In the fourth chapter, a conclusion is given with guidelines for further research and in the end, a list of used references is given.

2. KOHONEN NEURAL NETWORK

There are a large number of data processing methods that are based on the clustering of the set Q, which involve dividing and grouping the data into clusters Q_i, i = 1, . . . ,N so that data distances within the same cluster are minimal, while data distances between different clusters are maximal. This type of classification requires that the observed data can belong to only one cluster and must be classified into a certain cluster. Historically, artificial neural networks have shown good results in terms of input data classification and clustering (Roohi, 2013).

Starting from three primary learning paradigms, artificial neural networks can be divided into three main categories: supervised, feedback-reinforced and independent-unsupervised. Self-organizing maps (SOM), also known as Kohonen networks after their inventor Teuvo Kohonen, belong to the class of unsupervised networks (Kohonen, 2012). They determine the representation of internal weights for presenting input data without any user supervision. This is an extremely important feature in the case when there is a large dynamic of changes and fluctuations in the input data. Self-organizing maps are a visualization technique for data representation that reduces data dimensions through the use of self-organizing neural networks (Pal, 1993). Self-organizing feature maps (SOFM) learn to classify input vectors according to how they are grouped in the input space. The input space can be any set of data with the most diverse types of data contained in it (Kohonen, 2012).

A self-organizing map consists of elements called nodes or neurons, which can be visualized as a neural network in the form of a matrix. The usual arrangement of nodes is a regular arrangement in the form of a hexagonal or rectangular grid. Each node is associated with a weight vector of the same dimension as the input vectors representing the data, and is also associated with a position within the map structure (Kohonen, 2012). The procedure of placing a vector from the data space on the map starts by finding the node with the closest weight vector to the vector taken from the data space. Then the coordinates in the map of this node are set to the value of the vector. The distance between neurons is calculated based on their positions using the classic mathematical distance function. When input samples are presented to the network, a search is performed to select a winning neuron *c*. The input vector *x* at time *t* is compared with each of the weight vectors mi belonging to the SOM, and the minimum of the Euclidean distance between the input signal and the neuron's weight coefficients determines the best match, i.e. belonging to the same cluster.

$$\| x(t) - m_c(t) \| = \{\|x(t) - m_i(t)\| \ \| x(t) - mc(t) \| \} \tag{1}$$

In this case, the weight coefficients of the nodes are updated taking into account the environment in the form of a circle around the winning unit with a gain function α(t) (values of this function are $0<\alpha<1$) as follows:

$$m_i(t+1) = m_i(t) + \alpha(t)[x_i(t) - m_i(t)] \tag{2}$$

Outside this area, the weight coefficients remain unchanged:

$$m_i(t+1) = m_i(t) \tag{3}$$

The gain function is linear, with the highest values in the winning neuron and the lowest at the region boundaries. The arrangement of neurons in the SOM builds a discrete approximation of the distribution of samples used to train the neural network (Kohonen, 2012).

More neurons indicate regions with a high concentration of samples and fewer in regions where the samples are diluted. Figure 1 shows sample data as well as nodes of the SOM in the final state in the coordinate system. The final state of the map depends on three main conditions: the initial values of the weight vectors in the network, the data used for training and the parameters (characteristics) of the map. Map configuration parameters such as the number of network nodes, gain function, degree of learning and node distances are the main elements that determine the final

result. A self-organizing map represents a topological organizer in the sense of ordering data, but not a clustering procedure itself (Pal, 1993; Kohonen, 2012). The final weight vectors in the map are used for clustering, which allows the formation of clusters with specific network links.

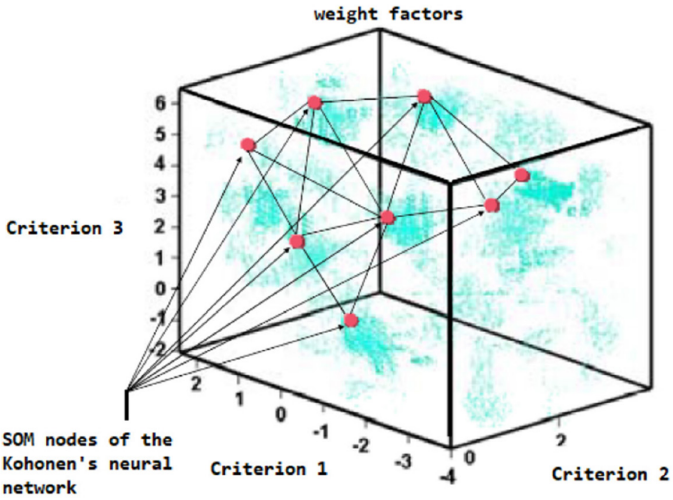

Figure 1. Distribution of nodes within the SOM based on input data.

3. PROPOSED ALGORITHM

The goal of every website user is to find the appropriate content as soon as possible, and the goal of every website owner dealing with sales is for the user on their website to be satisfied and make a purchase. When the concept of creating websites is based on marketing and advertising products that are primarily based on the content that is marketed to the user, we call it Contextual advertising (Zhang, 2012). The ideal mutual benefit scenario is that the user quickly finds the desired content/product and buys it. The psychology of customer behaviour defines the targeting of users in accordance with their experience, behaviour and habits as behavioural targeting (Ozcelik, 2019). The key problem is how to automatically classify users and products on the website and how to match them with each other. One of the methods presented in the professional literature is the Click-through rate (Zhou, 2019).

In this way, it is possible to monitor the user's movement within the website based on the monitoring of click events and thus try to understand the user's expectations in relation to their needs. On the other hand, this approach may require a fairly large sample of users in order to recognize their common characteristics. Another approach can be seen through the analysis of the strings that the user enters in the search field and in this way more clearly understand what exactly a specific group of users is looking for, in what order, priority, etc. This concept shows good results through the structure of the Vector space model (VSM) (Singh, 2015).

However, relying only on entered search terms can greatly reduce the quality of user classification because some users do not use text search, so their activity on the website cannot be detected. Some form of combination of these approaches should have the best results. During the last decade, one of the statistical models that shows exceptional results in modelling a large amount of data that can be more or less connected, i.e. correlated, is Latent Dirichlet Allocation (LDA) (Jelodar, 2019). In this way, grouping can be realized by analysing a large amount of information, by looking for previously unnoticed details that can create logical groups with a clear explanation of why some parts of the initial data are similar (Jelodar, 2019).

Starting from these scientific achievements, this paper proposes a solution for user classification based on artificial neural network (ANN) and in accordance with the principles of behavioural targeting, simultaneously combining the principles of click-through rate, VSM and the principle of LDA. The methodology used in this paper is based on the use of one of the web platforms for advertising and selling drinks in the Republic of Serbia. The activities of the user x_i, are stored in terms of each of their clicks, array **C**, and the entered search terms, array **S**. Also, for each user, certain pieces of information are stored: the time spent on a page - array **T**, the set of pages visited - array **P**, the items purchased - array **A**. On the basis of the results collected over several months, the detection of users who accessed the site multiple times was realized using client cookies in correlation with the identifiers of logged-in users who went through the authorization and authentication process. In this way, a clear distinction was made between users who visit the site while they are not authenticated among themselves and connecting an authenticated user with them while they were unauthenticated.

Considering that KNN can work with more criteria, for the purposes of this work, a total of 3 criteria were used: the total number of clicks on individual products, the terms that were searched and the items that were finally purchased. All three criteria are viewed as multidimensional parameters because they are based on the number of users, the time the user spent implementing the observed action and taking into account the distinction/pairing of the same users who are authorized or unauthorized.

Samples defined in this way are considered as inputs to KNN. The input vector x is compared at each moment t with each of the weight vectors m_i belonging to the SOM. The minimum value of the Euclidean distance determines the best match, i.e. belonging to a certain cluster. The number of clusters is not necessarily limited and does not have to be formally numbered and described. It presents the conclusion of KNN based on the entered results and groups users into N clusters in accordance with recognized common characteristics of user behaviour.

When a new user comes to the website, and KNN has already created its own clusters, the new user's activities will either contribute to assigning them relatively quickly to the existing cluster (if their behaviour is in accordance with the previously recognized behaviour of the user), or will contribute to the new organization of KNN (which may result in a change in the weight vectors m_i, or a change in the number of clusters and the logic used to group the nodes of the network into new clusters in the n-dimensional space).

In the first phase of work, the training of the network was done after the user left the site until the minimum amount of data needed for the training of KNN was formed. In the testing phase, corrections of input parameters and weight coefficients are dynamically applied in each of the three observed user activities. In this way, the first and key phase was realized, which represents the classification of users in accordance with the principles of behavioural targeting in correlation with the observed multicriteria principles of LDA. Based on the dynamic user classifications created in this way, the second phase of implementation of the proposed algorithm is entered. The second phase aims to dynamically create the content of the website in accordance with the conclusion of the first phase of user classification.

For these needs, the website was realized as a dynamic website, using the server programming language PHP and the MySQL database, as a server-side rendering method for displaying data to the end user. The initial view is defined by predefined content that is displayed to each user.

This content is stored in the database and displayed to the user for whom no previous activity is found in the client cookie. Based on that content, the user can either leave the site, which is not recorded, or click on one of the links/products, i.e. specific items, or enter search content. Regardless of which of the mentioned two activities is implemented, that activity changes the input vector of the KNN and the user tries to classify it in relation to the previous clusters of the neural network. With each subsequent activity, this process is repeated and the user can only be more precisely assigned to a cluster that is more suitable for the user experience. In relation to the calculated type of cluster to which the user belongs, the content that is dynamically retrieved and displayed from the database in the form of a group of articles and the articles themselves. They are displayed to the user on the page and in the block for recommended articles. This mechanism is presented in Figure 2.

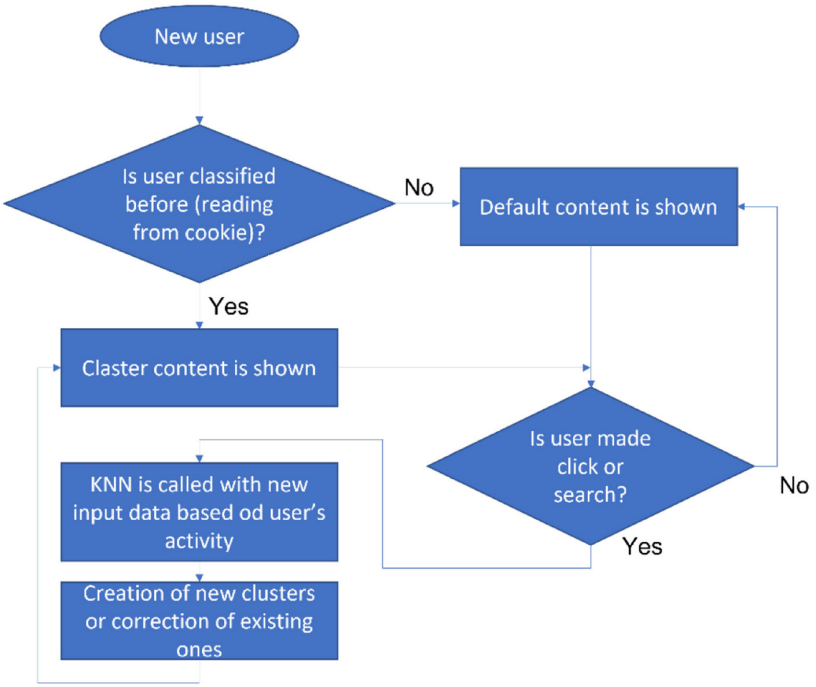

Figure 2. Proposed algorithm for user's activity in relation to the clicks

In the proposed way, each activity of the user can either confirm the previously juxtaposed group of clusters and their position increases, or the change appears if the weight coefficients and distances of the network nodes led to the change of the cluster by their recent changes. In each case, the dynamics of changing activities of each user are taken into account and entered equally into the total knowledge available to the neural network. Based on the change of cluster membership, the dynamic content that is further displayed to that user is directly changed.

The described activities were analysed over one year. Over 20,000 entries participated in the final form. In order to compare the results, a lot of different analyses were carried out, of which we singled out four special phases for the purposes of this work. Each phase lasted 3 months. In the first phase, the same content is used without changes based on user experience (Phase 1). This phase was taken as the reference phase. In the second phase, only the user's activity in relation to the click was observed (Phase 2). In the third phase, only the use of search keywords was observed (Phase 3). In the final phase, the simultaneous effects of user clicks and the use of search terms were combined, as described in this paper (Phase 4). The effect was measured in relation to the time spent on the viewed pages (*TC*), the total number of clicks that resulted in a

purchase (*CC*) and the value of the purchase (*VC*). These values are scaled to relative total values of all phases in the interval 1-100%.

The KNN was implemented in the form of an external API that referred to the described user activities and which activated the stored procedures in the primary database, which recorded all the user activities from before that were used as input vectors for the KNN.

The obtained results show that the measurement of the TC parameter by phases was 75%, 49%, 58% and 41%, Figure 3. In correlation with the measurement of the *CC* parameter, which has values of 81%, 74%, 69% and 52%, a difference is observed in Phase 2 and Phase 3. Such results indicate that the observed group of users does not have the same behavioural characteristics when compared in relation to the number of clicks and retention time, Figure 3.

However, the analysis of the *VC* parameter gives a more uniform situation, with values of 75%, 77%, 78% and 82%, and with a more clearly profiled function that indicates that the phase of integration of several different parameters, was the most effective from the point of view of users and website owners. These results are also shown graphically on the diagrams, Figure 3.

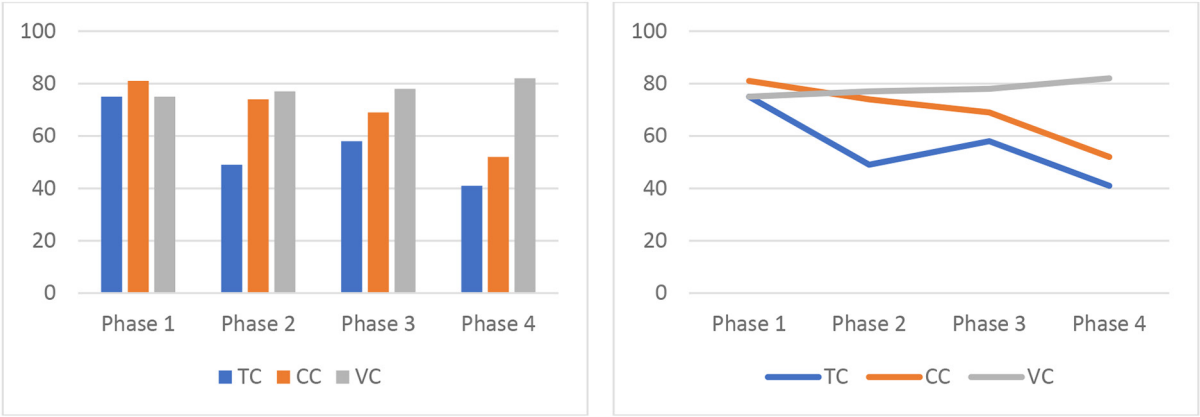

Figure 3. Values of parameters TC, CC and VC for Phase 1 to Phase 4 (two different types of charts).

The aforementioned analysis indicated the need for multicriteria analysis and contributed to the LDA concept. In order for the results to be even more credible, it is necessary to increase the sample number of users and include various factors that influence the decisions and attitudes of consumers. The mentioned testing was temporarily interrupted after the testing period because it was shown that the time required to update the KNN weight statuses became longer and longer with a larger number of data, so a different way of implementing the mentioned code must be found if it is maintained as a condition that every action of the user is carried out contacting KNN. This is certainly the subject of further work on improving the proposed algorithm.

4. CONCLUSION

This paper presents a solution for the dynamic generation of website content intended for advertising and product sales. Dynamic content generation is based on the dynamic creation of clusters of users in relation to their user behaviour on the site and their expectations. Clustering was realized using artificial neural networks. The results show that the application of the proposed algorithm increased the efficiency of the initial website solution and proved to be very useful. Further research will be directed towards changing the way clustering is realized due to

the speed of the system's response and changing the number of input parameters, the size of the dimensions of the matrix of the input set, and the optimization of the speed of calculating the weight coefficients of the proposed neural network.

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Cryptocurrency: Evidence from North Macedonia

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Regulatory framework;
North Macedonia;
Western Balkans

Abstract: *Cryptocurrency as a novel concept in finance, has lately attracted wide attention in the financial market. However, there is a divided opinion when it comes to embracing or ignoring them. Some are optimistic about their future, and others believe that the skepticism that surrounds them will strongly contribute to their disappearance from the market. The first part of the paper will give a brief background about cryptocurrencies and their associated advantages and disadvantages. The second part of the paper will focus on providing an overview of the cryptocurrency situation in North Macedonia, where they are currently unregulated. Since no legislation would protect consumers in case of fraud, the proper regulatory framework in this sphere is an urgent problem that requires immediate attention. Additionally, this paper will offer a small insight into other Western Balkan countries in this regard, where the situation is like in North Macedonia.*

1. INTRODUCTION

From a historical retrospective, the currency has always been evolving. It all started from gold and silver into metal coins and then eventually to paper or fiat money, used in today's economy. The fiat money is supplied by a country's central bank and protected by the government through regulations and laws, establishing the trust and value of the same.

However, recent digital developments and advancements led to the evolution of the currency over again. The late explosion and bust of virtual currency markets around the world have hit the financial system and institutions, placing cryptocurrency in a significant position in the portfolios of the financial market participants. The first triumphant cryptocurrency that changed the physical dimension of the currency was Bitcoin, created by Satoshi Nakamoto back in 2009. This led to the creation of thousands of other cryptocurrencies in the years that followed, surpassing 8.000 in 2021.

The abrupt invasion of cryptocurrencies in the financial markets created chaos for the regulatory bodies, who are still struggling to formulate policies and the proper legislation. Part of the reason behind this is the complex nature of cryptocurrency, but also the advantages and disadvantages that surround the same. This is particularly true in the case of developing countries such as North Macedonia, where regulators are still trying to figure out how to regulate, tax, and control cryptocurrency.

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2. BRIEF BACKGROUND ON CRYPTOCURRENCY

Though there is yet no strict definition of cryptocurrencies, in the latest research they are defined as a digital representation of value, not issued by a regulating authority, which does not exist in physical form, and in certain cases can be used as an alternative to money (European Central Bank, 2015). Cryptocurrencies use complex cryptography which allows for the creation and processing of digital currencies and transactions across decentralized systems. This is one of the main features that make them difficult to counterfeit (Sovbetov, 2018). They typically work through blockchain technology, a public ledger distributed over a network that records transactions executed among network participants, and serves as a public financial transaction database (Gatteschi et al., 2018).

The invention of cryptocurrencies began as an act of insubordination against the corruption of the traditional financial system. For a variety of reasons, these trends gained popularity after the global financial crisis a decade ago. After the crises, people stopped trusting financial institutions and shifted their attention to the use of cryptocurrencies as a substitute for traditional money (Goriacheva et al., 2017). In 2008, Satoshi Nakamoto, an anonymous creator, presented the world with Bitcoin, the first form of cryptocurrency that received serious attention (Nakamoto, 2008). With operations built on peer-to-peer information exchange technologies, Bitcoin is the trailblazer of many of the standards for digital currency (Mitchel, 2019). The code of this currency is a product of computer-based complex mathematical equations, which limits the number of possible Bitcoins to 21 million coins. This can be considered as an advantage of Bitcoin over other official currencies, whose new emissions are impacted by their depreciation and inflation, whereas the Bitcoin rate is determined by the ratio of demand and supply (Zahorodniy & Partyn, 2018).

Currently, more than 8.000 different types of cryptocurrencies are being traded worldwide. Apart from Bitcoin, there are various other types of virtual money which are referred to as an altcoin. Many altcoins have been developed to fix the shortcomings of Bitcoin. Initially, there was no great interest in altcoins, but as time went by, the views on cryptocurrency changed, thus more and more people started investing in all sorts of digital currencies (Zhao, 2015).

Table 1. Top 5 cryptocurrencies market capitalization

		January 2021		November 2022		
N.	Currency	Price	Capitalization	N.	Price	Capitalization
1.	Bitcoin (BTC)	$35.724	$667.320.519.657	1	$16.600	$319.337.757.181
2.	Ethereum (ETH)	$1.229	$140.576.634.356	2	$1.196	$146.446.263.414
3.	Tether (USDT)	$1.00	$24.333.048.444	3	$.99	$65.880.684.724
4.	Polkadot (DOT)	$16	$15.099.931.127	10	$5.5	$6.314.307.112
5.	XRP (XRP)	$0.2772	$12.555.994.634	7	$0.38	$6.314.307.112

Source: (CoinMarketCap, 2021)

Generally, the main ways to invest in cryptocurrency are the following (Bondarenko et al., 2019): (1) Trading – buying and selling through cryptocurrency exchanges. This method is recommended to more experienced investors; (2) Mining – the use of powerful computing to create the cryptocurrency. This method is generally safe but less profitable; (3) Cloud Mining – the purchase of computing power for rent; (4) Initial Coin Offering (ICO) – release of cryptocurrency, a process through which you can raise funds for the development of the project. This method is the most profitable, but with a higher associated risk.

3. THE LEGALIZATION OF CRYPTOCURRENCIES

Regulators in various countries have yet not established a consensus in determining the legal status of cryptocurrencies, leaving cryptocurrency transactions in a grey area. Generally, most of the countries have initially issued government warnings about the dangers and risks associated with investing in the cryptocurrency markets, stipulating the fact that many of the organizations that facilitate such transactions are unregulated. A few countries have further updated their laws on Anti-Money Laundering ("AML") and Combating the Financing of Terrorism ("CFT") to include cryptocurrency markets, and instructed the financial institutions that facilitate such markets to pay attention to the same. Some countries have imposed restrictions, or entirely banned investments in cryptocurrencies, as well as, barred financial institutions from facilitating transactions that involve cryptocurrencies (The Law Library of Congress, 2018). Below you can find a summary of cryptocurrency regulation across a few countries around the world:

Table 2. Cryptocurrency regulation in certain countries

Country	Cryptocurrency Status	Regulatory Framework
Australia	Property	• In 2017, the government enacted a bill that made digital currencies subject to the AML/CFT regulatory framework. • Taxed as an asset for capital gains.
Canada	Virtual commodity	• In June 2014, amended Canada's Proceeds of Crime (Money Laundering) and Terrorist Financing Act, to include virtual currencies, including Bitcoin. The Act is regarded as the world's first national law on digital currencies, and certainly the world's first treatment in the law of digital currency financial transactions under national anti-money laundering law. • Subject to income tax.
U.S.A.	Property, Currency, Investment instruments	• The responsibility for monitoring cryptocurrencies lies on a state level. Cryptocurrencies fall under the regulatory scope of the Bank Secrecy Act ("BSA"). This implies that cryptocurrency exchange service providers must get a license from Financial Crimes Enforcement Network ("FinCEN"), and adhere to AML/CFT regulations. Furthermore, The US Securities and Exchange Commission ("SEC") treats cryptocurrencies as securities and suggests that securities laws are applicable. • Taxed as property. Payment of wages in cryptocurrencies is subject to income tax and salary tax, and payments in cryptocurrencies to independent contractors are taxed by applying the self-employment tax.
China	Virtual Commodity	• In March 2018, China's central bank – The People's Bank of China ("PBOC"), banned any existing virtual currencies. Previously, in 2017, it also banned ICOs and domestic currency exchanges.
Japan	Property	• Cryptocurrency exchange businesses are regulated with the amendment of the Payment Services Act, which took effect on April 2017. Additionally, cryptocurrency exchange businesses are required to comply with AML/CFT obligations. Japan has one of the most progressive regulatory frameworks. • Subject to income tax – treated as miscellaneous income, rather than capital gains.
Switzerland	Property, Payment token	• Regulated by Financial Market Supervisory Authority ("FINMA") in 2017. AML/CFT regulations are applicable. • Subject to wealth tax – taxed as foreign currency.

UK	Crypto-asset	• The United Kingdom does not have any laws that specifically regulate cryptocurrencies. • Corporations are subject to corporate tax, unincorporated businesses to income tax, and individuals to capital gains tax.
European Union	Financial Instruments	• Currently, European Union has no general regulatory framework related to cryptocurrency. On September 24th, 2020, the EU Commission published a proposal for the regulation of crypto assets: the "Markets in Crypto-Assets Regulation" ("MiCA"). Once adopted and in place, it will be applicable in all EU member states. • Meanwhile, some countries have defined the status of cryptocurrency for taxation purposes. In Bulgaria, cryptocurrencies are taxed as financial assets, whereas, in Denmark and Spain they are subject to income tax.
Bolivia, Morocco, Nepal, Pakistan & Vietnam	N/a	• Ban all activities involving cryptocurrencies.
Bangladesh, Iran, Thailand, Lithuania, China & Columbia	N/a	• Indirect restrictions barring financial institutions within their borders from facilitating transactions involving cryptocurrencies.

Source: (The Law Library of Congress, 2018), (Cvetkova, 2018), (Bolotaeva et al., 2019), (EUR-Lex, 2020)

The acceptance of cryptocurrency appears to be linked with the state of development of a country. Developing countries with weak economies are not quite ready to introduce such payment systems, whereas developed countries are very interested in regulating and taxing the same (Drozd et al., 2017). Additionally, in a few developed countries, central banks are assessing the possibility of introducing a widely accessible Central Bank Digital Currency ("CBDC") into their economies. Currently, two CBDC models are in discussion: a retail CBDC and a wholesale CBDC. In terms of retail CBDC, the Riksbank in Sweden has launched a pilot project to determine the viability of an eKrona for retail payments, though no decision on technology has been taken so far. Another example of a retail CBDC is the Fedcoin, which was proposed in the US in 2014, but the concept has not been endorsed by the Federal Reserve. On the other hand, an example of a wholesale CBDC is the CADcoin in Canada, which has been used in simulations performed by the Bank of Canada in cooperation with Fintech firms and Canadian banks but has not been put into practice yet (Bech & Garratt, 2017).

4. EVIDENCE FROM NORTH MACEDONIA

Recently, cryptocurrencies have become a mainstream topic everywhere, including in North Macedonia. Due to the possibility of quick earnings, this type of investment is increasingly attracting the attention of citizens. In North Macedonia, the segment of cryptocurrency is not yet well regulated by law, thus, in case of fraud, there is no way to get compensated for the associated losses. If citizens get involved in this activity, they are doing it at their risk.

Currently, there is no official cryptocurrency company operating in North Macedonia. The same goes for Albania and Bosnia & Hercegovina. The only countries that have allowed the establishment of cryptocurrency companies in the Western Balkans are Kosovo[3], Montenegro, and Serbia.

[3] Under UN Security Council Resolution 1244/99.

Table 3. Active cryptocurrency companies in Western Balkan

Albania	N/A
Bosnia and Hercegovina	N/A
Kosovo*	Lyocha
Montenegro	Digital Montenegro, Coinmetro
North Macedonia	N/A
Serbia	Round Globe Technologies, ECD, Tradecore, Ulticoin, YourBTMs

Note: *Under UN Security Council Resolution 1244/99

Source: Adapted from (The World Bank Group, 2020)

The National Bank of the Republic of North Macedonia ("NBRM") actively monitors the views of the regulatory bodies of the EU regarding cryptocurrencies and their handling. According to the European Banking Authority ("EBA") and the European Securities and Markets Authority ("ESMA"), cryptocurrencies can rarely be treated as financial instruments and/or electronic money. In most cases, they are not covered by laws in the financial field. In the absence of regulation, the usual safeguards that apply to regulations in the financial sector do not apply to cryptocurrency, therefore consumers are at great risk. The current legal framework in North Macedonia (Law on Payment Operations, Law on Banks, Law on Foreign Exchange Operations, Law on the Unit of Currency in the Republic of Macedonia, as well as the Law on the Use of the Unit of Currency in the Republic of Macedonia) does not recognize the term cryptocurrency or digital asset, which is the case with most of the countries around the world.

Furthermore, according to NBRM, the general views on cryptocurrencies are in line with those of European financial regulators. It points out that cryptocurrencies do not have the status of deposits, and there is no mechanism in which clients can be reimbursed through the Deposit Insurance Fund, as in the case of funds invested in banks that have licenses for establishment and operations. Following the Law on Payment Operations, all payments are made in denars through the transaction account of the participant in the payment operations of the country. In rare cases, cryptocurrencies may be treated as electronic money, provided that several criteria are met, such as being issued by an authorized electronic money issuer. If cryptocurrencies have an investment nature in the background, i.e. are subject to trading on regulated platforms in the country and abroad by authorized participants, in that case, they can be considered financial instruments.

The first time that the NBRM officially addressed the public on cryptocurrencies, was right after the ONECOIN scandal in 2016, which turned out to be a classical pyramid scheme. It is believed that this announcement came as a result of the news regarding the London financial police launching an investigation into this cryptocurrency, for which NBRM had enough reasons to believe that it is bought a lot by Macedonian citizens. The launch of this investigation was a sufficient reason to stop any operations of this cryptocurrency in the country. NBRM used this opportunity to remind the public that the old Law on Foreign Exchange Operations somehow applies to cryptocurrencies, forbidding Macedonian citizens from having an account abroad and trading on foreign stock exchanges, i.e. forbidding any kind of investment in digital assets. Furthermore, they warned the public about the risks associated with investing in cryptocurrencies, such as the risk of loss of the invested money, the risk of fraud, the risk of volatility, and the risk of blocking certain cryptocurrency platforms due to activities related to money laundering and terrorist financing (NBRM, 2016).

In 2017, NBRM addressed the public with another official statement, as a follow-up to the previous announcement. Once again, they highlighted the dangers of cryptocurrency and warned

people to stay away from possible pyramid schemes. Nevertheless, cryptocurrencies are actually traded and mined unofficially in North Macedonia, and so far there has been no case of legal action against someone who participated in these activities. This questionable legal framework has led to the formation of an informal local market of cryptocurrencies.

In 2019, the Ministry of Foreign Affairs announced the "Decision on the transition to the second phase of the association between the Republic of North Macedonia and the European Union". This implied that part of the legislation that was in force during the first phase (2004-2018) ceased to be in force and capital markets were partially liberalized, i.e. the ban on investing in real estate abroad, the ban on investing in securities, etc. were abolished. Additionally, this also implied that the announcements that were made previously by NBRM ceased to apply as well. The grey zone surrounding cryptocurrencies finally became white. However, the risks NBRM warned about were real, leaving citizens to decide whether they accept cryptocurrencies. According to recent announcements, cryptocurrencies will soon be regulated by law in North Macedonia. The Ministry of Finance, the Financial Intelligence Office ("FIO"), and other financial regulators are in the process of determining the solutions to this issue, which will be implemented in the new Law on Prevention of Money Laundering and Financing of Terrorism (FIO, 2020).

The situation is pretty similar in the rest of the Western Balkans. The table below presents a synopsis of the regulatory framework related to crypto assets.

Table 4. Crypto Assets/ICO-s

Albania	**Kosovo***	**FBIH**	**Republic of Srpska**	**North Macedonia**	**Montenegro**	**Serbia**
Permitted, Prohibited, Unclear						
Unclear (New law is in the legislative procedure)	Prohibited	Unclear	Unclear	Unclear	Unclear	Permitted
Unregulated, Regulated, Unclear						
Unregulated (New law is in the legislative procedure)	Unregulated	Unregulated	Unregulated	Unregulated	Unregulated	(Partially regulated AML/CFT supervision)
The remit of the Central Bank/Banking Agency						
No	No	No	Unclear	Unclear	Yes (via AML/CFT regulations)	Yes
The remit of the Securities Regulator						
Yes	/	Unclear	Unclear	Securities Commission	Unclear	Yes
The remit of another designated regulator						
		Federal Ministry of Finance				
Licensing						
Not applicable yet	Not applicable yet	Not applicable yet	Not applicable yet	Not applicable yet	Via AML/CFT regulations (issuance/ exchange)	Not applicable yet
Number of firms that applied to regulators (including potential market entrants)						
/	/	/	5	/	/	10

Note: * Under UN Security Council Resolution 1244/99

Source: Adopted from (The World Bank Group, 2020)

According to the research conducted by the World Bank, most of the regulators claimed that crypto-assets are not regulated in their jurisdiction. Exceptions in this regard are Albania - which has already submitted the new Law on Financial Market based on Distributed Ledger Technology (DLT) to the Parliament for approval, and Serbia - where the National Bank has reported that AML/CFT regulations apply to cryptocurrency activities. Additionally, in Montenegro, the AML/CTF regulations imply that some crypto asset intermediaries are subject to licensing obligations by the Central Bank.

5. FUTURE RESEARCH DIRECTIONS

Having in mind that cryptocurrencies are still the focus of speculative investors, large capital movement, and the association with illegal actions, cryptocurrencies can pose great financial aggregate risks, thus urging for further research on several topics. *First*, the literature should work harder on resolving the motives for investing in crypto assets. In that sense, there should be a differentiation between crypto assets as an investment and as a medium of exchange. Furthermore, such findings will help to get to know better the factors determining the value of cryptocurrencies. *Secondly*, the literature should define the proper way to regulate the possession and usage of crypto assets, especially if one knows that large capital movements can be toxic for small and open economies. Moreover, the governments will have more solid conclusions when designing the regulation acts. *Third*, the research should prove the level of financial literacy is crucial to lowering the aggregate financial risks, and proper usage of financial instruments and services. And fourth, but not final, literature should find an argument for central banks or big and well-established financial institutions to use blockchain and Fintech more widely.

6. CONCLUSION

Cryptocurrency is a relatively new concept in the financial market and as such, it is surrounded by suspicion, mistrust, and skepticism. Although it seems like a promising alternative to traditional assets, the number of disadvantages associated with it is very high. Governments around the world are still struggling to establish the appropriate regulatory framework because of the complex nature of cryptocurrency.

The majority of the countries have addressed the citizens by issuing government statements related to one of the following: warning about the risks associated with investing in cryptocurrency markets, restrictions, or entire ban of investments in cryptocurrency, and facilitation of cryptocurrency transactions. Developed countries that have attempted to regulate cryptocurrency have mainly done so by updating their AML/CFT & tax laws and regulations.

In North Macedonia, similar to other developing countries, there is still no appropriate regulatory framework. This has led to the formation of an unofficial market of cryptocurrencies, where citizens participate at their own risk. However, according to recent news, cryptocurrencies will soon be regulated by the new Law on the Prevention of Money Laundering and Financing of Terrorism. This is especially important because when cryptocurrencies are not regulated and the country has no insight into who buys and sells them, they can be easily abused, especially for illegal activities.

However, it is hard to determine what the future of cryptocurrency holds, whether they will evolve and replace traditional currencies, or become entirely obsolete. With its potential for either becoming tremendously successful or unsuccessful, thorough research is recommended for anyone interested in pursuing an investment in the same.

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State and Perspectives of Electronic Invoicing in Croatian Companies

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Abstract: *The paper analyzes the current state and perspectives of electronic invoicing in Croatian companies. The digital transition or more specifically, the digital transformation processes affect all companies and are crucial for increasing efficiency, innovation, and the overall growth of the economies. Electronic invoicing, as one of the manifestations of digital transformation, brings about numerous economic benefits based on process automation and integration from order to payment between business parties. In the paper, the reasons and characteristics of Croatian companies that have introduced electronic invoicing and those that have not are presented in detail. The empirical study reveals that a company's adoption of electronic invoicing increases with the company's size. Also, the government's critical role in implementing electronic invoicing in Croatian companies is highlighted.*

1. INTRODUCTION

One of the most critical documents used in business processes and operations is the invoice (Haag et al., 2013). It represents payment information related to commercial transactions, and in addition to its vital role between trading partners, the invoice is also essential for tax administration, as VAT collection procedures rely on the integrity and credibility of invoices (Arendsen & Wijngaert, 2011). The process of traditional paper invoicing takes place in five steps: data entry, invoice printing, enveloping, mailing, and archiving, whereby the whole process requires time and money (Boshkoska et al., 2019). Further to that, other problems may arise such as incorrect data filling, issues with sending, and loss of documents, which can harm relations between business partners. There could also be difficulties associated with secure archiving, whether technical or methodological leading to the possibility of non-compliance with legal requirements (Veselá & Radiměřský, 2014). The idea of e-invoicing is not new. Electronic invoices have existed for approximately 40 years and were used with the support of EDI and XML formats. The broader availability of the Internet has led to greater adoption of electronic invoicing, with the public sector recently driving the adoption and implementation processes.

On a more specific note, and in the context relevant to the study presented herein, the Republic of Croatia issued the Law on Electronic Invoicing in Public Procurement (Official Gazette of the Republic of Croatia, 2018), which introduced the obligation to receive electronic invoices in public procurement procedures from December 2018 and the obligation to issue electronic invoices in public procurement procedures from July 2019 (MINGOR, 2022). Since then, public purchasers/contracting authorities have received electronic invoices via the central electronic invoicing platform "Servis eRačun za državu". In Europe, several legislations have been developed to promote the more comprehensive application of electronic invoicing in the EU. Also,

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many public sector organizations in Europe, including Sweden, Norway, Spain, and Denmark have announced mandatory programs/plans for e-invoicing. Italy has gone a step further, introducing a mandatory e-invoicing network for all business entities. In the first phase, the European market was mainly developed by the private sector, an advanced and high-volume industry. Today, the main driver is the growing number of governments requiring organizations to exchange invoices electronically. It is foreseen that the third phase will be the result of rapid technological development and the transfer of "the ball" to the B2C sector which will lead to further growth of the market for the implementation of electronic invoices. The global market's value for implementing electronic invoices in 2019 was estimated at EUR 4.3 billion, growing to EUR 18 billion in 2025 (Koch, 2019).

Most of the economic benefits of electronic invoice adoption do not come from savings in printing and postage costs but from the process automation and integration of activities from order to payment, increasing the transparency of business transactions and bridging accounting systems between suppliers and customers in real-time (Horák et al., 2020). Despite the clear benefits, there is still some reluctance to the implementation of electronic invoicing. Namely, the willingness of smaller organizations to invest in related digital solutions is still relatively low (CEF Digital, 2021a). It is also important to note the role of the private sector in raising the level of adoption of electronic invoicing as this is one of the tasks of information intermediaries who also provide issuing, receiving, and archiving electronic invoices and equip the business entities with ready-made solutions for using electronic invoicing (CEF Digital, 2021b). In Croatia, appointed by the Law on Electronic Invoicing in Public Procurement, the Financial Agency (FINA) represents a central information intermediary that receives and sends electronic invoices and supporting documents. This is in accordance with European norms, whereby other information intermediaries are required to connect to FINA's central platform for the exchange of electronic invoices.

The objectives of this paper are to empirically investigate the current situation and the perspectives of electronic invoicing adoption in the Croatian business sector. The level of adoption of electronic invoicing is analyzed with regard to the size of the company. Further to this, the role of the government in the adoption of electronic invoicing will be determined.

2. METHODOLOGY

To achieve the objectives and collect relevant data for this study, a survey was sent to the e-mail addresses of over 300 companies operating in the Republic of Croatia. The survey was divided into three sections. The first section collected information about the company's size, business sector, whether the company is subject to the law on public procurement, and if the company has introduced electronic invoicing. Depending on the answers, the second or third section is opened, collecting information about the use of electronic invoices. The second section is completed by companies that have not introduced electronic invoicing, while the third by those that have. The survey was distributed in August 2022 to a sample of micro, small, medium, and large companies operating in Croatia. Of the 59 companies that responded, 41 have introduced electronic invoicing, which is 69.49% of all surveyed companies, while 18 companies (30.51%) have not yet introduced electronic invoicing.

3. RESULTS

3.1. Sample Statistics

According to the category of company size, of all the companies that completed the survey, the largest number are micro companies (37; 62.71%), followed by small (14; 23.73%) and medium companies (5; 8.47%), and the smallest number are large companies (3; 5.08%). Most are providing services in the social and personal activities sector (13), followed by those operating in the processing industry (9), wholesale and retail trade; repair of motor vehicles and motorcycles and items for personal use and household, financial intermediation (6), construction, agriculture/hunting/forestry (4), real estate business, rental and business services, public administration/defense/compulsory social insurance (3), hotels and restaurants, fisheries, health care/social care, transport/storage/communications, education (2) and a single mining and quarrying company. To the question "Is your company subject to the Law on Public Procurement?", the vast majority of respondents, i.e. 46 (78%) answered negatively, 8 respondents (14%) answered affirmatively, and 5 respondents (8%) did not know whether they were subject to of the Law on Public Procurement. When companies were asked about their business cooperation, respondents could choose to what extent they agree with the answers provided using a scale from 1 to 5, where 5 means "I completely agree" and 1 means "I completely disagree". The results (Table 1) showed that the highest level of cooperation of the observed companies is with private companies (the real sector) where the mean level of cooperation on a scale from 1 to 5 is 4.15 (SD=1.23). Private companies (real sector) are followed by citizens (where the average level of cooperation is 2.97 (SD=1.67)). The lowest level of cooperation of the observed companies is achieved with the state (the public sector) with a mean level of cooperation of 2.53 (SD=1.37).

Table 1. Cooperation of companies with the government, businesses, and citizens

	5		4		3		2		1			
	N	%	N	%	N	%	N	%	N	%	Mean	SD
Government	18	30.15	13	22.03	15	25.42	5	8.47	8	13.56	2.53	1.37
Businesses	4	6.78	3	5.08	7	11..86	11	18.64	34	57.63	4.15	1.23
Citizens	17	28.81	12	20.34	5	8.47	6	10.17	19	32.20	2.97	1.67

Source: Author's research

3.2. Analysis of the Companies That Have Not Introduced Electronic Invoicing

As the most important reason for not introducing electronic invoicing, the respondents answered using the statement "Electronic invoicing is not legally mandatory for my company", with a mean level of agreement of 4.78 (SD=0.43), followed by the statement "Insufficient financial and time savings in business" with a mean level of agreement of 3.56 (SD=0.98), "High costs and complexity of implementing electronic invoicing..." with a mean level of agreement of 2.94 (SD=1.06), "Working with electronic invoices is complicated" with a mean level of agreement of 2.11 (SD=1.13), "Security risks..." with a mean level of agreement of 2.06 (SD=1.00). The lowest level of agreement for not introducing electronic invoicing was on the statement "Employees' resistance to changes" where the mean level of agreement was determined to be 1.78 (SD=0.88). Of the 18 companies that have not yet introduced electronic invoicing, 5 (28%) respondents answered that they do not know if they will introduce electronic invoicing, and 3 (17%) respondents are certain that they will not. Out of 10 respondents whose companies intend to introduce electronic invoicing, 4 (22%) will do so within a year, 3 (16%) within three

years, and 3 (17%) in more than three years. Among the 10 respondents who have not introduced electronic invoicing, but intend to introduce it, the highest level of agreement with the reasons for introducing it was found with the statement "On my own initiative to improve business, increase efficiency and reduce costs", for which a mean level is 4.60 (SD=0.66), followed by the statement "In order to harmonize with the accounting practices of other business entities" where the average level was determined to be 4.00 (SD=0.77), while the lowest level was for the statement "For the purpose of mandatory application of electronic invoicing in public procurement and harmonization with the legislation of the Republic of Croatia", where the mean level was determined to be 2.60 (SD=1.28).

Respondents whose companies have not introduced electronic invoicing are evenly divided (9 to 9) regarding the question "Do you think that the government decision on the mandatory exchange of electronic invoices between companies (Business-to-Business) would have a positive effect on your business?". On the other hand, to the question "Do you think that the state decision on the mandatory exchange of electronic invoices towards citizens/consumers (Business-to-Consumer) would have a positive effect on your business?", 8 respondents were of the opinion that such a decision would positively affect the company, and 10 respondents disagreed.

3.3. Analysis of the Companies That Have Introduced Electronic Invoicing

Those companies falling under the requirements of the Law on Public Procurement are obliged to receive electronic invoices from December 1st, 2018, while invoice issuers are obliged to issue and send electronic invoices from July 1st, 2019. Results showed that out of the 41 companies that introduced electronic invoicing, 20 of them decided to introduce electronic invoicing before July 1, 2019, which is 49% of the surveyed companies, and 18 surveyed companies (44%) did that after the specified date. Three respondents could not give a definitive answer related to the timing of when they introduced electronic invoicing. When asked about the reasons for the introduction of electronic invoicing, the respondents mostly agree with the statement "In order to harmonize with the accounting practice of other business entities", to which a mean level of agreement of 3.85 (SD=1.42) was determined, followed by the statement "For the mandatory application of electronic invoicing in public procurement and harmonization with the legislation of the Republic of Croatia" with a mean level of agreement of 3.78 (SD=1.67), while the lowest level was determined for the statement "On its own initiative to improve business, increase efficiency and reduce costs" with a mean level of agreement of 3.68 (SD=1.56). For the survey question asking from which sector companies mostly use electronic invoice transactions, the respondents selected the statement "Government (public sector)", with a mean level of 4.10 (SD=1.48), followed by the statement "Businesses (real sector)" with a mean level of agreement of 3.88 (SD=1.23), while the lowest level was for the statement "Citizens (B2C, G2C)" with the mean level of agreement of 2.34 (SD=1.57). The highest level of agreement with the benefits from the implementation of electronic invoicing was found with the statement "Electronic invoicing has accelerated the exchange and processing of invoices", where the mean level of agreement was 4.12 (SD=1.25), followed by the statement "Electronic invoicing has led to a significant reduction of administrative costs of preparing, printing and enveloping invoices" with a mean level of agreement of 3.85 (SD=1.39). The mean level of agreement for the statement "Electronic invoicing led to improved documentation management" is 3.61 (SD=1.46), while the lowest level of agreement was determined with the statement "Electronic invoicing led to faster payment and collection of receivables" where the average level of agreement was determined

to be 3.10 (SD=1.32). For the statement "Implementation of electronic invoicing in the business was expensive and complex", the mean level of agreement was 2.90 (SD=1.14) while for the statement "Employees had resistance to change during the implementation of electronic invoicing", this value was 2.44 (SD=1.21).

For the exchange of electronic invoices companies most often use the services of private information intermediaries. There are 21 such companies among the respondents (51%), while 15 companies (37%) use the services of the state information intermediary. There were 5 (12%) that do not use the services of an information intermediary. Among companies that have introduced electronic invoicing, invoices are most often exchanged directly from the company's accounting program (23; 56.10%). 9 companies (22%) exchange electronic invoices through the web interface of the selected information intermediary, and 9 companies (22%) also exchange electronic invoices through FINA's web application called e-Račun. Companies of all sizes for the exchange of electronic invoices most often use their own accounting (and/or ERP) programs (ranging from 80% for medium-sized companies to 47.62% for micro-companies). FINA's web application e-Račun is used only by micro and small companies. More precisely, 33.33% of micro-enterprises and 16.67% of small enterprises use FINA's web application e-Račun. Companies that have introduced electronic invoicing have mostly positive attitudes towards the statement that the government decision on the mandatory exchange of electronic invoices between companies (Business-to-Business) would have a positive effect on the companies' operations, so 24 respondents agree with this statement, while 17 respondents do not agree with this statement. The majority of surveyed companies (26) do not agree with the statement that the government decision on the mandatory exchange of electronic invoices for citizens/consumers would have a positive impact on business operations.

3.4. The Relationship between Company Size and Electronic Invoicing Adoption

The assumption that there will be a difference in the adoption of electronic invoicing among companies of different sizes was tested with a Chi-square test between two characteristics of analyzed companies based on the questions: "Into which category does your company belong?" and "Has your company introduced electronic invoicing?".

Table 2. Crosstabulation analysis of companies by size and use of electronic invoicing

			Has your company introduced electronic invoicing?		
			Yes	**No**	**Total**
Category	**Micro**	N	21	16	37
		%	56.8%	43.2%	100.0%
	Small	N	12	2	14
		%	85.7%	14.3%	100.0%
	Medium and large	n	8	0	8
		%	100.0%	0.0%	100.0%
Total		N	41	18	59
		%	69.5%	30.5%	100.0%

Source: Author's research

The empirical Chi-square value was 7.59, with an empirical level of significance of 0.006, therefore it can be concluded that a statistically significant correlation between the size of the company and the use of electronic invoicing exists.

3.5. The Role of the Government in the Adoption of Electronic Invoicing in Companies

To test the assumption that the government has a significant role in the adoption of electronic invoicing in companies, two claims were put into relation: the use of electronic invoicing, and the level of business cooperation between companies and the government (public sector). The average level of importance of doing business with the government was 1.32 points higher among companies that introduced electronic invoicing compared to companies that did not introduce electronic invoicing. Specifically, the average level of importance of doing business with the state (public sector) among companies that have introduced electronic invoicing is 2.93, while the average level of importance of doing business with the state among companies that have not introduced electronic invoicing is 1.61.

Table 3. The relationship between the use of electronic invoicing and business cooperation between companies and the government

The use of electronic invoicing		N	Mean	Std. Deviation
Doing business with the government (public sector)	Yes	41	2.93	1.40
	No	18	1.61	.70

Source: Author's research

By conducting the Independent Samples Test (t-test for Equality of Means), with the empirical t-ratio of 4.80, it can be concluded that there is a statistically significant difference in the importance of doing business with the government (public sector) among companies that introduced and did not introduce electronic invoicing. The conclusion was reached with an empirical significance level of <0.001.

Finally, there is a question related to the perspectives of introducing electronic invoicing in order to find out if the companies that have not introduced electronic invoicing intend to do that soon. For the intention of introducing electronic invoicing, "soon" is considered the period of up to three years, i.e. the sum of the answers "Yes, within a year" and "Yes, within three years". Of the 18 companies that have not introduced electronic invoicing, 5 have not declared an opinion on this matter, while 3 companies declared they certainly will not introduce electronic invoicing. Among the respondents who expressed the intention to introduce electronic invoicing, 4 respondents intend to introduce it within one year, and 3 respondents within three years, which gives result of 7 respondents who have the intention of introducing electronic invoicing soon. Also, 3 respondents intend to introduce electronic invoicing, but beyond the framework of three years. Although 56% of companies intend to introduce electronic invoicing, only 39% of companies intend to do so within three years.

4. DISCUSSION AND CONCLUSION

Electronic invoicing brings various benefits compared to traditional invoicing as presented in the introductory part of the paper and verified in the empirical study. The European Union recognized electronic invoicing as a tool for increasing the productivity of the public sector, as did the legislator in the Republic of Croatia, which introduced a law according to which all companies participating in the public procurement process must exchange invoices electronically. This paper aimed to analyze the state and perspectives of electronic invoicing in Croatia, to determine the adoption with regard to the size of the company, and to determine the role of the government in the adoption of electronic invoicing. The limitations of this research are certainly the sample size. To generalize the results to all companies in the Republic of Croatia, further research on a larger sample is definitely needed.

In this pilot study, the analysis showed that there is a relationship between the size of the company and the use of electronic invoicing. Little over half of the micro-enterprises use electronic invoicing, while the percentage of adoption of electronic invoicing is growing drastically among small companies, while medium and large companies use electronic invoicing 100%. Regarding the role of the government in the adoption of electronic invoicing, a significant difference was observed between companies concerning the extent of business cooperation with the government and the use of electronic invoicing, leading to the conclusion that the government plays a significant role in the adoption of electronic invoicing in companies. Although the research found that less than half of the companies that have not yet introduced electronic invoicing have the intention of introducing electronic invoicing soon, in terms of the expected adoption of electronic invoicing the perspective is positive, because, with a longer period of time, most companies do intend to introduce electronic invoicing.

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Comparing Genetic Algorithm and Variable Neighborhood Search Method for Solving Job Shop Problem

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Abstract: *Job Shop scheduling problem is one of the most complex and researched problems in the field of production planning. In this paper, two methods for solving Job Shop scheduling problem are presented and compared. The genetic algorithm and variable neighborhood search method were chosen and implemented in software for solving Job Shop problem. The paper first briefly presents Job Shop scheduling problem and then explains the development of solving software and implementation of selected solution methods. The results of using implemented genetic algorithm and variable neighborhood search method are presented on test instances with various dimensions. Solutions obtained using these two methods were put in comparison and analyzed, as well as compared with the optimal or best-known solutions in the literature.*

1. INTRODUCTION

Job Shop scheduling problem is one of the most complex and researched problems in the field of production planning. Different heuristic methods are mainly used to solve it, and in this paper variable neighborhood search method and genetic algorithm were chosen. Among other frequently used methods for solving the Job Shop problem are the ant colony algorithm (Saidi-Mehrabad et al., 2015), particle swarm optimization (Nouiri et al., 2018), artificial bee colony algorithm (Li et al., 2014), as well as many hybrid methods (Huang & Liao, 2008), (Li & Gao, 2016). The paper consists of five sections. After the introductory part, Section 2 briefly presents the Job Shop problem. In Section 3, genetic algorithm and variable neighborhood search method used to solve the Job Shop scheduling problem are described. In Section 4, the results of experiments on test instances are presented. Finally, concluding remarks are given in Section 5.

2. JOB SHOP PROBLEM

Job Shop scheduling problem represents the problem of determining the order in which products will be processed on machines, where each product can follow a different processing sequence, i.e. have a different order of operations (Pinedo, 2008). This problem belongs to the group of NP-hard problems (Garey et al., 1976). Although Job Shop may be seen as a production planning problem by setting, the concepts used to solve this problem can be applied in many other areas. For example, in the field of traffic and logistics when routing and scheduling trains or airplanes as shown by Liu and Kozan (2009), or when assigning staff and planning shifts, creating a class or lecture schedules, etc. In this paper, the basic form of the Job Shop problem (Zhang et al., 2019) is considered. Let there be n jobs, J1, J2,...Jn, that needs to be processed on m machines M1, M2,...Mm, and let each job have a known (different) sequence of processing operations that it needs to follow, with

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each job being processed on each machine at most once. The time needed to process each product on each machine is also known, given in the form of the matrix *tij* for *i*=1, 2,...*n* and *j*=1, 2,...*m*. Each machine can process only one product at any time and each product can only be processed on one machine at any time. All jobs are of equal priority, available from the same initial moment, and it is not possible to interrupt the started processing of any product on any machine. It is necessary to find the sequence of execution of jobs on each machine in such a way that the completion time of the last processing operation on the last product is as short as possible while respecting all the aforementioned restrictions. Minimization of the total time needed to process all products and minimization of idle time on machines and others can be used as an objective function, while in this paper makespan is being considered, as previously stated.

3. GENETIC ALGORITHM AND VARIABLE NEIGHBORHOOD METHOD FOR THE JOB SHOP PROBLEM

Before implementing the selected solution methods in the software, it is necessary to determine how the solution will be represented. In the developed software, the solution is presented as a structure that contains two attributes: the schedule of execution of jobs on the machines and the time required to process all products, i.e. the objective function. The job execution schedule is written in the form of a sequence of $n \times m$ members (where n is the number of jobs and m is the number of machines). Array elements represent processing operations and have values from 1 to n, thereby indicating the job to which the operation belongs. The ordinal number of occurrence of value i in the sequence indicates the ordinal number of the i-th job operation and thus the machine on which that operation is executed. This way of recording the schedule is presented by Sevkli and Azdin (2006). The solution algorithms are presented in more detail below. Both algorithms are implemented in the programming language C# (Visual Studio environment).

3.1. Genetic Algorithm

Genetic algorithm is a heuristic first presented by Holland (1992) and is based on the idea to simulate biological process of evolution in order to find the best possible solution to various optimization problems. The very idea of applying simulated evolutionary processes in order to create a machine that learns was first mentioned by Turing (1950). The analogy between genetic algorithms and Darwin's theory of evolution is reflected in the fact that through generations the most desirable traits of individuals are favored, meaning that individuals that are better adapted, or in the case of optimization problems, have a better value of the objective function, have a higher probability of transferring their genetic material to the next generations. The methods used in genetic algorithms that simulate evolutionary processes are called genetic operators and refer to selection, crossover and mutation processes (Mattfeld, 2013). The genetic algorithm (GA) implemented to solve the Job Shop problem can be represented by the following functions:

- Creation of the initial population
- Input data: number of individuals in population, *n* (number of jobs), *m* (number of machines), order in which jobs are processed on machines, duration of processing each job on each machine
    1. Repeat until number of individuals in the population is reached
        a. Generate a random permutation of numbers from 1 to n
        b. Create a sequence of one initial solution by repeating the generated permutation m times in a row
        c. Calculate the time needed to implement the obtained schedule

2. Sort the individuals in the population into a non-decreasing sequence according to the value of the objective function

- Output data: Initial population ie. an array with a given number of individuals
- Crossover
- Input data: two parent entities, the order in which the jobs are processed on the machines, the processing time of each job on each machine
  1. Randomly select a segment of size 50% to 60% from the schedule of the first parent
  2. Rewrite the selected segment, in the same positions, in the child's schedule
  3. Make a copy of the other parent's schedule
  4. For all elements of the selected segment
     a. Remove the first occurrence of an element from a copy of the other parent's schedule
  5. In the remaining positions in the child's schedule, write the elements from the updated copy of the other parent's schedule maintaining the order
  6. Calculate the value of the objective function for the newly obtained individual
- Output data: Newly generated individual – child
- Mutation
- Input data: The unit to be mutated, the order in which the jobs are processed on the machines, the processing time of each job on each machine
  1. Randomly select two elements in the layout of the individual for mutation
  2. Replace positions of the selected elements
  3. Calculate the objective function of the mutated individual
- Output data: Altered (mutated) individual
- GA
- Input data: order in which jobs are processed on machines, duration of processing each job on each machine, number of individuals in population, n (number of jobs), m (number of machines), c (crossover rate), number of generations
  1. Create an initial population
  2. Repeat until number_of_generations
     a. Repeat until number_of_units_in_the_population
        i. Randomly select the first parent from the best c% of the population
        ii. Randomly select the first parent from the best c% of the population
        iii. Perform crossover
     b. Repeat for each individual in the new population
        i. Perform mutation
     c. Create a sequence of individuals of the old and new population sorted non-decreasingly by execution time
     d. Determine the next generation as the number_of_individuals_in_the_population of the best individuals from the sequence generated in previous step
  3. The first individual of the last generation represents the best obtained solution
  4. Present the best obtained solution on the Gantt chart
- Output data: The best solution obtained and the Gantt chart of the best solution obtained

3.2. Variable Neighborhood Search Method

Variable neighborhood search heuristics (VNS) was presented by the authors Mladenović and Hansen (1997) and since then it has been widely used in solving a large number of optimization problems. The method is based on the principle of local search, whereby the search environment

changes. After defining a set of environments and determining the initial solution, the process of improving the solution consists of a local search phase and a perturbation phase (Hansen et al., 2017). In the implemented VNS based algorithm three methods of modifying the solution were used. The adjacent solution within the first neighborhood is obtained by swapping the places of two randomly selected array elements, and while choosing a solution within the second environment, the element of the sequence and the position to which that element will be moved are randomly determined, whereby all elements in between are moved by one place. The jump (preturbation) function is defined as a multiple repetition of the method of moving to a second neighborhood solution. That is, a jump is performed by moving several randomly selected layout elements to another, also randomly selected position. The implemented algorithm can be represented by the following functions:

- Check neighborhoods for improvements
- Input data: order in which jobs are processed on machines, duration of processing each job on each machine, current solution, number of environments, maximum number of consecutive attempts without improvement
    1. Set i=1 and set the counter of consecutive attempts without improvement to 0.
    2. Repeat until maximum number of consecutive attempts without improvement is reached (Loop 1)
        a. Repeat until i is greater than the number of environments (Loop 2)
            i. Select the neighboring solution y from the i-th neighborhood of the current solution.
            ii. Calculate the objective function for y.
            iii. If that solution is better than the current one, set current solution to y, set the counter of consecutive attempts without improvement to 0 and return to the beginning of Loop 2.
            iv. Otherwise, increase i by 1 (next neighborhood) and return to the beginning of Loop 2.
        b. Increase the counter of consecutive attempts without improvement (current solution remains unchanged) and return to the beginning of Loop 1.
- Output data: Current solution
- VNS
- Input data: order in which jobs are processed on machines, duration of processing each job on each machine, n (number of jobs), m (number of machines), maximum number of jumps, maximum number of consecutive attempts without improvement
    1. Create the initial layout by repeating the sequences 1,2,3,…,n m times.
    2. Compute the objective function for the initial solution.
    3. Set the best achieved solution to the initial solution.
    4. Repeat until maximum number of jumps is reached (Loop 1)
        a. Check neighborhoods for improvements
        b. If the current solution is better than the best achieved solution, update the best achieved solution
        c. Perform a jump
        d. Increase jump counter
        e. Set the solution obtained by jumping to the current solution
        f. Compute the objective function for the newly obtained current solution
        g. Return to the beginning of Loop 1
    5. Present the best achieved solution on the Gantt chart
- Output data: Best achieved solution, Gantt chart of the best achieved solution.

4. EXPERIMENT RESULTS

For the experiment performing purposes, test instances presented by Taillard (1993) were used. The implemented solving methods were applied to groups of examples with dimensions of 15x15, 30x20 and 50x15, that is, test examples with 15 jobs and 15 machines, 30 jobs and 20 machines and with 50 jobs and 15 machines. For all examples with dimensions 15x15 and 50x15 optimal solutions are known, most of which were achieved by Brinkkötter and Brucker (1999) and Taillard (1993). Benchmark results for 30x20 examples and other test instances are presented by Shylo (2014) and updated regularly.

The stopping criterion in both implemented methods is not time-based, i.e. it is fulfilled by a certain number of generations for the genetic algorithm and the number of jumps for the variable neighborhood search method, but presented results were obtained for approximately the same time, close to 5 minutes of work per example.

Table 1 presents the results obtained by solving test examples with dimensions 15x15, and Table 2 shows the results for examples with dimensions 30x20. The best solutions obtained from 10 runs of the algorithm are shown.

Table 1. Results for 15x15 test instances

15x15	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9
GA	1282	1278	1275	1216	1276	1267	1266	1259	1351
VNS	1269	1276	1257	1220	1263	1267	1257	1258	1323
Optimal	1231	1244	1218	1175	1224	1238	1227	1217	1274
relative deviation GA	4.1%	2.7%	4.7%	3.5%	4.2%	2.3%	3.2%	3.5%	6.0%
relative deviation VNS	3.1%	2.6%	3.2%	3.8%	3.2%	2.3%	2.4%	3.4%	3.8%
Better algorithm	VNS	VNS	VNS	GA	VNS	=	VNS	VNS	VNS

Table 2. Results for 30x20 test instances

30x20	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9
GA	2374	2309	2189	2325	2260	2356	2219	2274	2281
VNS	2262	2187	2089	2209	2192	2259	2134	2184	2209
Benchmark	2006	1939	1846	1979	2000	2006	1889	1937	1963
relative deviation GA	18.3%	19.1%	18.6%	17.5%	13.0%	17.4%	17.5%	17.4%	16.2%
relative deviation VNS	12.8%	12.8%	13.2%	11.6%	9.6%	12.6%	13.0%	12.8%	12.5%
Better algorithm	VNS	VNS	VNS	VNS	VNS	VNS	VNS	VNS	VNS

As can be seen, the VNS algorithm provided better solutions for the vast majority of the first 2 sets of examples. In Table 3 are presented results achieved solving test instances with dimensions 50x15. Here, the best results out of 20 runs of the algorithms are shown.

Table 3. Results for 50x15 test instances

50x15	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10
GA	3096	2932	3016	2845	2907	2968	2984	3111	3075	2877
VNS	2940	2971	2837	2884	2909	2945	3108	3061	2853	2887
Optimal	2760	2756	2717	2839	2679	2781	2943	2885	2655	2723
relative deviation GA	12.17%	6.39%	11.00%	0.21%	8.51%	6.72%	1.39%	7.83%	15.82%	5.66%
relative deviation VNS	6.52%	7.80%	4.42%	1.59%	8.59%	5.90%	5.61%	6.10%	7.46%	6.02%
Better algorithm	VNS	GA	VNS	GA	GA	VNS	GA	VNS	VNS	GA

When considering examples with greater dimensions, VNS is not as dominant compared to GA as it was for smaller test instances. In fact, both algorithms have the same number of better solutions, but the VNS has more consistently low relative deviations. For better comparison, average relative deviations from optimal or best known solutions for both algorithms for all sets of examples are shown in Table 4.

Table 4. Average relative deviations

	15x15	30x20	50x15	Total average
GA	3.8%	17.2%	7.57%	9.52%
VNS	3.1%	12.3%	6.00%	7.13%

In total scores, VNS still shows better results than GA. As hybrid versions of the genetic algorithm are often found in the literature, one assumption that would explain the results could be that the basic form of the genetic algorithm is not suitable enough for solving the Job Shop problem.

5. CONCLUSION

The paper describes solving Job Shop scheduling problem using a variable neighborhood search method and genetic algorithm. The obtained results were compared with each other. And the experiment showed that the variable neighborhood search method gave more successful results for the majority of test examples. Although the subject of the work was primarily a comparison of the two implemented methods, the obtained results were also compared with the optimal (or best known) solutions for the tested examples, where none of the methods managed to reach these values. Deviations from the optimal solutions were on average 9.52% for the genetic algorithm and 7.13% for the variable neighborhood search method. The planned direction of further research would be the development of a hybrid method that would incorporate the positive features of both algorithms with the aim of more precisely targeting the points where modification will be made (mutation or transition to a neighboring solution) and thus increase the efficiency of the algorithm.

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Risk Management in the Automation of Business Processes through the Application of Robotic Process Automation

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Abstract: *In a modern business environment with very big data flows, employee focus is crucial for success. This problem developed a need for new technological advancements such as Robotic Process Automation (RPA). As the RPA technology is relatively young, there is still an insufficient amount of research about which project management techniques are the best for it. This paper aims to recognize the key principles of risk management which can be applied to the automation of business processes through the use of RPA technology and to emphasize the significance of risk management for conducting successful RPA projects.*

1. INTRODUCTION

Today's business environment requires a fast response to changes and constant adaptation. Companies aiming to be competitive must constantly develop better business processes.

RPA enables process automation through "robots" performing processes the same as humans. Although it seems that creating RPA solutions is simple, while automating through RPA, companies may be faced with challenges that can be viewed as risks of the RPA projects.

There is little research on risk management in business process automation through RPA. Therefore, this research is based on literature that defines and explains the functioning of RPA technology and literature that deals with risks as components of project management.

2. THE TERM ROBOTIC PROCESS AUTOMATION

Although the term RPA alludes to actual robots going between offices performing tasks instead of people, it represents software-oriented solutions applied to other programs' user interfaces carrying out the business process the same as a human. In RPA, the word "robot" is equivalent to a software license (Kirchmer, 2017; Willcocks et al., 2015).

Robotic Process Automation can be applied to highly frequent, repetitive business processes with clear predefined rules of execution (HerbertNathan, 2017). By creating and using a digital workforce, RPA provides a more efficient business process execution (Kirchmer, 2017). Instead of complete automation, RPA aims to increase productivity, decrease errors in the work process and provide better services to clients (Panyi, 2020). This is achieved through the automated

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handling of standard situations while leaving exceptions to employees (Kirchmer et al., 2019). RPA should not take the place of people in total, but enable them to focus on complex work demands (Panyi, 2020).

Business process automation through RPA contributes to achieving various business benefits (Kämäräinen, 2018). There are various positive conclusions related to the implementation of RPA in literature case studies, but the positive outcomes must be the result of good management of the RPA projects, and especially adequate risk management.

One definition of risk is the uncertainty that may have a positive outcome. However, in the context of this paper, this aspect will not be considered and the word risk will be connected to the unforeseen, unfavorable outcomes of automating business processes through RPA.

3. BASIC CONCEPTS OF PROJECT RISK MANAGEMENT

Every project includes certain risks, regardless of the industry or department it relates to (Kendrick, 2015). The goal of risk management is to minimize the possibility of unfavorable events, and the strength of their impact if they occur (Tesch et al., 2007).

The Project Management Institute (PMI) has defined 6 steps that lead to successful risk management (Pritchard, 2014):

Step 1: Risk management planning
Step 2: Risk identification
Step 3: Qualitative analysis of risk
Step 4: Quantitative analysis of risk
Step 5: Creating plans of action
Step 6: Monitoring and controlling risk.

4. AN OPPORTUNITY FOR RPA AUTOMATION

For the research, risk management will be simulated on the RPA project example. As an example of an RPA project, a hypothetical business process will be considered.

For this research, it is assumed that the following opportunity for RPA automation was noted.

> *Every month many employees leave or join the company. It is necessary to cancel or obtain an insurance policy with a private medical insurance company for each person. From the internal system containing employee data, necessary information is gathered and per request sent to an external associate who provides private medical insurance policies. The application is sent by accessing the external system and finding and filling in the form, which differs depending on whether the insurance policy is opened or canceled. Several fields need to be filled in which takes 30 minutes on average. The process is based on rules from the moment the need to send a request is established.*

5. THE PLAN FOR RISK MANAGEMENT

Based on the authors' experience and RPA knowledge a risk checklist was formed (Table 1).[4]

[4] The checklist was based on the hypothetical list of the RPA projects that began in the imaginary company

Table 1. Checklist of risks for the RPA projects

Risk ID	Risk
1	The Subject Matter Expert (SME) incorrectly filled the robot making application
2	The SME demands a subsequent change in the execution of the business process
3	Problems with access to the systems used in the given business process
4	The existence of differences between the test and production environment
5	Employee resistance to the new way of working
6	Skepticism toward the new way of working
7	The business process based on the created documents is unclear to the developer
8	Lack of licenses
9	Conflicts among teams
10	Over automation
11	Incompatibility with the safety protocols
12	The developer has too much freedom
13	Unavailability of the test environments
14	Performance of the basic business function of certain business units endangered
15	Postponing important decisions
16	The SME is overburdened by his business activities
17	Phases of the project, on which subsequent phases depend, are late with execution
18	Updates and changes to systems that are used in the business process
19	The developer lacks experience
20	Suddenly abandoning the project
21	The SME found that a part of the business process is missing in the documentation
22	Lack of understanding of the RPA vocabulary

Most sources propose the risk probability be determined intuitively based on experience without calculating precise numbers, but rather that the probability of risks is classified as risks with high, intermediate, or low probability. Due to that, the risk probability will be calculated as a relative frequency of occurrence of risk in N number of conducted projects.

Definition 1. Let m represent the number of positive outcomes of event A in n repetitions of the experiment. Then the number

$$r = m / n \tag{1}$$

is the relative occurrence frequency of event A in n experiment repetitions (Kovačević, 2015).

Therefore, for every risk, the probability will be determined as:

$$\frac{\textit{The number of projects during whose realization the given risk occurred}}{\textit{The total number of projects which have been taken into account}^{5}} \tag{2}$$

As far as the impact is concerned, the authors will, for the research paper, determine it intuitively based on acquired experience in the field of RPA technology.

for the period of three months and imagined notes taken during the project's realization. Notes were analyzed and risks have been defined.

[5] Due to the fact that the checklist was formed based on a hypothetical list of RPA projects that began in an imaginary company in a 3-month period and imaginary notes taken during the project realization the number of projects in which a certain risk arose is known to the author.

6. IDENTIFICATION OF RISK ON THE SPECIFIC RPA PROJECT EXAMPLE

Based on the checklist above, the initial register of risks is formed (Table 2) when analyzing the selected business process for automation (opening/closing private health insurance).

Table 2. Initial risk register

Risk ID	Probability
1-1*	0,4
2-3	0,2
3-4	0,1
4-5	0,2
5-6	0,2
6-9	0,4
7-11	0,2
8-12	0,1
9-13	0,1
10-16	0,2
11-17	0,3
12-18	0,2
13-20	0,1
14-22	0,2

Note: * The second digit represents the risk ID from the checklist.

7. QUALITATIVE ANALYSIS

Probability can be great (≥ 0,5), intermediate (> 0,1 && < 0,5), or low (≤ 0,1), and the impact is viewed as high (one/more project aims endangered), intermediate (demands significant replanning) and low (bigger change of plans not required) (Kendrick, 2015). The estimate is made based on the Probability/Impact matrix. The qualitative analysis is provided in Table 3.

Table 3. Qualitative analysis of risks

Risk ID	Probability	Impact	Estimate
1-1	Intermediate	Low	Low exposure
2-3	Intermediate	High	High exposure
3-4	Low	Intermediate	Low exposure
4-5	Intermediate	High	High exposure
5-6	Intermediate	High	High exposure
6-9	Intermediate	High	High exposure
7-11	Intermediate	High	High exposure
8-12	Low	High	Average exposure
9-13	Low	Intermediate	Low exposure
10-16	Intermediate	High	High exposure
11-17	Intermediate	High	High exposure
12-18	Intermediate	High	High exposure
13-20	Low	High	Average exposure
14-22	Intermediate	Intermediate	Average exposure

For risks with high exposure, a quantitative analysis through the application of the Failure Models Effects Analysis (FMEA) technique follows.

8. QUANTITATIVE ANALYSIS

With the FMEA technique, a Risk Priority Number (RPN) is determined based on Occurrence, Severity and Detectability value (Carbone & Tippett, 2004). These values are measured on a scale from 1 (least adverse outcome) to 10 (most adverse outcome) (Perrin, 2007). The quantitative analysis is provided in Table 4. The higher the RPN, the greater the risk (more important on the priority list) (Perrin, 2007; Carbone & Tippett, 2004).

The authors view that in this case the best action is to classify the risks into low-priority and high-priority ones – RPN = 500 should be the referential value. Risks with an **RPN greater than or equal to 500** will be considered **high priority** for which action plans will be created.

Table 4. Quantitative analysis of risks

Risk ID	O	S	D	RPN = O*S*D
2-3	**10**	**10**	**6**	**600**
4-5	**10**	**7**	**8**	**560**
5-6	**10**	**7**	**8**	**560**
6-9	**10**	**9**	**6**	**540**
7-11	10	9	2	180
10-16	10	10	4	400
11-17	**10**	**10**	**10**	**1000**
12-18	**10**	**10**	**9**	**900**

9. PLANS OF ACTION

To act upon the noted high-priority risks, adequate responses to them should be created. Plans of action describe activities that will be carried out to decrease the high-priority risks.

There are numerous ways of responding to individual risk, however, all responses to negative risks fall into one of the following categories (as mentioned, in this paper only negative risks are taken into account) (Perrin, 2007):

Avoidance strategy: Eliminating the potential threat. For example, the project anticipates cooperation with an organization that has trade unions threatening to go on strike. The avoidance strategy would then be to choose a partner that does not have trade unions.

Transfer strategy: Some or all consequences are transferred to third parties connected to the given risk, including the responsibility for creating action plans. An example of this strategy is the purchase of an insurance policy or a purchase of another form of warranty.

Migration strategy: Decrease of probability or impact of risk. Designing systems of tolerance towards mistakes is an example of this strategy.

Acceptance strategy: Applied in cases when it is impossible to choose any other strategy.

Table 5. Plans of action for high-priority risks

Risk ID	Strategy	Plan of action
2-3	Migration	The risk has a very high impact on the RPA project's performance. So, activities should minimize the probability of this risk occurring. Before beginning to develop the RPA solution, a check of access to the demanded systems should be made. The RPA developer may attempt to access a certain system only after reaching the automation point where the system is used. So, the RPA developer and the SME should check if access to all needed systems is available beforehand.
4-5	Transfer	This risk occurs with all projects which imply changes in the established performance system of business activities. It is especially visible in RPA projects as the very word "robot" makes employees feel uncomfortable and afraid that they might be substituted. The proposed response to this risk is regularly reminding the higher management of how important it is to educate the employees and keep them up to date with the new information technology. Responsibility is transferred to higher management. They should be reminded of the importance of managing this risk whenever officially reporting. The assistance should be offered during employee education. Employees developing the RPA solution should prepare the education content and be exempted from other activities while conducting the education process. If possible, the employees being educated to be freed from their regular work activities, too.
5-6	Transfer	The risk can be overcome the same as the risk 4-5.
6-9	Migration	To avoid conflict during the RPA project's execution, communication and amicable rapport with all stakeholders should be maintained. Each time an official report is given, other stakeholders should be included together with the upper management.
11-17	Migration	To overcome this risk, precise deadlines must be set to carry out all RPA project phases before beginning to develop the solution and the resources necessary must be defined and provided.
12-18	Migration	Update and change applications and systems used in the business process greatly impact the RPA project's course. This risk has a great influence while maintaining the RPA solution. There should be official communication systems with the internal teams maintaining systems for business processes chosen for automation. They should promptly share information about any changes. If it is an external system, a similar deal should be made. This way of overcoming risk is deemed adequate, as often the same systems are used in different business processes chosen for RPA automation.

10. MONITORING AND CONTROL

Risk monitoring and control implies answering the following questions (Pritchard, 2014):

Question 1: Have the action plans been executed as proposed
Question 2: Have the action plans been as efficient as expected
Question 3: Has the project team followed the organizational policy and procedures
Question 4: Are the project assumptions still valid
Question 5: Have the triggers of risk occurred
Question 6: Have the new external influences changed the organization's risk exposure
Question 7: Have new risks occurred.

Further activity needs to be carried out in accordance with the answers, to monitor the risks.

11. FUTURE RESEARCH DIRECTIONS

As the research in question is independent, due to the confidentiality of the data for the needs of this research, real data could not be used, nor a real RPA implementation project. The research is based on information found in the available literature, and the authors' experience in

business process automation through RPA. An object of future study could be carrying out the noted steps for risk management on the sample of a real RPA project and defining the complete methodology for leading the RPA project which would consider all project aspects.

12. CONCLUSION

A case study has established that, for the given example of project automation of the business process through the application of RPA technology, the following risks are of top priority:

Risk 1: Problems with access to the systems which are used in the given business process
Risk 2: Employee resistance to the new way of working
Risk 3: Skepticism towards the new way of working
Risk 4: Conflicts among teams
Risk 5: Phases of the project, on which subsequent phases depend, are late with execution
Risk 6: Update and change systems that are used in the business process.

Also, for successful automation of the given business process, the following activities which present responses to the previously stated identified and prioritized risks should be conducted:

Risk 1: Compulsory check of the access to the requested systems before beginning development of the RPA solution
Risk 2: Every time an official report is made, the higher level of management needs to be reminded of the importance of the employees being educated about new information technologies and participating in the education in the field of RPA technology
Risk 3: When reporting, include other primary stakeholders with the higher management
Risk 4: Setting deadlines for the execution of all phases of the RPA project before starting to develop the solution and defining and providing resources necessary for carrying it out
Risk 5: Establishing official communication systems with the teams responsible for maintaining the systems used in business processes selected for the automation. They should, through those channels of communication, provide prompt information in case of any change.

It can be concluded that the RPA projects are mostly not complex, and not high risk, but exactly that may lead to a misconception that there is no need for risk management.

If risks are managed, it can be easily established whether the requested automation is risky. A feasibility study for individual RPA projects would be suggested. In the case of a high-risk RPA project, whose risks do not allow its execution, the project must be abandoned and the stakeholders informed. This way, major savings of key resources are made.

Financial analysis is not of key importance in deciding to carry out automation through RPA. Besides finances, the risks following automation must be considered. Only such an approach to automating business processes through RPA can achieve the benefits of RPA solutions.

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Social Networks – A New Way of Communicating in Healthcare

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Abstract: *The advancement in IC technologies has provided health systems with newer and better means of reaching large populations. This paper investigates how social networks facilitate health message-sharing on the Internet and provide users with numerous tools to create, publish or share various content formats. The literature review points out two basic motives for the use of social networks by sick people: "information support" aimed at obtaining information and increasing knowledge about the disease and its therapies by sharing experiences with other users, and "social and emotional support" enabled by digital environments which encourage empathy among online peers allowing each person to access help from different social media while controlling the level of disclosure of their identity and condition. The authors of this paper conclude that a deeper understanding of shared content and user behavior in online settings can help communicators improve health literacy, raise community awareness and provide social support.*

1. INTRODUCTION

The spread of technologies in mHealth, as a subfield of eHealth, has led to the emergence of social media, a new way of communicating with healthcare services that enable patients to play an active role in managing their health and ultimately improve the overall quality of their health care and outcomes. Social media is widely used in health contexts by various users. Approximately 80% of cancer patients use social networks to connect with their "companions". More than 80% of US government-owned health services have social media accounts. Among healthcare professionals, 65% of radiologists in the United States and Europe use social media for various health reasons (Braun et al., 2019). Social media is defined in different ways. Some definitions focus on the technological features of social media that distinguish them from traditional technologies, while other definitions concentrate on the communication characteristics of social media. The content "created by users for users" is an important characteristic that distinguishes social media from traditional ones.

Social networks can perform multiple functions: clinical access and triage, providing emotional support to patients (Criss et al., 2015; Goodyear et al., 2019), sharing information and monitoring health parameters, as well as online consultation with medical staff. They have been used to stimulate participation in health-related events, as well as to encourage changes in health behaviors. Namely, participants/patients use them to document (and share) their progress in changing their health behaviors, by posting images of healthy meals, sharing virtual prizes for weekly physical activity achievements, creating group challenges to reach health-related goals, taking part in competitions regarding health behaviors, etc. The importance of social networks is

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also reflected in the possibility of reaching a wider and more diverse population, including hard-to-reach groups and areas. Thus, in trying to reach as many users as possible, health systems worldwide often opt for communication via SMS messages, which represent a safer communication medium due to the reach of mobile phone signals and an unreliable Internet connection (Mamula Tartalja et al., 2022).

The use of social networks for health purposes can be grouped into different categories from the perspective of social media users. Healthcare institutions use social networks for information surveillance, dissemination of health information and fight against disinformation, as well as for health intervention and social mobilization. Health researchers and professionals use social media for health-related research, professional development, facilitating doctor-patient communication, and offline services. Users of social media use them to search for and share health information, exchange social support in online communities, and track, monitor and share health statuses or activities. Patients want to connect and communicate with each other. That is why it is important to add a community feature to a healthcare app.

2. RESEARCH METHODOLOGY

The aim of this paper was to indicate the importance and benefits that healthcare organizations, clinicians, patients and regulatory bodies can gain from the use of various forms of electronic communication between doctors and patients. Also, the characteristics of doctor-patient communication that takes place over the Internet as a communication medium were analyzed through three different subgenres: *Twitter* social network, *Viber* application and *Stetoskop.info* web portal, with the aim of highlighting the importance of improving the level of 'health literacy' in the target group of patients. Online consultations performed by various medical specialists were monitored. Although they all belong to electronic discourse, these three subgenres can be distinguished by their own dynamics of development and linguistic manifestations. The analysis of messages sent via Viber and Twitter dealt with the graph-based and stylistic elements and conversational macrostructure of the discourse since it is about exchanging a large number of short messages regarding a specific situation. Concerning communication taking place on web portals, there is a simple rhetorical structure 'question-answer' mainly present, so the emphasis was placed on how patients presented themselves and the topic they addressed as well as how they asked questions, while the accuracy of professional explanations was observed in the doctors' answers, but also a certain degree of 'distancing' due to the lack of diagnostic data.

From the ethical aspect of research, the availability and visibility of communication are also different in the mentioned subgenres. The exchange of messages via Viber is the least visible since it is private and available only to the participants in a conversation. In order to access a user's profile on the Twitter social network, it is necessary to register and 'follow' the user on the network in order to be able to read their short messages (*tweets*). The most accessible subgenre includes web portals. The communication is public and viewable without any prior registration or membership. Online consultations are only a part of the content offered by web portals, in addition to texts about diseases and treatment methods, articles about health and family, and information about professional meetings and lectures, with all posts, also containing the dates of posting and the authors' names as well.

3. RESULTS AND DISCUSSION

Data from social media are mainly analyzed in order to predict the future incidence of disease for individual users. The use of social media to detect individual diseases is especially useful for people who are at risk but less motivated to seek diagnosis and treatment; therefore, social media monitoring can complement the traditional doctor-patient interaction method of disease detection so as to proactively provide health advice to those who are less likely to seek help. Furthermore, data from social media can also be investigated in order to predict outbreaks of infectious diseases among the population (e.g., the COVID-19 epidemic). User-generated social media posts can provide insight into cognitive and behavioral health issues. The analysis of social media posts can be used to reveal public concerns and sentiments about ongoing epidemics, public attitudes toward the actual implementation of recommended disease prevention measures, and also to monitor discussions on controversial health topics, such as vaccination and e- cigarettes.

From the technical and technological aspects, the use of social media in the provision of healthcare services should ensure privacy and security for users. Social networks enable closed groups that are easy to administer, therefore the network architecture could be used to help communities of users/patients who have the same problems. Social networks allow private messages; thus the architecture can ensure an additional layer of privacy. Since social networks also allow account verification, hospitals and formal caregivers could use them, thereby increasing user trust.

By analyzing patients' conversations on social media, researchers can assess patients' understanding of the disease and their coping strategies, identify their concerns about the disease, understand their barriers to changing health behaviors, identify disease-related symptoms, and assess patients' post-recovery experience.

As mentioned above, three subgenres of the electronic discourse in social media were analyzed. The aim was to point out the importance of using adequate linguistic tools to enable better understanding between participants in communication. It was observed that the graph-based and stylistic innovations that emerged with the advent of electronic communication such as repetition of graphemes, words and punctuation marks, unconventional use of lower- and upper-case letters, use of emoticons and emoji, are used in the communication between doctors and patients through social networks and applications for exchanging short messages. Given that this form of electronic communication is often called 'written speech', the authors of messages, by using these innovations, compensate for the lack of prosody, intonation, the fallacy of accent in the sentence, facial expressions and gestures, as integral elements of oral communication, in order to achieve better understanding and interpretation of their messages. A significantly more formal style of expression was observed on web portals, probably due to greater visibility of message content, and therefore a lower level of privacy. Patients tend to formulate their questions precisely while using post titles to concisely highlight the reason for their inquiry. On the other hand, doctors are very careful in answering patients' questions, being aware of the fact that their answers, advice, recommendations, or diagnoses could, exactly due to the wide availability of this medium, be (mis)used by some patients who would not be suitable for such therapy.

Authors of several studies (Zummo, 2016; Umefjord et al., 2006; Chiu, 2016), analyzing the contents of websites and platforms dedicated to online consultations with physicians, as well as surveying users of these online services, identified different intentions that make patients opt for this type of communication with a doctor. The most common reasons why patients decide to

visit a doctor online refer to asking for a medical opinion, i.e., a diagnosis based on the symptoms they have, and then to searching for a second opinion, which generally follows a traditional visit to the doctor's office, for confirmation of the opinion received, or due to dissatisfaction with the previous medical examination. Patients who already have a disease confirmed most often use online services to get more information about the disease and treatment options, and also to ask for advice, recommendations, empathy, and share experiences.

The non-medical reasons why patients decide to ask for doctor services online are related to the ease of use and constant availability of services and information, then to privacy protection guaranteed when it comes to symptoms and conditions that make patients feel ashamed, as well as due to the lack of time to visit a doctor, which most often implies long waiting time at a healthcare facility, but also the lack of time for the doctor to answer the patient's questions within his working hours, due to the crowded office. One of the reasons is that it is easier to express oneself in writing. Namely, patients often avoid asking the doctor directly everything they want to know about their disease, either because they feel insecure and shy, or because of the atmosphere of doctor supremacy in doctor-patient communication, which is present in institutional discourse (Heritage, 2004).

However, while patient web portals and mHealth applications can be very useful, there are barriers in regard to their design and usability. Ching and Kapoor (2017) point out a recent survey that showed that 41% of users feel frustrated when navigating portals, which is a factor limiting the adoption of these technologies. According to the same survey, 26% of patients complained about the speed of sending notifications, and 21% claimed that the tools contain too many medical or technical terms. Nevertheless, the post-pandemic medical industry has seen an increase in patient engagement, especially regarding the need to collaborate remotely with service providers and review vaccine data and lab results.

4. CONCLUSION

Traditional public surveys can take weeks and are expensive, while social networks provide real-time data and are inexpensive to assess the effectiveness of public health communication, allowing communication participants to adapt their communication strategies to public needs on time. Healthcare professionals and researchers can use social networks for their professional development, such as learning, collaboration and career advancement. Social networks can be used to collaborate on research projects (Chen & Wang, 2021), access and share trending research findings and medical knowledge, search for a job, attend a medical conference remotely, and discuss interesting or difficult cases with colleagues. Studies (Pizzuti et al., 2020) found that different social media platforms have different roles in the professional development of healthcare professionals and researchers: Pinterest is mainly used for education about healthcare quality, Twitter for gathering news and information about conferences, and LinkedIn for career advancement.

According to Trigo et al. (2020), it should be noted that any ad-hoc mHealth solution based on social networks can exchange biomedical information without the need for a separate information system that would guarantee additional safety and security. However, in the same paper, the authors state that "biomedical interoperability standards are highly recommended" (p. 3) and give examples of successful initiatives in terms of standardization carried out within the healthcare domain, such as Health Level 7 (HL7) and Digital Imaging and Communication in Medicine (DICOM).

Social media in mHealth provide patients with access to medical information, yet if patients cannot understand the given information or the system is not functional, they will not have any benefits from mHealth services. The research results indicate that information shared on social media should primarily be presented in a user-friendly manner. The importance and necessity of introducing social networks, but also social media in general, are relevant for the mHealth architecture and system of healthcare service provision for several reasons. Social networks are easy to use, socially encouraging, decentralized, flexible, global, and free, with high data availability, low latency, and a large number of users. Moreover, social networks can facilitate health-related research by providing additional data for learning about patient illness experience, as well as by recruiting research participants, especially from hard-to-reach populations.

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Usage of E-platforms Google Meet, Microsoft Teams and Zoom in Education

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Microsoft teams;
Zoom

Abstract: *The crisis caused by COVID-19 has forced educational institutions to use electronics for educational purposes and thus to digitize the entire process of lectures as well as exams and other school activities. Distance learning is, of course, welcome at a time when it is necessary to limit oneself socially as much as possible to help curb the spread of infections. But everything has both good and bad sides and e-learning is no exception. Rapid changes in this area required even faster adaptation by teachers, professors, or lecturers, as well as pupils and students. The latter, already born in the age of electronics and accustomed to drastic innovations in this field, probably had fewer problems with this. The purpose of the research is to identify the advantages and disadvantages of e-learning observed by users. The research will be limited to three of the most widespread e-meeting programs. These are Google Meet, Microsoft Teams and Zoom. Assuming that these are the three most used programs, the satisfaction of the users of these programs is also an important issue in the research.*

1. INTRODUCTION

With the development of technology, online education has become increasingly popular around the world since 2013 (although it is still not the most popular method), and the COVID-19 crisis has further accelerated the digitization and use of electronics in education. Despite the ever-faster unfolding and more frequent use of electronic tools for learning purposes, in most cases, they were only an additional element, a diversification of the classical form of education. However, the current global situation has forced educational institutions to use exclusively e-learning. Teaching methods and student habits have completely changed. E-learning is not just about moving the physical classroom to the virtual. There is much more. It is about adapting the traditional system to new technologies, opportunities, values, needs and, last but not least, events in the field of economy. For effective e-learning, we must therefore adapt the entire model, not just the equipment or space. E-learning plays an important role in the development of future educational models, and systems. Which, in fact, is somehow sensible or necessary in the age of digitalization. All over the world, we are robotizing production, digitizing homes, and gadgets, and increasingly developing advanced smart devices, so it is high time we took a step forward in the field of education as well. E-learning also offers the possibility of abandoning methods based primarily on memorization and mechanical training. The new form of learning emphasizes the importance of encouraging students to actively participate and research, to independently search for and process information, to analyze and solve problems, and to communicate and cooperate effectively. It encourages students to think more actively, participate more actively and be more independent. The development of students is at the forefront and not so much the subject itself. As e-learning takes advantage of modern technologies, it consequently eliminates time and space constraints. One of the advantages of this is the possibility of choosing the learning environment of each individual

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according to his knowledge, abilities and preferences, teachers can improve their methods and diversify their lectures, and schools have the opportunity to avoid geographical boundaries. Based on the experience gained so far, schools around the world are increasingly flirting with the idea of introducing an online form of learning in combination with the traditional way, even at a time when the situation in economies will stabilize.

2. E-PLATFORMS

Online learning or just networking itself is made possible by various platforms. The three most common ones will be presented below.

2.1. Google Meet

Google Meet is a platform (Figure 1) that allows users to have free one-hour video conferences with up to 100 participants. It also offers the possibility of advanced features for organizations, such as the possibility of up to 250 participants (https://apps.google.com/meet/how-it-works/).

Signing up for Google Meets is fairly simple, as you only need to sign in with a (pre-existing) Google Account or a Google Workspace account for business use. When using a computer, no additional installation of the program is required, and for use over the phone, we install the application. We join the video conference using a link or code sent by the host. With the paid version, there is also the option to call the meeting number in combination with the assigned PIN code. If we use the free version of Google Meet, we must log in to the account to participate, but the paid version does not require this. A special feature of Google Meets is the subtitles (in English only) provided by speech recognition technology (https://nerdschalk.com/7-google-meet-chrome-extensions-you-can-try-now/).

Figure 1. Google meet platform
Source: Own

Before attending the video conference, Google Meets allows us to view our cameras as other participants will see us. We can turn the camera and sound on and off. Google Meet automatically changes the layout of your video meeting to show the content and attendees that are most active. We also have

the option to change the layout. Anyone can easily pin and remove participants and mute them. Either way, you cannot turn on the other person's sound again. Educational editions were created especially for educational purposes. Here, only the user who created the meeting - the teacher - can remove or mute the participants. All participants are allowed to share a screen (full screen or application window), and send instant messages - which also include file sharing - to participants during calls.

This platform has many extensions to power up online classes. For example, there is Google Meet Grid View. The main thing that this extension allows us is to see all the participants at once, instead of only 16, we are allowed to see without an extension. Furthermore, there is Google Meet Plus, with which we can create breakout rooms and control attendance, it gives us quiz options and a dedicated control panel, etc. Google Meet Enhancement Suite includes the ability to automatically mute the microphone, turn off video when joining a meeting or enable captions, lets users quickly mute and unmute themselves using a keyboard shortcut; and Auto Join (skipping the waiting screen when joining a meeting). Besides that, you can start and leave meetings quickly, mirror videos, remove all participants, or enable dark mode. With Nod – Reactions extension you can "raise your hand" (figuratively). You can also send other reactions like "thumbs up", "hand clap", "laugh", "hmm", and "wow". There is also Meet Attendance which gathers a list of attendees instead of the host. These are just some of the many extension options (https://apps.google.com/meet/how-it-works).

There are three versions available to us. The first, free, allows the meeting to last up to 1 hour, with a maximum of 100 participants. We can create an unlimited number of meetings, and participants can join via a browser. We can send out invitations to external participants, but they must still sign in with a Google account. We are offered options for subtitles in English, screen sharing and customizing the layout. Google Drive provides 15 GB of space per user. In case we need help, online self-help and community forums are available. The next possible version is Google Workspace Essentials. This version is chargeable and costs $ 8 (6.69 €) per active user per month. It allows the duration of the meeting up to 300 hours, and the maximum number of participants is 150. In addition to all other options available to us in the free version, you can join the video call via a US or international phone number and save the recording of the meeting in Google Drive. Google Drive provides 100 GB of space per user (up to 2 TB in total), disks are shared, and we can also use Drive File Stream. In case we need help, we have ongoing online support and community forums. The latest possible version is Google Workspace Enterprise. This version is also payable from 6 (5.02 €) to 18 USD (15.05 €) per active user per month. The meeting can be attended by up to 250 people. In addition to the options listed so far, live streaming in the domain for up to 100,000 viewers and smart noise extraction are also enabled. Google Drive gives you unlimited space, disks are shared, and we can use Drive File Stream (https://apps.google.com/intl/sl/meet/pricing/).

Detailed overview of versions of Google Workspace Enterprise (https://workspace.google.com/pricing.html):

Business Starter:

- USD 6 / user/month
- Custom and secure business email
- 100-participant video meetings
- 30 GB cloud storage per user
- Security and management controls
- Standard Support

Business Standard:

- USD 12 / user/month
- Custom and secure business email
- 150 participant video meetings + recording
- 2 TB cloud storage per user
- Security and management controls
- Standard Support (paid upgrade to Enhanced Support)

Business Plus:

- USD 18 / user/month
- Custom and secure business email + eDiscovery, retention
- 250 participant video meetings + recording, attendance tracking
- 5 TB cloud storage per user
- Enhanced security and management controls, including Vault and advanced end-point management
- Standard Support (paid upgrade to Enhanced Support)

Enterprise:

- Contact sales for pricing
- Custom and secure business email + eDiscovery, retention, S/MIME encryption
- 250 participant video meetings + recording, attendance tracking, noise cancellation, in-domain live streaming
- As much storage as you need
- Advanced security, management, and compliance controls, including Vault, DLP, data regions, and enterprise endpoint management
- Enhanced Support (paid upgrade to Premium Support).

2.2. Microsoft Teams

Microsoft Teams (Figure 2) is an online platform that enables connectivity not only through video meetings (as is the case with the other two platforms) but also through chat, calls, and the ability to share and edit documents. All of this is possible even when we are not connected in a video call. This allows us to send messages directly to one or more people. We can also tag people when we post a message to get their attention. The text we want to send can be edited. You can save received messages, search for them by senders or keywords, and filter them for display (https://www.microsoft.com/sl-si/microsoft-365/microsoft-teams/instant-messaging).

As already mentioned, one of the functions of the platform is also a video meeting. Anyone with an email address can be invited to join the meeting. You can also include the use of other Office applications in the meeting, share your screen, or even use a digital whiteboard. We can join meetings even when we do not have an Internet connection, by combining a PIN code and a call using a global caller's number (https://www.microsoft.com/sl-si/microsoft-365/microsoft-teams/video-conferencing).

The application can be installed on Android and IOS devices. Microsoft differentiates its offer according to users. It offers packages for home use, which do not include the Teams application, and packages for companies, which include the application. Thus, Microsoft Teams is included in three of the four payable offerings (https://www.pcmag.com/how-to/use-microsoft-teams-for-free).

Figure 2. Microsoft Teams platform

Source: https://www.microsoft.com/sl-si/microsoft-teams/download-app

The offers differ mainly in the number of programs they include, the level of security, the inclusion of desktop applications, etc. However, there are no differences in the offer within the Teams application. Thus, in all three versions, a maximum of 300 people can be included in the video call (https://www.microsoft.com/sl-si/microsoft-365/business/compare-all-microsoft-365-business-products).

2.3. Zoom

The third Zoom platform (figure 3) presented was positioned in the Leaders Quadrant (Magic Quadrant for Meeting Solutions-year (2020) by the world's leading information technology research and advisory firm – Gartner (https://zoom.us/gartner-meetings).

Figure 3. Zoom platform

Source: https://www.monitor.si/novica/zoom-je-postal-svetovna-uspesnica-a-tudi-tarca-zlorab/197273/

Zoom is a video conferencing platform that can be used through a computer desktop or mobile app, and allows users to connect online for video conference meetings, webinars and live chat (https://www.webwise.ie/parents/explainers/explained-what-is-zoom/).

Zoom allows up to 1000 video participants to join a meeting and 49 videos viewed on one screen. Similar to the aforementioned. Zoom also offers various options such as hand raising, sharing screens, files, recording meetings, group or personal chat, etc. With Zoom, you can host online events with up to 100 interactive video participants. and up to 10,000 view-only attendees. Zoom can be used online or as an application for Windows, MacOS, Linux, iOS and Android OS.

Detailed overview of versions of Zoom (https://workspace.google.com/pricing.html):

Basic Personal Meeting:

- free (just sign up)
- Host up to 100 participants
- Group meetings for up to 40 minutes
- Unlimited one-on-one Meetings

Pro:

- 139,90 EUR / year/license
- Host up to 100 participants
- Group meetings for up to 30 hours
- Social Media Streaming
- 1 GB Cloud Recording (per license)

Business:

- 189,90 EUR / year/license
- Host up to 300 participants
- Single Sign-On
- Recording Transcripts
- Managed Domains
- Company Branding
- All features included in Pro and more

Enterprise:

- 189,90 EUR / year/license
- Host up to 500 Participants
- Unlimited Cloud Storage
- Dedicated Customer Success Manager
- Recording Transcripts
- All features included in Business and more

Zoom United Business:

- 326,00 EUR / year/license

Phone

- Includes all the phone features of Zoom United Pro
- Unlimited calling within Global Select
- Optional add-on: add unlimited calling in up to 18 other countries

Meetings

- Host meetings with up to 300 participants
- Single Sign-On
- Recording Transcripts
- Managed Domains
- Company Branding.

3. ADVANTAGES AND DISADVANTAGES OF E-LEARNING

First of all, it is necessary to point out the fact that without an internet connection, none of the platforms can work. Therefore, we can first highlight the problem of internet connections. People who have poorer internet connections or limited internet access (either due to financial situation or something else) consequently have a poorer experience using the programs. As one of the main disadvantages of e-learning, however, users cite inefficiency compared to real classes. Namely, they report problems with concentration when looking at the screen for a long time. Video meetings require more concentration than live meetings. Our communication consists of verbal and non-verbal speech, and the latter is made more difficult by video meetings. Because our brains are "together", but we are located far apart, special subconscious emotional conflicts occur in our bodies and they also tire our bodies.

One of the advantages is that users have the option of a virtual background, which they perceive as an advantage or as a conformable way to attend class when they do not like their real backgrounds during video meetings. Another advantage is the location, as we can attend classes from the comfort of a home armchair or while visiting a hairdresser, for example. At the same time, we don't have to huddle in overcrowded classrooms and look for empty seats.

4. CONCLUSION

Students had to adjust their daily habits due to distance learning. The first change, which is not necessarily a bad one, is definitely that in the morning student just sit in front of the screen and don't have to huddle on the bus, wait in rush hour, scurry around the school hallways, etc. At the same time, e-learning also means a reduction in physical contact with peers, which can lead to a lack of work motivation or even depression. As we found out earlier, e-learning also causes stress due to the lack of physical contact with interlocutors, which in turn makes us even more tired. However, as far as physical health is concerned, frequent enough, long enough and properly performed breaks are crucial. This means not sitting for too long, not looking at the screen for too long, and moving around during breaks, not just turning off the screen and sitting still.

All three programs (Google Meet, Zoom, and Microsoft Teams) are not complex to use and learning the features they offer is fairly easy. In addition to instructions and help on the official websites, you can help yourself with videos on YouTube.

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Framing a Model for Mobile Learning Using Augmented Reality

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Abstract: *This paper considers the possibility of creating a framework for mobile learning with elements of augmented reality, intending to better adapt teaching content to students who are in the same or different locations. The framework, in which the use of mobile devices in learning is observed, depends on the purpose for which the mobile device is used (for research purposes, simulation, etc.), on technical capabilities, and the level of user capabilities. The goal is to achieve a quick and efficient understanding of the learning content, as well as good cooperation from the participants. The sustainable link between AR and HE goals must be established in accordance with the cognitive approach, according to the axioms of the theories related to learning, with the aim of unifying the association of this technology with the teaching–learning process.*

1. INTRODUCTION

With the rapid development of mobile technology, augmented reality (AR) is one of the innovative technologies for improving the interaction between real and virtual spaces by superimposing virtual objects or information in a physical environment. Smartphones and tablets with AR technology are being increasingly used as pedagogical tools in education, including science (Lin & Tsai, 2021). Augmented reality can be applied to different aspects of education. In the last few years, there has been an increase in the number of examples of the application of augmented reality in education, with an emphasis on higher education, where better student engagement, better perception, and more positive attitudes have been noted as the effects of the application of augmented reality (Chen et al., 2016). AR technology enables the enrichment of the learning experience, makes learning easier, increases motivation, and improves focus in students (Sırakaya & Sırakaya, 2020).

Mobile devices, by default, offer certain unique advantages which can be utilized in education, such as mobility, social interactivity, connectedness for data sharing within devices, individuality, and the capability to gather real and simulated data from a location and the environment (Klopfer & Squire, 2012). Aside from easier access to learning materials, they also have the potential to ensure individual learning, which used to come only in the form of mentor work between a lecturer and a student (Peters, 2007).

2. MOBILE LEARNING

Correct dimensioning of mobile device usage in the learning process creates a new dimension that can affect the efficiency of learning to gather active experience (Kohen–Vacs et al., 2013). Mobile device usability is viewed through the prism of gathering, adopting, storing, and managing information. In the everyday search for information, there is already a trend of the

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prevalence of mobile devices. Such a type of informal learning provides a basis for the adjustment of formal learning materials to mobile devices for the purpose of better integration.

The usability of a device is viewed through the physical comfort and satisfaction of a student challenged by cognitive stimulation, the acceptance of information, and the ability to move from a physical to a virtual location. The usability of devices ties together the needs and activities of students and the software and hardware components of a mobile device. The high mobility, intuitiveness, and simplicity of a device can decrease cognitive overload, i.e. make task fulfillment easier.

The role of mobile devices in learning, depending on the environment and the topic being learned, should be motivating and relevant when adopting information, especially when location characteristics are used to choose and present the content. The mobile device system should be able to fulfill the following roles:

- Positioning via devices such as GPS, NFC, RFID, QR code, or 2D bar code.
- The creation of "learning paths" through instructions after precise positioning, defining the contents, and following existing activities. These paths can be defined in advance or randomly generated. The more independent students are, the more imminent individual learning paths become (Meek et al., 2012).
- The most important part of the system is the choice and presentation of the learning content depending on the location. Namely, the materials are delivered to a student based on the previously defined positioning, assessment of the connection between the student's location and the materials, as well as based on the individual characteristics of the student. In addition, good interoperability and interactivity between a student and a teacher play a major role in the acceptance of the new learning method, as well as in its efficiency (Nandwani et al., 2012).

The main characteristics of mobile applications are defined, to a large extent, by functional and nonfunctional user requirements. Functional requirements encompass all application settings, which can differ greatly, as applications are very specific. On the other hand, nonfunctional requirements encompass the answers to individual users' requirements, as well as some general requirements that refer to mobile device characteristics, such as the usage of wireless technology, security, privacy, and interoperability.

Through the dynamic experience of mobile applications in learning, and during the process of problem-solving, students coordinate their activities better in the virtual world than in the physical one. As with traditional education, the types of participation include the engagement and motivation of students, especially if some sort of a game is being played, which results in the better processing and memorization of information. The educational materials presented in the form of a game, such as learning foreign languages using augmented reality mobile applications, demonstrate great potential for inspiring teamwork, social interactions, and better results of learning (Liu et al., 2016).

The goal of device usability should be an increase in students' focus on the task at hand, and not the specific tools used to fulfill the said task. Digital information that can be presented on mobile devices can easily integrate into existing materials using various codes, images, or other markers. This opens the door to an increased potential for combining learning resources through mobile technology and augmented reality, all with the goal of improving the understanding of study materials. In the example of using QR codes in mobile learning, students had an evident positive reaction to the augmentation of study materials (Chen et al., 2011).

Criteria used to define the aspect of mobile device usability are the following:

- Device mobility, in terms of moving to another environment without a change in data reception and processing performance;
- Information availability, i.e., access to information from any location at any time. This enables the *just-in-time* learning principle, where information follows the user, i.e., the user can store it and reuse it under identical conditions as when first receiving it, but at a later time when this information is necessary;
- Mental comfort, which encompasses understandability, ease of learning, ease of remembering, and intuitiveness, thus affecting the cognitive load and the rate at which students will fulfill a task. Metaphors, incomplete information and mnemotechnics, complicated displays, or illogicality of activities can impede cognitive performance;
- Student satisfaction in terms of interface esthetics, the physical appearance of the device, and device functionality when learning. This criterion is difficult to predict and define in advance, as satisfaction and enjoyment are defined by the personal and cultural style of each individual. Latest-generation mobile devices use their modern technical characteristics to achieve higher user satisfaction.

When using mobile devices in learning activities, there must be an array of conditions satisfied, which stimulate students to cooperate and interact (Yang et al., 2015):

- Location-related conditions in which students can use mobile devices,
- Access to information whenever and wherever necessary (just in time learning),
- The least possible cognitive overload with materials and activities that can be simplified using mobile device functionalities when fulfilling a task,
- Esthetic and functional approach that can be personalized per the requirements and preferences of the user.

3. THE PROCESS OF MOBILE LEARNING

The process of mobile learning is an intersection between three aspects: mobile devices, learning, and interaction, as shown in Figure 1.

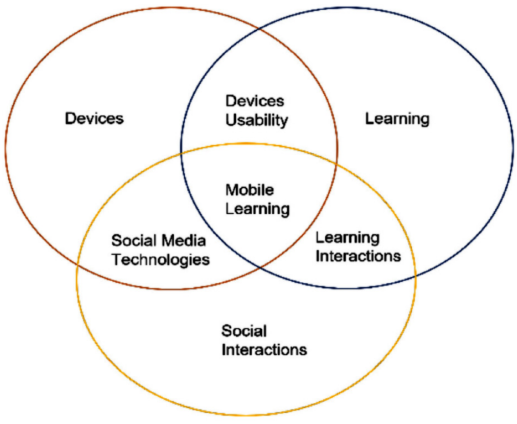

Figure 1. Mobile learning through the prism of mobile devices, learning, and social interactions

Source: Koole, 2009.

The goal of mobile learning is to give a student the competencies for better assessment and choice of information, redefining achieved goals, and questioning the understanding of what

they have already learned. Efficient mobile learning provides an improved cognitive environment where physically distant participants can communicate with each other, instructors, learning materials, and physical and virtual surroundings.

The criteria for assessing the mobile learning process are the following:

- Mediation, which implies that the very nature of interactions between participants replaces the participants in their interpersonal communication, as well as in the interaction with their surroundings, tools, and information;
- Access to information and its selection, which implies that with the increase in the amount of information, students need to increase the amount of effort to recognize the appropriateness and veracity of said information;
- Knowledge navigation, which implies that, based on the learned materials, students acquire the skills necessary to place information in the context of situation and necessity.

In the mobile learning system, the following should be kept in mind:

- The method of mobile device usage that will improve the interactions between students, the community, and the system,
- The students' method of accessing other systems and devices using their mobile devices to confirm or assess the relevance of information and the process flow, all with the goal of fulfilling tasks,
- Students' independence in navigation through information filtering,
- The method of switching the roles of students and teachers with the necessary equipment.

The advantages achieved through the mobile learning process, in addition to offering students interactivity through spoken communication and multimedia access to the Internet, include:

- Using the wireless network, students can reach physical and virtual destinations on their mobile devices,
- The ability to access different materials anywhere and anytime ensures a better understanding and adoption of information,
- Learning in specific contexts can offer the authenticity of the social and cultural environment, which provides a better insight into the application of the acquired knowledge and skills,
- A well-implemented system can play a major role in the decrease of cognitive overload in students, enabling them to adopt and transfer information, when necessary, in a simpler manner.

4. DESIGNING LEARNING ACTIVITIES

The process of designing learning activities should encompass:

- An assessment of the previously adopted level of knowledge,
- Adjusting the existing teaching techniques (diagrams, advanced organization models, etc.) with the goal of simplifying the overview of information,
- Using additional multimedia forms to stimulate understanding and memory,
- Ensuring differently structured activities depending on the context and characteristics of potential users, as well as on the environment where the activity is to take place,
- Designing learning situations in terms of stimulating the activity of transferring concepts and procedures according to different contexts,
- Enabling the research, discovery, choice, and assessment of relevant information according to the unique conditions of the task at hand.

When it comes to learning interactions in the process of mobile learning, the following should be kept in mind:

- Interactions between students, teachers, experts, and the learning system itself,
- Students' need for social interaction, as well as the need to adopt information and/or skills,
- The dimensioning of a media space that is large enough for developing joint ideas, practical work, and mentoring, both between students and between a student and a teacher.

5. AUGMENTED REALITY TECHNOLOGIES IN MOBILE LEARNING

Applications that support augmented reality can be designed to respond to the educational needs of students in vocational educational institutions. As a result, not only will the students with special needs be able to access an inclusive design through an application, but all students can benefit from a good design (Bacca, et al 2015).

Applying augmented reality can be very effective with learning materials that are difficult to understand or are entirely conceptual by increasing the students' interest in the concepts of learning (Parhizkar et al., 2012). Among other things, it can provide students with an experience that is built into the learning materials that describe real situations. Using augmented reality, students can explore materials that have been shaped by a given situation or learning context. The most prominent examples have to do with the exploration of physical surroundings by topic of interest, such as history, the arts, technology, biology, astronomy, etc. (Yen et al., 2013).

The previous applications of augmented reality in the domain of education have enabled:

- Learning using 3D content, which allows students to better understand the materials,
- Comprehensive, group, and situational learning, where students connect with each other, both time- and space-wise, for better cooperation,
- A sense of attendance, immediacy, and direction,
- The visualization of the invisible elements of the learning materials, and
- Establishing a connection between formal and informal education.

6. SETTING UP THE FRAMEWORK FOR THE MOBILE LEARNING MODEL WITH ELEMENTS OF AUGMENTED REALITY

The framework in which the use of mobile devices in learning is viewed depends on the purpose of the usage of the device (research, simulation, etc.), technical capabilities for access and installation, and the level of user competencies (Alioon & Delialioglu, 2015).

Setting the framework for mobile learning based on augmented reality encompasses the definition of:

1. The model and form of learning materials that will be used through augmented reality;
2. The type of interaction between the participants and learning materials using mobile devices;
3. The context of the augmented reality application defined according to a certain model (usually identity, location, surroundings, etc.);
4. The type of learning meant for the augmented reality model in terms of individual or group work, professional training, etc.

The creation of the model primarily encompasses the definition of the necessary entities that participate in the AR-powered mobile learning process. The basic entities are students and teachers, who, along with the learning objects (course materials, printed materials, physical surroundings, etc.) make up the real-world part of the model. Virtual reality enhances the materials with an augmented context using a predefined interaction between these contents depending on the characteristics of the student. The characteristics of the mobile device enable the augmentation of reality.

The components of the mobile learning model using augmented reality include:

- The real world or the context, including all course materials, learning objects, or the environment where learning is taking place.
- Digital content or augmented context, including 3D graphics, symbols, images, explanations, etc. that enhance the real world.
- Learning activities that tie together the real-world and digital content through different interpretations, amendments, interactions, etc. (Santos, et al., 2013).

The real world implies the presence of the learning objects, students, teacher, and learning materials in different forms. Important contextual elements are the goals and tasks the teacher provides (lectures, laboratory exercises, homework, independent work, etc.).

The augmented context implies the addition and display of clearly defined and evaluated information in a multimedia format, based on the symbols of the learning objects. Adding augmented content is a form of contextual visualization, i.e., the presentation of virtual information in the context of a real-life environment. Contextual visualization can have beneficial effects on learning, since virtual information is in accordance with real-world objects, which decreases the need for attention-switching between different media. In addition, contextual visualization uses multimedia symbols in the known, real environment, which helps students manage what they're learning. Teachers are tasked with adjusting the objects and surroundings to the students' needs. Course materials can include the interface, information (text, image, or audio), and its own characteristics such as length, language, and choice of words. The information contains 3D graphic computer models and notes or symbols such as numbers, circles, arrows, etc.

Learning activities can include individual steps in the learning process using course materials, with the option to use additional study materials. The augmented reality system, based on the symbols and pre-prepared additional contents in the database, evaluates, pairs, records, and archives content. Interactivity during the use of augmented reality allows students to potentially adjust certain parameters with the goal of tracking the expected outcomes (Matsutomo et al., 2012). These adjustments are possible precisely because of the dynamic rather than static nature of augmented reality.

7. LEARNING MATERIALS IN THE AUGMENTED LEARNING ARCHITECTURE

Learning materials in the context of augmented reality architecture are educational content used to distribute learning. These materials can be digital or analog, single-use or multi-use, or they can be referred to during the learning process (IEEE standard for learning object metadata, 2002).

Creating learning materials for augmented reality requires several electronic educational resources (hardware, software, content), which include texts, audio, video, virtual 3D objects,

different forms of feedback, navigation, and instructions. Such learning materials should be easy to integrate with traditional printed publications (textbooks, handbooks, or other books). This is especially important in terms of the enhancement of the didactical effect through the implementation of various educational practices, such as the need for new training materials, consolidation of learned materials, virtual laboratory work, researching virtual models, etc. (Sannikov et al., 2015).

The identification of objects from the real world that are being used for learning is done using mobile devices. These objects are first assigned augmented reality symbols that define the name or location. Then, the augmented reality symbol is identified using a multimedia device, such as a camera, a tablet, or a smartphone. Afterward, based on the identifying information, the user can download contents from the database, which will then join real-world objects.

8. THE GOALS OF INTEGRATING AUGMENTED REALITY INTO THE MOBILE LEARNING PROCESS

The mobile learning model based on augmented reality technology can be integrated into traditional classes at any higher educational institution. The integration of this model into everyday classes, based on pedagogical methodology, has the goal to create, realize, and test new technologies for the visualization of augmented reality in the mobile environment in order to further motivate students. The goal of implementing this model has two major points:

- On one hand, technology enables an enhancement of materials beyond regular textbooks during traditional classes,
- On the other hand, the application of scientific content is implemented into the real world.

Given this, the teacher and the textbook are not completely eliminated from the learning process, but they are supplemented with new technologies based on pedagogical tools.

The mobile learning model based on augmented reality technology can pose an alternative to traditional teaching methods, where instructions can be applied simply and in real time. The saved time that's necessary to adopt new knowledge can easily be measured.

9. DISCUSSION IN THE PLACE OF CONCLUSION

The application of augmented reality in the mobile learning process allows for more efficient adoption of course materials, which is apparent in test results and the decrease in errors in work (Radosavljevic et al., 2019). Students' professional competencies and skills, as authors (Sannikov et al., 2015) explained in their works, are more easily and quickly adopted using augmented reality applications. Owing to the possibility of adjusting the materials to the user, there has been a decrease in the number of errors and an increase in the understanding of course materials (Radosavljevic et al., 2019).

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Efficiency of Learning Using Augmented Reality Technology

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Abstract: *The intensive development of information technologies has led to the introduction of many innovations in the educational process. Innovations often rely on the use of new technologies in the educational process and aim to increase the efficiency and effectiveness of learning. This paper presents the use of augmented reality in training students to process graphic images. The method of using augmented reality in the training has been presented in the paper, and afterward, the results of the research, which compared student efficiency using written text instructions and student efficiency using augmented reality technology in the training process. The results of the research did not show a significant difference in efficiency. But, it should be taken into account that the students, who were part of the research, encountered this type of training for the first time, so the opportunities that augmented reality provides in the training process needs to be further investigated.*

1. INTRODUCTION

The development of fifth-generation mobile networks and information technologies that rely on these networks (artificial intelligence, cloud computing, and IoT), has affected all areas of society. Education, as one of the pillars of any society, is no exception. Mobile learning, LMS platforms, simulations, virtual labs, etc. have changed the education process. The goal of using modern information technologies in education is to impact both the quality and the scope of knowledge adopted by students (Büyükbaykal, 2015). The widespread use of new technologies and social media among the younger population has incited the educational services sector to accept them as an integral part of the learning process (Haleem et al., 2022). A special challenge is posed by the application of immersive technologies (augmented and virtual reality) in education. These technologies have already brought about certain conclusions. The most important conclusion has to do with their importance in skill acquisition in students, as well as in the increase of confidence in the application of those skills (Santos et al., 2014; Radosavljevice et al., 2018; Urlings et al., 2022).

In this paper, the authors will provide a demonstration of the experience of using augmented reality technology in education, as well as the results of a study that was conducted to find out whether students are more time-efficient in mastering learning materials through the usage of augmented reality in training. The paper is organized into several parts. After the introduction, there is an overview of relevant literature in the area of learning and augmented reality technology. Then, there is the overview of the scientific study that cross-examined the efficiency of task fulfillment using augmented reality technology as opposed to learning and work strategy that used text-based instructions. Finally, there are the results of the research with a discussion and a conclusion.

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2. LEARNING AND MODERN TECHNOLOGIES

Learning is comprised of constructive processes in which an individual activates, independently or in a group, elaborates, builds, and organizes knowledge (Seidel & Shavelson, 2007). The definition of electronic learning (e-learning) provided by the United States Distance Learning Association is "the process of mastering knowledge and skills through information and instructions received via different technologies and distance learning methods" (Levels et al., 2019). The application of various technological solutions in the learning process is a means to positively affect the factors and outcomes of learning. The learning process is considered successful if it is efficient and effective. Learning is efficient if students adopt knowledge or master skills through optimal engagement. Efficient learning encompasses learning where the number of activities a student must fulfill in order to learn is minimal. Learning is effective if the knowledge that the student adopts can be applied and tied to previous knowledge to create more complex skill sets (Hoy, 2010). The efficiency and effectiveness of learning must be adjusted to one another. An efficient learning strategy must be effective, and vice versa. A learning strategy that is efficient must realize and satisfy the criteria of effective learning through the steps it takes to realize it. A study (McMahon, 2006) defines 7 criteria of effective learning as follows:

- The scope of learning materials presented to the student must be in accordance with the ability and time the student has;
- The amount of information presented to the student must be appropriate;
- Students must be given clear instructions on the activities expected of them;
- Activities conducted by students that belong to higher-order thinking and learning must be rewarded;
- The teacher should demand students' active participation during the lecture;
- The student must be given options to choose from during the lecture;
- The student must be given feedback on their performance

The choice of learning strategy defines the steps to realize the learning process. Strategies such as learning through reading or underlining are efficient from the perspective of resources and activities taken during learning but are not considered effective. Strategies such as practice testing, which is comprised of taking tests and using flashcards, as well as distributed practice, where students use previously acquired knowledge in several timed sessions, are considered highly effective but are quite demanding in terms of efficiency, and therefore not sufficient (Biwer et al., 2020). The use of contemporary technologies in different learning strategies can contribute to the optimization of learning efficiency and effectiveness (Radosavljevic et al., 2019).

Research has shown that there is a positive effect of the application of modern technologies in teaching. Students readily accept new technologies as a part of the learning process, and they consider them an integral part (Penprase, 2018; Dunn & Kennedy, 2019; Radosavljevic et al., 2019). The use of technology in learning has a positive effect on student motivation. The increased motivation results in an increase in the participation of students, which, in turn, increases the effectiveness of learning (Kennedy & Dunn, 2018; Pechenkina & Aeschliman, 2017). Technological solutions used in the realization of the curriculum most commonly rely on the use of multimedia content, social networks, mobile phones, cloud platforms, MOOC, digital and smart classrooms, and immersive technologies.

The use of technology in education is also a positive ecological factor, as it decreases the amount of paper and other waste (Camilleri & Camilleri, 2016). The importance of introducing

technology into the educational process became especially apparent during the COVID-19 pandemic, when different e-learning platforms enabled the realization of education regardless of the situation, as students could not physically attend lectures (Hoofman & Secord, 2021; Fauzi, 2022).

Augmented reality (AR) technology is defined as the technology which merges real-world information with digitally generated information presented as a part of the real environment (Encyclopedia of Multimedia, 2006). The application of augmented reality technology has a positive impact on the motivation and performance of students during learning, as well as on the interest students have in the learning materials. Due to the way the content is presented, it is believed that augmented reality technology is important in transferring knowledge and skills that are applicable in the real world (Bacca et. al., 2014; Radosavljevic et al., 2018; Lima et al., 2022). There are more and more studies on the application of augmented reality technology in education each year. A study by Chen and Wang (Chen & Wang, 2008) examines the possibilities of tangible augmented reality (TAR), where learning is realized through the merging of digital learning materials and objects in the physical space. One of the conclusions of the study is that students tend to adopt knowledge faster than during traditional lessons. A study (Juan et al., 2016) demonstrates an increase in the efficiency of the learning process through the use of augmented technology in dentistry. Studies (Tzima et al., 2019; Uygur et al., 2018) analyze the role of teachers in augmented reality learning. A study (Radosavljevic et al., 2018) analyzes augmented reality technology in the context of professional vocational education. These studies conclude that augmented reality is still not being used to a greater extent in the education process and that this technology and its potential are still unknown to teachers. All the above-mentioned studies confirm that there is an increase in motivation and learning effectiveness when augmented reality technology is used.

3. RESEARCH AND RESULTS

The study, which tested the efficiency of learning through augmented reality technology was carried out at the ATUSS academy, ICT College in Belgrade, Serbia, in March 2022. Fifty-seven first-year students of undergraduate academic studies at the Communication Technologies study program took part in the study. All students in the study were between 19 and 23 years old and digitally literate (they know how to use mobile phones, e-mail communication, web searches, the Moodle platform for e-learning). The study was carried out during laboratory practical lectures for the course Graphic Software Tools. In these practical lectures, the students learn how to digitally process photographs using raster image processing software.

The students who participated in the study were tasked to follow a laboratory exercise in one of three possible ways. The first group, comprised of 15 students, conducted the exercise following paper-based instructions. The second group, also comprised of 15 students, used paper QR codes to load instructions in an augmented reality application. The third group used digital QR codes displayed on their monitors to load instructions. The goal of the study was to compare the time efficiency using a strategy encompassed textual instructions, as opposed to time efficiency using visual instructions through augmented reality technology.

The study was conducted in several phases. In the preparatory phase, it was necessary to create an augmented reality app that the students would use to carry out the exercise. For this purpose, the software platform Unity (https://unity.com/) was used. This is a cross-platform integrated

development environment used in the process of production of video games, simulations, 2D and 3D modeling, and interactive applications. Aside from this software, Vuforia (https://developer.vuforia.com/), a software development kit for augmented reality applications, was also used. With these platforms, an augmented reality application was developed and used during the realization of laboratory exercises. The hypothesis defined in this phase was that augmented reality technology in the learning process is more efficient than traditional text-based learning. An additional hypothesis was that the most efficient method of using augmented reality was one that encompassed digital as opposed to paper-based QR codes (as shown in Figure 1). Aside from the application development, this phase also included the preparation of instructions for the exercises in a textual form, as well as a questionnaire on the experience using augmented reality technology, which the students were asked to fill out during the study.

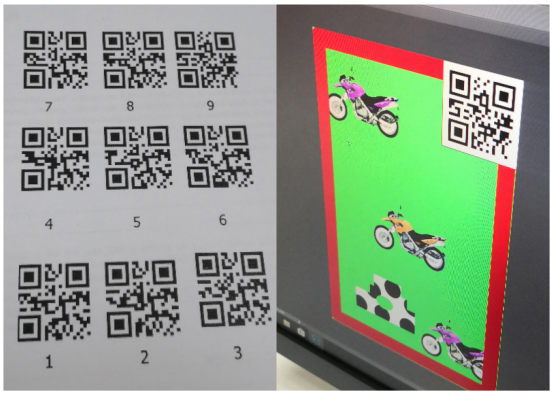

Figure 1. Printed and Digital QR Codes

Figure 2. Scanning QR codes and following instructions on mobile phones using the augmented reality application

The realization phase of the study commenced with the division of students into groups. Students were distributed into four time slots based on the number of their student cards. As that number had been assigned to students when they enrolled in the school using a random order, this method can be considered viable for the division into statistically even groups. Each group had a maximum of 15 students, as the room assigned for laboratory exercises contains 15 working stations. Each student carried out the exercise individually, following the instructions given to them in one of the three ways. The first group received the instructions in a textual form printed on paper. The second group received instructions in the form of printed QR codes. Using their phones, on which they had previously installed the augmented reality application for this exercise, these students scanned the codes. Upon scanning, they received an image with graphic instructions for the exercise. The third group received the instructions in digital form, where the QR code for the augmented reality application was integrated into the program for the exercise. Figure 2 presents the way students used the augmented reality application using digital and paper QR codes. Figure 3 presents The display of content on a mobile phone upon scanning the QR code.

In their assigned time slots, the students were given the necessary materials along with the instructions. The time required for the students to carry out the exercise was tracked. The exercise comprised the processing and montage of a photograph defined through precise steps. After finishing the exercise, the students filled out a questionnaire that gathered basic data about the students, while those students who used the augmented reality application also filled out a questionnaire regarding their experience using the application.

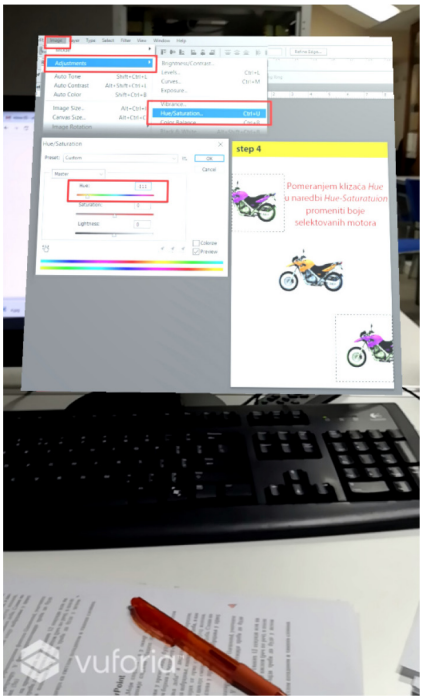

Figure 3. The display of content on a mobile phone upon scanning the QR code

The following phase of the study encompassed the processing of the gathered data. The results are presented in Figure 4 and showed that students who were given text-based instructions fulfilled the task in an average of 16.27 minutes (with a standard deviation of 5.96). The students who used the augmented reality application with printed QR codes took, on average, 18.80 minutes (with a standard deviation of 5.03). The students who used the augmented reality application with digital QR codes required, on average, 19.51 minutes (with a standard deviation of 4.40).

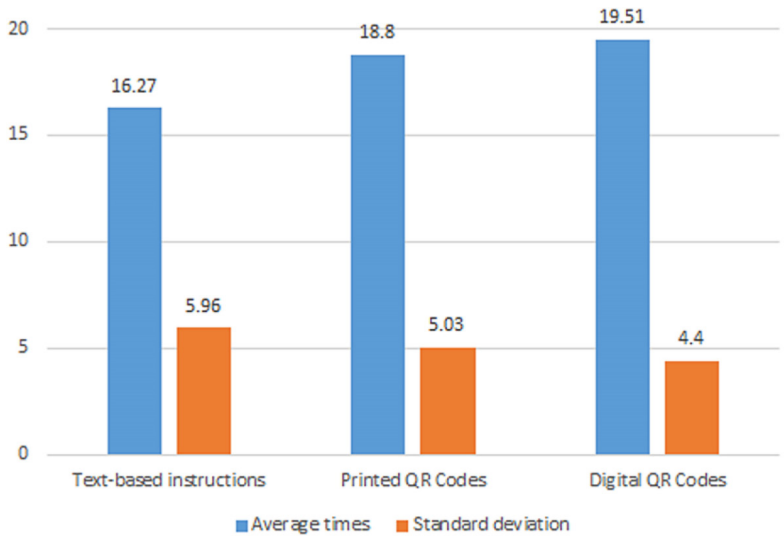

Figure 4. Average times required to carry out the exercise (in minutes) by instruction format

Source: Own research

The results presented above do not confirm the hypotheses of the study. The efficiency of learning, i.e. of the realization of the laboratory exercise, was lower when using augmented reality technology than when using text-based instructions. The students that carried out the exercises using text-based instructions required the least amount of time. The least efficient were those students

that used QR codes. One of the possible explanations for such results lies in the questionnaires that asked about the students' experience using the augmented reality application. For more than 92% of the students that used the application, this was the first time encountering this method of work and learning. The authors believe that having to get acquainted with the new method of learning, i.e. carrying out the exercise had an impact on the results that pointed out a low level of efficiency in learning using an augmented reality application. Despite these results, the general experience using this augmented reality was rated as positive. Figure 5 provides an overview of the results of the study, which point to the advantages of using augmented reality in learning. The application of augmented reality provided the students with clear instructions for carrying out the exercise; they found the concept of augmented reality understandable, and its application in the learning process entertaining, which positively affected their motivation to learn.

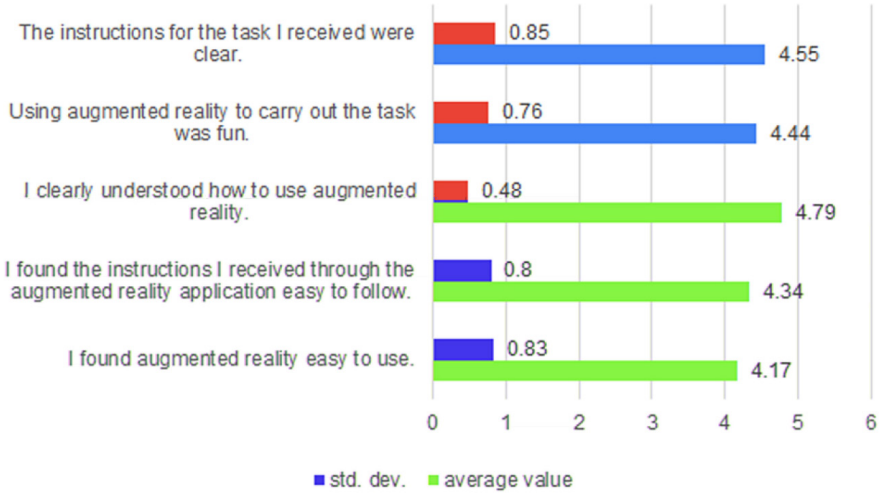

Figure 5. The advantages of the application of augmented reality in learning based on the questionnaire

Source: Own research

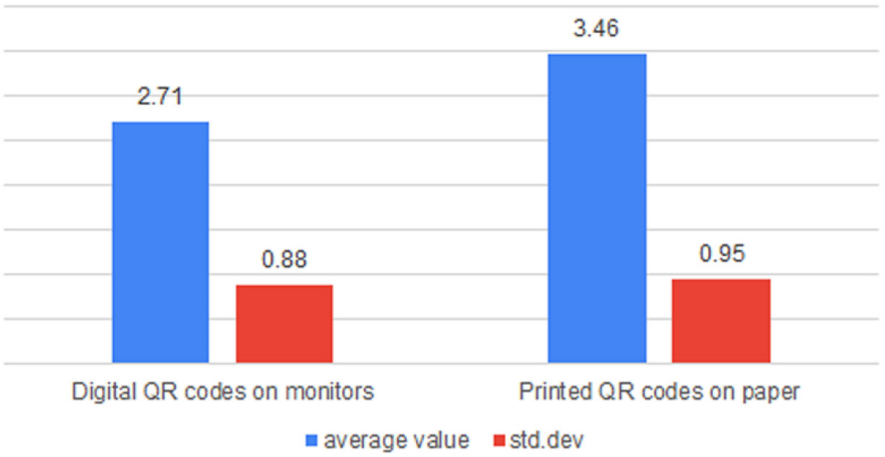

Figure 6. Image shaking with printed and digital QR code scanning

Source: Own research

The question regarding the technical aspect of the realization of augmented reality, in terms of image quality and QR codes on the screen, pointed to an issue with scanning depending on the quality of the screen. As the quality of some monitors was not at an appropriate level, there was mild image shaking and distortion, and those students who scanned their QR codes on these

monitors experienced issues. The augmented reality application had trouble recognizing the QR codes, and the content would not show up on students' mobile devices, or it would occasionally disappear. The students that had printed QR codes experienced fewer scanning issues, and their answers to the question regarding image display in the application correlated to the perceived ease of use (Figures 6 and 7). In addition, the focusing of the mobile device camera on the digital QR codes was a slower process than in the case of scanned QR codes.

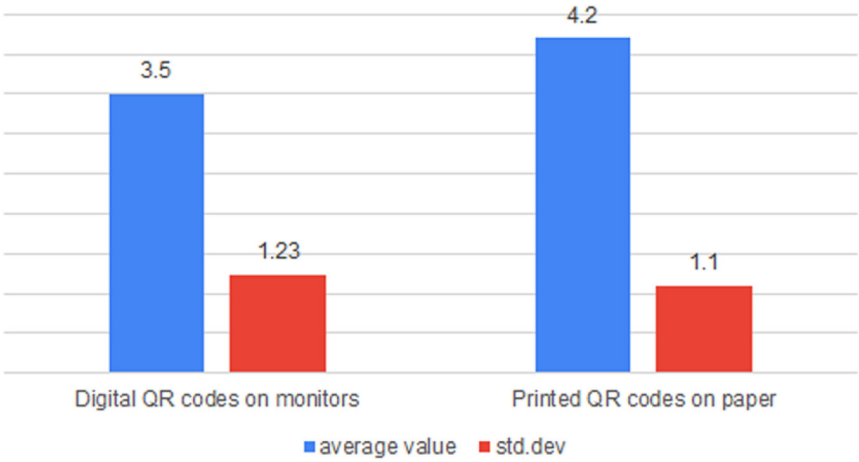

Figure 7. Ease of use of augmented reality with printed and digital QR codes
Source: Own research

4. CONCLUSION

Augmented reality technology is one of the most recent information technologies. The paper provides insight into a study that had the goal of comparing the efficiency of the learning process using augmented reality technology as opposed to a traditional learning strategy that uses printed text. The starting hypothesis that augmented reality would be more effective in the learning process was not confirmed in this study. Nevertheless, this conclusion should be taken with reservation and further examined. As most participants experienced the augmented reality learning strategy for the first time in this study, some time was necessary for them to get acquainted with this strategy during the exercise. This impacted the time necessary to carry out the task and, by extension, the students' efficiency. It has also been established that there were issues with the scanning of digital QR codes and that those QR codes were causing issues with content display in the augmented reality application. If the content was not being displayed on a high-quality monitor, there were issues with scanning the digital QR code, and the image displayed in the application was shaky. The scanning of digital QR codes was also slower as compared to printed codes, as mobile devices were experiencing issues focusing the camera on the monitor.

The positive results of the study are tied to the conclusions regarding the application of augmented reality in the learning process. It is advised that printed QR codes be used when implementing augmented reality into the learning process, as they were shown to be more reliable than digital ones. The application of augmented reality allowed for a clear transfer of knowledge and instructions for the laboratory exercises, and augmented reality was characterized as easy to use, as well as entertaining, which had a positive impact on the students' motivation to work and learn. Regardless of the hypothesis not being confirmed, this study provided results that may be useful for further research and implementation of augmented reality technology, not only in educational information systems but in other information systems as well.

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Information Security – SOC Potentialities

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Security information;
Event management

Abstract: *Nowadays, information is an essential resource and a valuable asset. Like any other asset, information is potentially vulnerable and subject to various threats, whether deliberate or accidental. The methodology adopted for the study was exploratory and descriptive, focusing on document analysis of information in the field of the theme. The paper aims to focus on the operationalisation and management of the Security Operations Center (SOC), to foster and optimise the definition of policies and instruments for data loss prevention and recovery, as well as to carry out training actions for employees. The main results emphasise that cybersecurity involves a set of tools, policies, guides, risk management approaches, training actions, good practices and technologies that can be used to protect the assets of organisations and users in cyberspace, to preserve the guarantee the so-called information security triad.*

1. INTRODUCTION

The defence of the security perimeter of organisations is considered and the way they approach cybersecurity internally has gained increasing importance with changes in work regimes caused by the COVID-19 pandemic and the existence and perception of increasing volumes of cyberattacks, some of them triggered against large companies and public entities (Vieira, 2022). In this sense, it is considered urgent to outline strategies for access control and network and infrastructure protection. It is also considered that intrusion tests, as well as vulnerability and threat management, may contribute to optimising the organisation's security levels.

GARTNER report explains that Cyber Risk Management (ISO/IEC 27005, 2018) involves the design and deploy a cyber-risk management program aligned with business needs by using fit-for-purpose methodologies, technology choices and organisational structures (Gartner, 2022). Also to the National Institute of Standards and Technology (NIST), Risk Management is the ongoing process of assessing the risk to IT resources and information, as part of a risk-based approach used to determine adequate security for a system, by analyzing the threats and vulnerabilities and selecting appropriate cost-effective controls to achieve and maintain an acceptable level of risk (NIST, 2022).

2. SECURITY OPERATIONS CENTER

In today's increasingly connected world, where organisations are constantly collecting and storing more data than ever before, having a robust and effective Security Operation Center (SOC) cannot be underestimated. With the right tools and personnel in place, the SOC can help to protect an organisation's most valuable assets and ensure that its data and systems are safe from harm.

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It should be noted that the SOC, as a service essentially aimed at risk management, includes the skills underlying the triad people, processes, and technologies responsible for monitoring, analysing and maintaining an organisation's information security, providing the necessary basis for it to protect its most sensitive assets, detecting and responding more quickly to threats.

The SOC is a centralized facility that serves as an intelligence hub for the organisation, gathering data in real-time from across the organisation's networks and other digital assets and using intelligent automation to identify, prioritize and respond to potential cybersecurity threats. When a cyberattack occurs, the SOC acts as the digital front line, responding to the security incident with force while also minimizing the impact on business operations.

It is considered that in an organisational context, SOC's main activities and responsibilities include (Rotich, 2022):

- Asset inventorying to allow better identification of all assets that should be protected (e.g. servers, databases, computing devices, endpoints, etc.) and all tools that are used to protect these assets, such as firewalls or antivirus software;
- Continuous monitoring of the network to detect any nonconformities and to provide a complete overview of the activity. A SOC monitors 24/7/365 the entire IT infrastructure looking for suspicious events;
- Searching proactively for suspicious behaviour and tests and assessing network security to detect advanced threats and identify areas of vulnerability or insufficiently protected assets. The SOC team performs vulnerability assessments and penetration tests that simulate specific attacks. Based on the results of these tests, the team adopts best practices, adjusts software and security policies and draws up better incident response plans;
- Constant monitoring of all used security resources, such as firewalls, IPs, antivirus, anti-DDoS and others to cross data about events, providing a Security Information and Event Management (SIEM) solution that detects almost instantly intrusion attempts;
- Prevention techniques to deter and deflect a range of known and unknown risks;
- Threat intelligence capabilities to assess the source and impact of cybersecurity incidents and identify areas of vulnerability or insufficiently protected assets;
- Development of the organization's incident response plan, establishing roles, tasks, activities and responsibilities in the event of an incident and defining the metrics by which the degree of success of the response will be evaluated. The SOC may also collaborate in designing backup procedures to ensure business continuity if a data breach event occurs;
- Using a combination of automated technologies and human intervention, the SOC provides a decisive response to address a security incident as quickly as possible. These kinds of actions often include an investigation to determine the causes of the vulnerabilities that allowed the hackers to access the systems, the disconnection of the network of compromised terminals, the pause or interruption of compromised processes, the redirection of network traffic, the application of antivirus software, the delete of infected files or the disable of passwords;
- Reporting to ensure all incidents and threats are fed into the data repository, making it more precise and responsive in the future. Reporting also is used, after an incident, the SOC ensures that incident data is kept ensuring evidence and future auditing and that customers, regulators, users, law enforcement, and other related entities are notified as required by applicable regulations;
- Developing compliance mechanisms to ensure reliability and compliance with internal and external rules and regulations. A SOC must ensure that all security systems, tools and

processes are compliant with the General Data Protection Regulation (GDPR) and other data privacy regulations. After an incident occurs, the SOC must be in a position to ensure that law enforcement, regulators, users, clients and other parties will be notified under the law and regulations and that the necessary data from the incident is retained for evidence and future audit processes.

Figure 1 shows a *representation of the main operations developed by a SOC.*

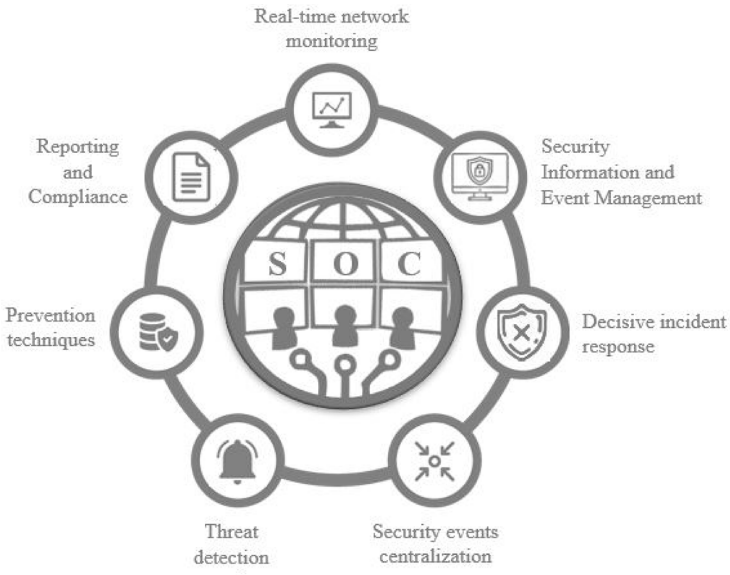

Figure 1. Security Operations Center
Source: Vieira, 2022 adapted from Softwall

As shown in Figure 1, a SOC brings together skilled people, processes, and technologies to continuously carry out different types of activities for the identification, monitoring, prevention, detection, treatment, response, and mitigation of cyber incidents of diverse types and origins.

A SOC team should include employees who have a professional skill set in information security and cybersecurity. The number of team members depends on the type of business, but usually, a SOC team includes security analysts, malware analysts, and cryptography and forensic specialists.

There are several reasons and benefits to the existence of a SOC in an organisation (Rotich, 2022):

1. **Centralized command:** A SOC is a unified command centre that aggregates data across the organisation's IT infrastructure, spanning network devices, computers, and cloud applications. SOCs can help organisations to adopt a comprehensive approach to managing and monitoring cybersecurity risks and to ensure that all major security incidents, such as data breaches, are handled effectively.
2. **Log management and analysis:** The cybersecurity teams must keep networks safe from cyberattacks. Log management and analysis is a fundamental function of the SOC as it helps to identify trends and anomalies that could indicate a security breach, allowing it to take appropriate steps to mitigate them. By focusing the analysis and management of log data across the entire network, the SOC team looks at logs and establishes normal or baseline activity and uncovers anomalies that might provide hints about possible intrusions as well as examining how quickly systems respond when something does go wrong. Many

hackers know that organisations often fail in analysing log data, which can allow viruses and malware to run and be undetected by victims of the attacks for some time.

3. **Compliance requirements:** A SOC helps organisations meet and comply with compliance with industry, national and global privacy regulations by providing an audit trail of all activities related to the security of data and systems. Storage retention policies are also managed by the SOC, ensuring that relevant logs and other data are kept appropriately based on regulatory or business requirements, strengthening the organisation's compliance.
4. **Minimize costs:** While many organisations think that implementing a SOC comes at a very high cost, the costs associated with a data breach - including reputational damages, data theft, corrupted data, or lost customers – is much greater. A SOC also helps mitigate the financial consequences of a cyberattack, as SOCs reduce dwell time, resulting in reduced financial costs when an attack happens. Additionally, partnering with a SOC reduces the significant financial costs of hiring and retaining an in-house team of cybersecurity experts and managing the cybersecurity tools needed to power a SOC.
5. **Threat prevention:** A SOC monitors the organisation's entire environment and configures rules and actions in a preventive way so that threats, virtual attacks and security incidents are dealt with or blocked, preventing them from spreading and protecting critical business data from being compromised or stolen. In addition, a SOC, by providing details of suspicious activity occurring on the network, is also improving network visibility. The SOC also can isolate and contain the threat until it can be fixed or removed. Today's modern SOC can isolate and contain the threat until the remedy is applied.
6. **Communication and collaboration:** The close collaboration between all SOC team members allows organisations to enact their cybersecurity practices much more efficiently. For example, many SOCs are operating 24 hours a day, 7 days a week, allowing for the real-time detection of incidents and continuous monitoring to provide immediate responses.
7. **Faster and effective response:** SOC provides a centralized, complete and real-time view of the performance of the entire infrastructure from a security perspective, detecting and mitigating threats in real time to detect, identify, prevent and resolve problems before they can cause many problems. SOC reduces dwell time, which is the amount of time an attacker is not detected on the network after initial access. Each minute that an attacker remains within the network, the greater the potential for damage. SOCs reduce dwell time from months to minutes, reducing the financial impact when an intrusion occurs.
8. **Continuous protection:** Continuous monitoring is vital to detecting the earliest indications of abnormal behaviour. Adversaries don't work 9-5, nor do they adhere to a traditional Monday-Friday work week. Businesses are under assault 24/7. SOC doesn't stop when all the organisation's employees are asleep, but rather proactively monitors for threat indicators, even throughout holidays and weekends. So, whether in-house, hired, or virtual, SOC team members are on hand to check for potential vulnerabilities and to detect attacks 24 hours a day.
9. **Remote worker protection:** With the increase in employees working remotely from home due to the COVID-19 pandemic, a new set of risks and threats has emerged, leading to the need to put in place robust monitoring controls to counteract these threats. By providing remote cover for these home workers, a SOC helps to reduce eventual cyber risks.
10. **Forensic investigation facilitation:** SOC is responsible for performing forensic investigation during and after an attack to help understand what happened, where it happened, to what systems and machines, and any digital footprint left by intruders, enabling analysts to investigate security incidents more quickly and comprehensively.

These benefits of a SOC are condensed in Figure 2 in five major points.

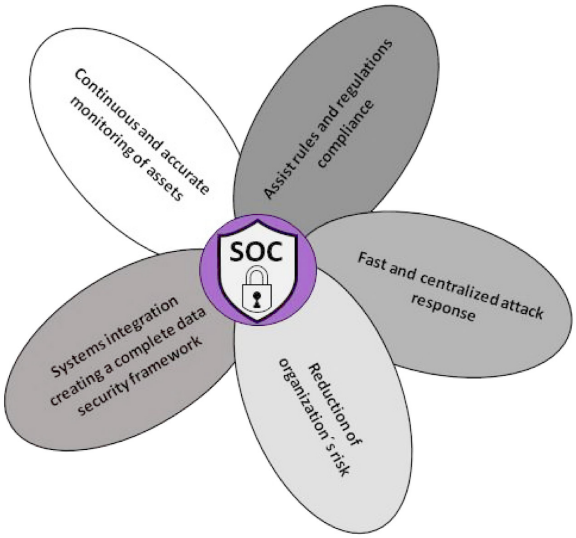

Figure 2. Benefits of a SOC
Source: Vieira, 2022 adapted from Shieldbyte Infosec

As shown in figure 2, a SOC helps to keep sensitive data and systems safe and makes it easier to respond quickly and effectively to any incidents, so by deploying a SOC, organisations can take a proactive approach to cybersecurity instead of waiting for an attack to happen.

3. SECURITY INFORMATION AND EVENT MANAGEMENT

Keeping criminals off networks and protecting data is the essential job of a SOC team. To do so, a SOC team needs a SIEM with the appropriate tools to be able to detect and contain threats, so, SIEM provides organisations with visibility into the activity on their networks so they can detect early and respond quickly to potential cyberattacks and meet compliance requirements.

SIEM is the tool typically used to monitor IT security events, which is a system that aggregates data from various sources, normalizes it, enriches it and sends it to a centralized management console, later used by the SOC team. SIEM is a set of tools and services that combine Security Information Management (SIM), which focuses on collecting and managing logs and other security data, and Security Event Management (SEM), which involves real-time analysis and reporting. SIEM correlates and aggregates event data generated by applications, security devices, data centres, cloud resources and other systems in an organisation's IT ecosystem.

According to Mezmo (2022), "from a user perspective, SIEM is a centralised security information dashboard used to display alerts and suspicious network activity". So, SIEM tools are used within a SOC and use predetermined rules to help security teams analyse network traffic and events, define threats and generate alerts. A SIEM solution helps to demonstrate a pattern of anomalous behaviour by flagging it as a real concern for security analysts to investigate. For example, antivirus software may fail in detecting a recent and as yet unknown type of malware, but a SIEM system, by analysing the bandwidth that machines are using, can generate an event warning if one of them is consuming more resources than it should and alert SOC analysts to look further into the problem.

In the last decade, SIEM technology has evolved to make threat detection and incident response faster and smarter with Artificial Intelligence (AI). Effectively, some SIEM platforms integrate

AI that automates processes and 'learns' from data to improve the detection of suspicious activity. Automatically, these platforms network traffic, prevent access pre-emptively and generate alerts to security analysts to investigate the event even further. In fact, according to Mezmo (2022), "too many false positives from a SIEM create a phenomenon called analyst fatigue or analyst burnout and leaves analysts apathetic to alerts." For this reason, a SIEM solution helps to demonstrate a pattern of anomalous behaviour, flagging it as a real concern for security analysts to investigate and quickly determine the correct steps and procedures that should be followed.

In conclusion, a SIEM's operation allies the log analysis with a comprehensive network security strategy by using a combination of advanced technologies and human resources to detect, contain, respond and remediate a variety of cyber threats. Through mechanisms for monitoring the network and user behaviour, limiting access attempts, monitoring and responding to incidents, SIEM performs log management, automation and correlation of events and uses human experts to respond to potential cyberattacks and mitigate and remediate their consequences.

4. FUTURE RESEARCH DIRECTIONS

Ensuring security levels in an organisational context according to the outlined strategies is an increasing challenge. In this sense, it is considered urgent to explore in detail the circumstances surrounding the definition of alerts through SIEM tools. It is also considered that it will be urgent to establish a set of security metrics to improve the daily operations of the SOC, by strengthening the SIEM system used to monitor and alert security events, improving its alarming capabilities.

5. CONCLUSION

It is advocated that to ensure the security of application systems and infrastructures, the SOC permanently monitors the network and security resources used, detects threats, identifies vulnerabilities and reacts to incidents. Good information security practices should also be a major concern for organisations (ISO/IEC 27002:2022, 2022). On the other hand, once the SOC is certified, it carries out security audits within the scope of ISO 27001:2018 Standard and carries out intrusion exercises for the organisation's network and systems to analyse attack vectors and validate whether there is the monitoring of these vectors, as well as verifying that the SOC's processes are properly implemented to react based on alerts.

It is thus concluded that the SOC is not "just" a blocker but is essentially a service that aims at risk management, demonstrating the existing risk, in the sense of placing the control systems of the most technologically intelligent equipment available in the search for security solutions that can do correlation and alerts in real-time.

Coordinating and unifying an organization's security tools, as well as security incident response and processes, was one of the key benefits of operating or outsourcing a SOC. This centralization usually allows for more timely and rapid detection of threats and a more agile, effective and efficient response. In addition, the existence of a SOC contributes to strengthening the organization's degree of compliance with applicable privacy regulations.

In the current context, teams responsible for ensuring cybersecurity need to monitor many devices, users, applications and, consequently, cybersecurity events related to these elements. The

most used platform to monitor cybersecurity events is the so-called SIEM, which is a system that aggregates all the security information from different sources, standardizing it, enriching it and sending it to a centralized management console. A SIEM, therefore, combines SIM security information management, which focuses on collecting and managing logs and other security data, and SEM which involves real-time analysis and reporting.

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Cybersecurity – Security Operations Center

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Incident response;
Incident control

Abstract: *Currently, most organizations are dependent on Information and Communication Technologies, in the sense of accomplishing their underlying business activities. In this scope, cybersecurity is considered the domain that has the strength to protect sensitive information, be it at the individual level or in an organizational context. The objective of this paper is to introduce the concept, relevance, and functions of a Security Operations Centre. The methodology underlying the study was based on the use of the MITRE Adversarial Tactics, Techniques and Common Knowledge framework as a matrix of tactics and techniques based on real scenario observations. The main results emphasize the importance of incorporating the Security Operations Center as a barrier against cybersecurity threats. Security Operations Center brings additional value to the organizational context, through people, processes and technologies while also using several frameworks to improve work management, incident response and incident control.*

1. INTRODUCTION

Information security is the process that protects information and assets (Falé, 2022). It is considered that (Russo & Reis, 2020) the analysis of risks and vulnerabilities are fundamental in an organizational context as well as the procedures underlying business continuity.

In this regard, the three pillars of cybersecurity with a first known reference dates back to 1977, to a paper entitled Audit and evaluation of computer security by the U.S. Department of Commerce. This model has no author, but even now it focuses (Microsoft, 2022) on Confidentiality - Keeping data secret and ensuring that only authorized people can access your files and accounts; Integrity - Ensuring that information remains intact without data being inserted, modified, or deleted without proper permission; Access/Availability - Ensuring access to information and systems when it is needed.

However, the three pillars previously mentioned characterize only the minimum, the elementary ones; The pillar of Authenticity, linked to basic access mechanisms such as logins, passwords, and tokens, and the pillar of Irretrievability, linked to the authorship of the information provided using digital certificates and digital signatures, should also be included.

SOC potentiates the cybersecurity posture of an organization. It serves as a barrier against cyberattacks and therefore ensures the proper functioning of an organization. SOC must be aligned with the use of ISO/IEC27002:2013, which incorporates a set of good practices and controls that help in information security management (ISO/IEC 27002:2013, 2013). It uses the MITRE ATT&CK framework as a matrix of tactics and techniques based on real scenario observations and NIST as an incident response framework.

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In this sequence of concerns regarding the current good practices emanating from international standards, it is considered that the analysis of the threats and vulnerabilities underlying each organization is of particular interest. Thus, identity theft, extortion, and data loss, among others, should be covered. In this sense, outlining a cybersecurity strategy should be a justified concern by organizations to define the layers of defense corresponding to the various levels necessary for the functioning of the organization. The use of the National Institute of Standards and Technology (NIST) reference framework for the different phases associated with a Cybersecurity Incident Response Cycle can be added value given the specificity of the issue.

According to the report prepared by the National Center for Cybersecurity (CNCS, 2022), which describes that "The dominant cyber threats in Portugal during 2021 were phishing/smishing/vishing, ransomware, online fraud/burglary and account compromise". Phishing/smishing (40% of incidents), social engineering (14%) and malware distribution (13%) were the types of incidents most recorded by CERT.PT in 2021. Thus, analysis, monitoring, and control are considered urgent because of the possible implications in the event of an incident.

2. SECURITY OPERATION CENTER

The Security Operation Center (SOC) is an organizational unit. According to Splunk (2022), the SOC promotes the existence of a centralized function within an organization, involving people, processes, and technology to perform continuous monitoring and improve the organizational posture of security. It aims to predict, detect, analyze, and respond to cybersecurity incidents. That is, the SOC not only identifies threats, but it must also analyze, investigate, respond, report vulnerabilities and plan how to prevent such occurrences from happening again in the future.

The SOC responds to cybersecurity incidents in real-time and in duality seeks to improve the cybersecurity posture of the organization. As a function that focuses on preventing and mitigating cybersecurity risks, the sectors in which it operates are homogeneous. It can play a role in financial markets, industry, government, energy, etc. Most SOCs, adopt a hierarchical approach to incident management, where analysts and engineers are categorized based on experience and skills.

In general, the SOC response to an incident is divided into lines. It has a SOC Manager (L4), Engineers, and incident responders such as level one, level two, and level three SOC analysts (L1, L2, L3). The SOC reports to the CISO, and the CISO to the CIO or CEO. Figure 1 presents the general flow of an incident response, delimited by each analyst level.

So, figure 1 shows a general workflow for responding to a cybersecurity incident, a function performed by the SOC. As the figure indicates, the tasks of the SOC are subdivided by lines, its purpose being to escalate incidents according to the specificity and skills required for its resolution. This workflow is intended to be general and can be adapted to the reality of each organization.

The L1 analyst starts in the triage phase, identifying the incident. If the incident has the profile of an existing playbook, the L1 analyst will proceed to resolve it. If the existence of the playbook is not confirmed, the L1 should escalate the incident to the L2. L2 core functions revolve around investigation, more robust threat and vulnerability knowledge, incident mitigation/containment, and finally documentation, creating playbooks and runbooks. L2 should escalate to L3 when deep, complex analysis is required, determining the origin of threats, whether they pose a threat to the organization and how to stop them. This activity is called Threat Hunting.

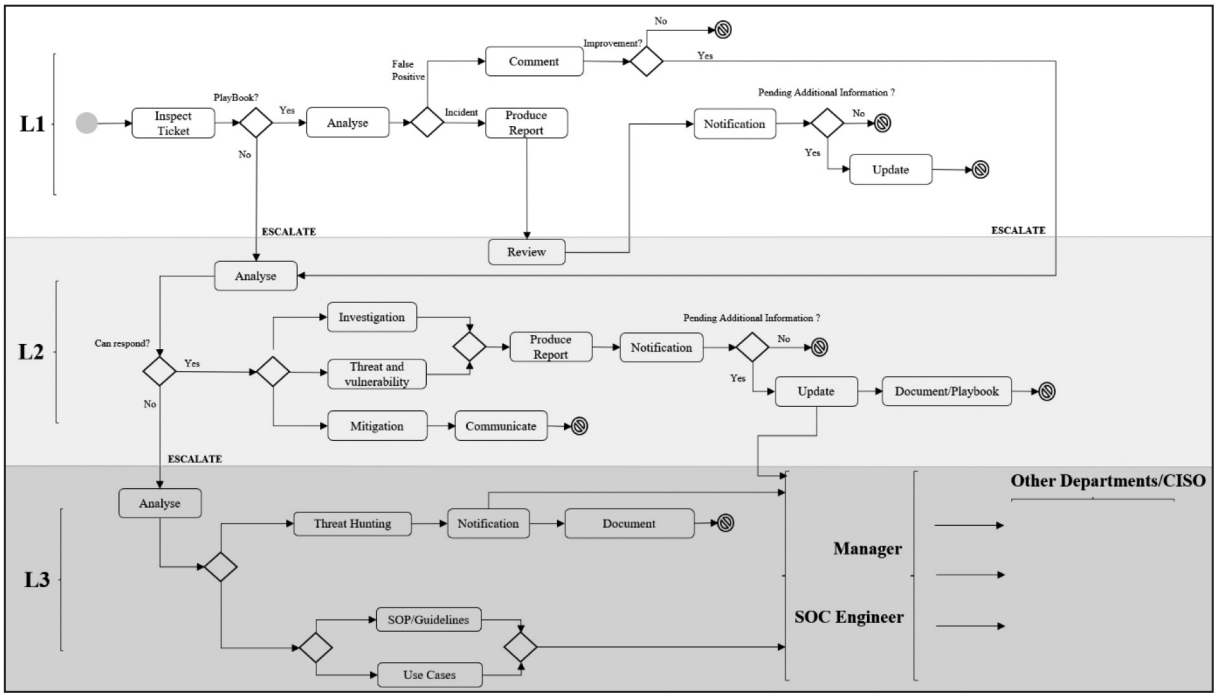

Figure 1. SOC incident response workflow

Source: Falé, 2022.

The SOC engineer has the responsibility of designing managing and maintaining the SOC infrastructure and network. They must work closely with the SOC manager whose function is to manage the day-to-day operations of the SOC team, and the SOC analyst to ensure everything works as intended.

The resolution of the various incidents is embodied in tickets. Tickets contain fields that can be adjusted to classify and categorize them, before their final resolved status. This flexibility allows tickets to be searched and filtered by each specific field. The status of the ticket varies depending on its resolution phase. Figure 2 is designed to show the different states of a ticket.

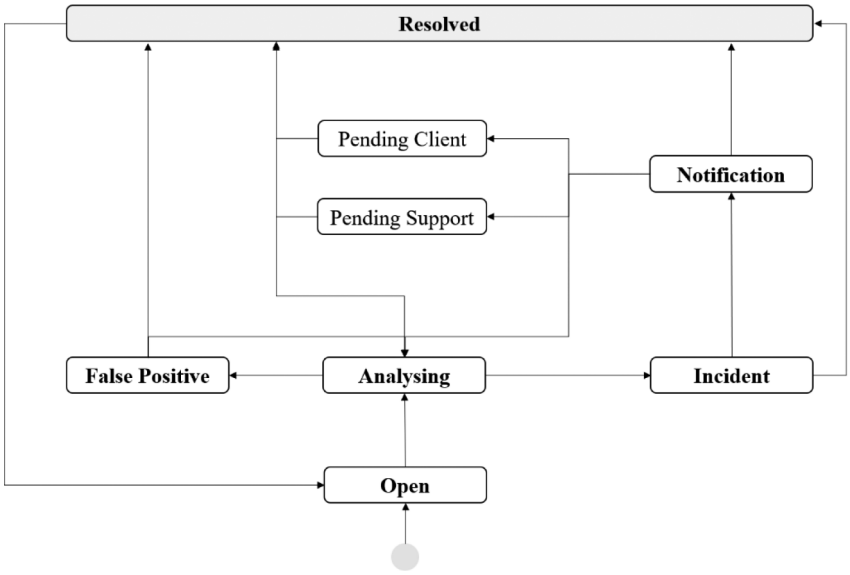

Figure 2. SOC ticket status workflow

Source: Falé, 2022.

We highlight the importance of the ticket management presented in Figure 2 given the criticality of the information handled, and given the specificity of each resolution phase. Figure 2 intends to establish a general workflow of a ticket state. The different ticket core phases derive from two main states: false positive or incident. These two states originate after the ticket starts in the analysis state. The end point of the ticket goes through the internal or external notification state and the resolved state. The workflow also has great flexibility that allows the reiteration of previous phases.

It is considered that a cybersecurity strategy must have layers of defense corresponding to the various levels required for the operation and specificity of the organization. As such, the SOC provides added value to an organization by acting as an external and internal barrier, an extra all-around layer of protection, following the zero-trust policy. Continuous monitoring ensures that threats are detected and resolved in real-time, more efficiently protecting the business, and minimizing the costs and losses of a data breach. Any large enterprise subject to compliance with privacy regulations should consider having a SOC.

From the customer's point of view, the SOC can be not only a protection tool but also an analysis and support tool to define strategies. The SOC through its research and documentation provides visibility to the trends of cyber-attacks and vulnerabilities in systems. Therefore, it contributes to the overall observability of the organization, allowing leadership to make informed decisions, considering cybersecurity. Currently more than ever in organizations, cybersecurity has a guaranteed place in the strategic decision-making of companies/organizations. The cybersecurity strategy must always be aligned with the business strategy and consequently the SOC also.

3. FUTURE RESEARCH DIRECTIONS

It is considered that in the current context, the SOC analyst must keep up to date with the latest trends, news and adversaries' tactics, techniques and procedures. One of the critical success factors of providing a good SOC service is emphasizing the added value in your team, the ability to adapt, and respond with regards to trend analysis, the latest developments and cybersecurity threats to the specificity of the business.

The SOC can add value in terms of monitoring and responding to a diverse set of cybersecurity incidents. We emphasize the importance of the existence of a continuous improvement perspective, to optimize the SOC, either by updating detection and prevention rules, establishing procedures and protocols, or adjusting measures and expectations with customers.

4. CONCLUSION

The area of cybersecurity is in an emerging position, with exponential growth (Cisco, 2022). This is not surprising, considering that the transition to digital, requires this information to be kept secure. Increasingly, organizations are taking the cost related to cybersecurity as essential. According to Morgan (2021) the "U.S. Bureau of Labor Statistics projects" identifies that the information security analyst position will be the 10th fastest growing occupation in employment growth, with a growth percentage of 31%, with the average growth rate of all occupations being 4%. In the cybersecurity field, over the past 8 years, the number of unfilled job openings has grown by 350%.

According to (IBM, 2022), and in summary form, the countermeasures must ensure the following topics: Critical infrastructure security - Protection of systems, networks and other assets;

Network security - Cable and Wi-Fi; application security - Use of data, authentication, permissions and other; Cloud security - confidential computing, encryption of data stored, in transfer and during processing; Information security - Data protection measures and compliance with standards and regulations such as RGPD; User education - Awareness and training of the organization's employees in order to strengthen end-point security; Continuity planning and disaster recovery - Tools and procedures for response and unplanned events; Storage security - Encryption, isolated data copies; Mobile security - Security of apps, mail, etc.

In Portugal, it is possible to identify that partnerships and cooperation between entities on the subject of cybersecurity have recently corroborated and strengthened the national space. However, with the ending of the National Strategic Plan for Cyberspace Security (ENSC) in 2023 and given the recent developments such as the pandemic, telework and division between East and West, the ENSC should be strengthened in its greater esteem post-2023.

Another relevant problem in this context is to link this set of concerns to the domains of sustainability given the context of innovation often underlying the issue under study (Reis, et al., 2021).

SOC is a centralized function inside of an organization, involving people, processes, and technology to continuously and better monitor the organizational security posture. It aims to prevent, detect, analyze, and respond to cybersecurity incidents. We also highlight the importance of all cybersecurity solutions. These solutions are necessary for the protection of information, which in turn protects the organization altogether, meaning its people, clients, processes, products and services.

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An Approach to Improving Network Security Using Log Analysis

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Log messages;
Troubleshooting;
Malicious activities.

Abstract: *Troubleshooting is the process of detecting, identifying and resolving problems within a computer network by means of specific methods, tools and operations. Troubleshooting implies following a set of procedures or steps that conform to the security standards and policies of a company. Diagnosing the source of a problem can be done by tools for system monitoring, recording log messages, manual testing of device configuration, as well as by tools for device operation analysis. The procedure for using log messages to resolve both common problems and those caused by attacks is explained in this paper. Furthermore, this paper describes the way security threat management systems use the contents of log messages to analyze hardware problems and malicious activities.*

1. INTRODUCTION

It is almost impossible to imagine any segment of our lives without computer networks. There are different realizations of a properly designed and configured computer network. Generally, all networks can be defined by their hardware, software and network protocols which enable both proper communication in a computer network and the use of numerous applications. Since the appearance of the first computer networks, the way of communication and the functioning of the networks themselves have been changed and adapted several times to current trends, i.e. demands and standards of large corporations. In the beginning, there were several manufacturers of hardware equipment for computer networks and each of them developed its standards and protocols for communication. Over time, all components of computer networks, protocols and hardware have been significantly improved. Today, there is a large number of new network devices, routers and switches of newer generations, firewall devices, WiFi routers, etc. (Panek, 2020)

Once a computer network is set up, there are numerous challenges and issues that IT staff can encounter. With the realization of modern complex computer networks, the risk of network problems increases, either as a result of bad connectors and/or damaged cables at the physical level, wrong device configuration or as a result of threats and attacks on the computer network (Simpson et al., 2011).

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Challenges and problems in a computer network can be divided into those that occur due to various situations that do not depend on people:

a. Power cut - unplanned works, power supply failure, a blown fuse;
b. Natural disasters - fires and earthquakes;
c. Device overload – too high level of received voltage;
d. Component failure – hardware components with a manufacturing defect.

On the other hand, computer network problems can be caused by human error:

a. Configuration errors – misconfiguration, wrong IP address, deleted configurations;
b. Targeted attacks and network failures - Zero-day, viruses and trojans, phishing, DDoS;
c. Poor planning and improper project implementation - poor assessment of requirements and inadequate analysis of the necessary resources for flawless network operation.

The consequences can be almost imperceptible, with minimal packet loss, but in some cases, the mere functioning of a computer network can be affected. In order to detect errors or in the network as well as potential attacks, it is necessary to continuously analyze network traffic by observing the content of log messages (Ranjbar, 2015). Quick and accurate detection of problems implies taking adequate countermeasures to eliminate them. The main steps in the problem solving procedure will be explained in this paper.

2. COMPUTER NETWORK TROUBLESHOOTING PROCEDURE

Troubleshooting is a process of solving problems. When IT staff troubleshoot problems, they use specific methods and operations to detect the cause of a problem and eliminate it. Troubleshooting consists of a series of steps and procedures in accordance with the standards and policies of a company or an organization (Ranjbar, 2015). It includes certain tools for system monitoring, log messages, testing of devices and system and analyzing. There are several steps in a troubleshooting process, as shown in Figure 1:

1. First, it is necessary to diagnose a problem after the monitoring system notifies a problem on specific devices or in the application;
2. Then, relevant information about the problem should be gathered. It is important to detect which device is affected, if there are one or more affected devices, when the problem occurred, if the problem occurred for the first time, etc.;
3. After that, the cause of the problem should be identified and a plan to solve the problem defined;
4. Next, solutions should be implemented and processes repeated and changed if necessary;
5. Finally, the entire troubleshooting process should be documented.

The entire communication between two devices is realized thanks to a large number of protocols that are defined within the layers of the OSI model, i.e. the TCP/IP stack of protocols (Ranjbar, 2015). Errors and problems that arise in the computer network are also observed through these reference models. Cabling problems often occur at the physical layer. It is not unusual to use inadequate types or damaged cables. The connectors on the cables themselves may be poorly connected. Hardware problems might occur as well.

Components can fail due to poor quality, maintenance, or long-term load. At the connection layer, the second layer of the OSI model, the most common problems are: mismatched speed and/or duplex settings on the switch port itself, incorrect Spanning Tree Protocol settings, problems

related to ARP attacks and MAC Spoofing or DHCP Spoofing (Ranjbar, 2015). At the network layer, potential problems could be duplicate IP addresses and misrouting due to misconfiguration of routing protocols or implementation of static routes. At the transport layer where TCP/UDP ports are used, there are frequent problems related to disabling the transfer of certain data due to ACL lists or activated policies on the firewall. At the other layers (session, presentation and application layer), most problems are connected with the applications or specific protocols. Since there is a large number of protocols at OSI or TCP/IP layers, this can be the cause of many problems. Server configuration problems (Apache, Nginx...) might occur as well.

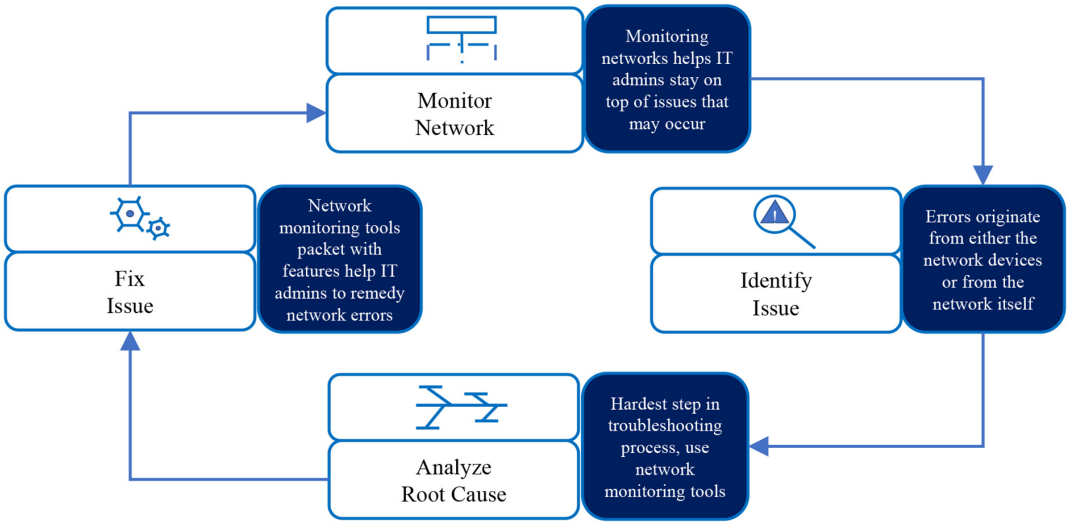


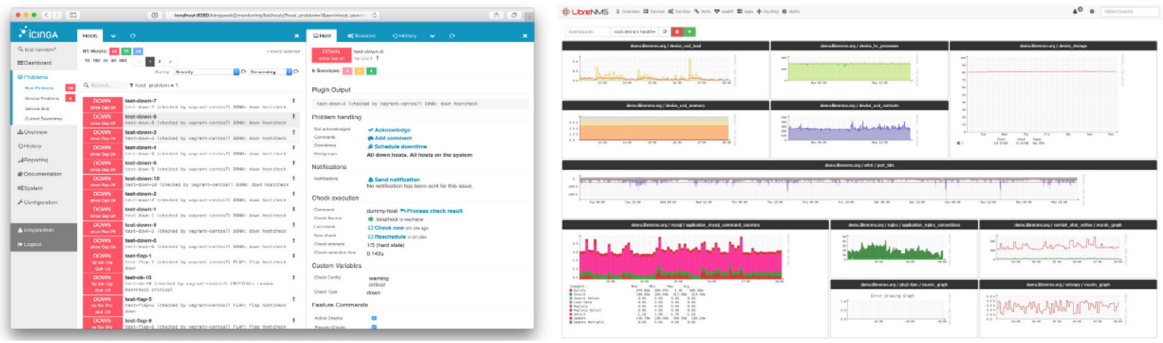
Figure 1. The main steps in network monitoring and troubleshooting

3. SYSTEM MONITORING AND LOG MESSAGES

Collecting information about the overall operation of the computer network in the form of log messages is one of the most important steps in the entire process of solving problems and locating errors. All available information about the cause of the problem and its consequences is collected. The obtained information is then analyzed. Based on the analyzed data, further preparation for the following steps is carried out in order to eliminate the located problems. The accuracy of information gathered from log messages is of crucial importance (Jing et al., 2015).

The network monitoring step can include many sub-steps, tools, systems or software, and the ways and methods of gathering information depend on the environment. There are several ways to gather relevant information about a network's behavior. It might be through a monitoring system – which consists of one or more programs that perform different operations like monitoring, information gathering, notifying administrators, etc.

The information can refer to the use of the server memory and load of its processor, device availability or problems with TLS certificates. Such information is most often "extracted" from the devices themselves, mostly using the SNMP protocol. With the SNMP protocol, some other basic and more advanced information can also be obtained, such as the device name, IP address, VRF, QoS, port information on the switch, etc. Examples of such monitoring systems are IcingaWeb2, LibreNMS and Grafana. Then, relevant information about a network behavior might be gathered via data collection agents – i.e. software/applications installed on end devices that collect and forward log messages to the central log message management system.



A) B)

Figure 2. Display of the interface of different monitoring tools: A) Web interface of the IcingaWeb2 monitoring tool (source: https://icinga.com); B) Web interface of the LibreNMS monitoring tool (source: https://alternativeto.net/software/librenms)

Agents are configured to check specific log files (which are often in plain text document format) and forward them to the central system. It is possible to indicate exactly which type of log messages needs to be collected. It is not necessary to collect all log messages since they can occupy additional memory space. Information can also be gathered by log message management systems – the central system where log messages are collected, normalized and analyzed.

Log messages are special texts recorded and stored in log files. Log analysis is a process of analyzing and extracting information from log messages. There are several types of log messages depending on the type of event being recorded: system, network, technical or security ones (Vaarandi et al., 2018). Optimization of log messages is considered to be the essential procedure since it is necessary to know which type of log messages will be collected, monitored and analyzed. A piece of the log information is forwarded to centralized log systems directly or through various log message transmission mechanisms, while other information is obtained from the operating system as part of the overall log message generation process. Log messages are written in log files and these files can be generated by the system or applications, or generated by the administrator (Vaarandi et al., 2018). By default, log messages use UDP port 514 for communication, while the default port for TCP protocol is 6514. It is possible to use other ports for the transmission of log messages. Log analysis takes place during the process of searching log messages and looking for specific information, but it also takes place when examining a specific incident that occurred due to a network failure.

Log messages can be divided into the following main groups: System log messages (Activities in the system, End devices, Applications), Network log messages (Email, Firewall, VPN), Technical log messages (Proxy, DNS, HTTP, DHCP, Web and SQL), Security log messages (Antivirus, Network intrusion detection system – NIDS, Host intrusion detection system - HIDS, Data loss protection - DLP). Additionally, log messages may be divided according to the severity level indicated by the content of a log message. A log message can be informative as well as displayed as a warning or an error in an application or a system. The severity level of a log message ranges from 0 to 7 with the lower the level, the greater the severity (Suh-Lee et al., 2016).

4. CENTRALIZED SYSTEMS FOR MONITORING LOG MESSAGES

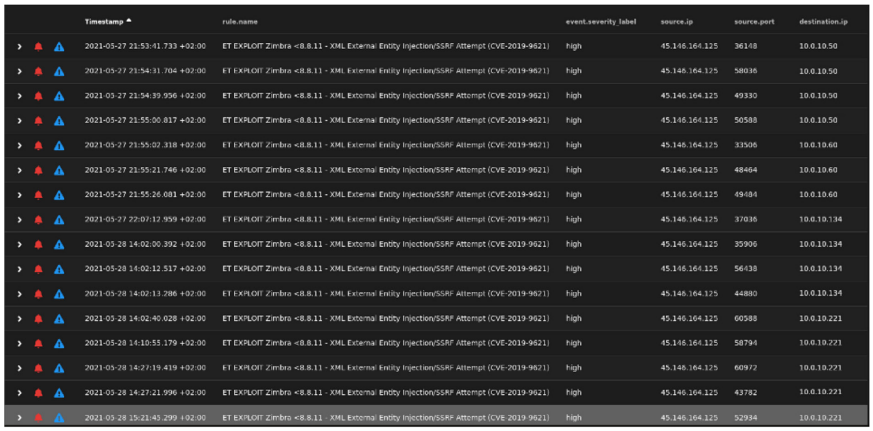
The system for monitoring and analyzing events in the network consists of agents for collecting log messages and the system for managing log messages, as explained above.

Security Information and Event Management (SIEM) is a system for managing security information and events. SIEM represents a centralized system for collecting regular and security log messages. It provides different types of notifications and warnings, uses special algorithms (AI and ML) for analyzing data and has possibilities for isolating malicious packets and analyzing packet capture files. This system processes data in real time and data can include almost any type of log messages, whether it is data from routers, switches, mobile phones, or applications (Bhatt, 2014).

The features of a SIEM system are identical to a log message management system, except that they mainly focus on security and (mostly) malicious activities. Activities can range from simple ping packets coming from the Internet to compromised services such as FTP, web servers, third-party applications, etc. In the SIEM architecture, there are agents for collecting log messages which send captured messages to the main center for processing and analysis. Further analysis is performed, data are compared, their correlation is performed, data groups are formed and activity alerts are created based on the extracted data. Different SIEM solutions depend primarily on the manufacturer, but all of those solutions include the following functions: data aggregation, threat intelligence, correlation and security monitoring, alert analytics, forensics, threat detection, incident response and Security Operations Center (SOC) automation (Bhatt, 2014). Every security engineer in a Security Analysis Center (SOC) should have insight into network activity, the way of communication between devices and its duration and the type of exchanged data, and know the standard procedure if any problems occur.

5. CASE STUDY

In this chapter, an example of potential threats and malicious activities in the network will be presented using the methods of analyzing and collecting data through the Security Onion platform using SIEM. Specifically, malicious activity in Security Onion was analyzed when an alarm „`ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621`" with the severity level *HIGH* was detected.



	Timestamp	rule.name	event.severity_label	source.ip	source.port	destination.ip
›	2021-05-27 21:53:41.733 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	36148	10.0.10.50
›	2021-05-27 21:54:31.704 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	58036	10.0.10.50
›	2021-05-27 21:54:39.996 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	49330	10.0.10.50
›	2021-05-27 21:55:00.817 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	50588	10.0.10.50
›	2021-05-27 21:55:07.318 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	33506	10.0.10.60
›	2021-05-27 21:55:21.746 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	48464	10.0.10.60
›	2021-05-27 21:55:26.081 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	49484	10.0.10.60
›	2021-05-27 22:07:12.959 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	37036	10.0.10.134
›	2021-05-28 14:02:00.392 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	35906	10.0.10.134
›	2021-05-28 14:02:12.517 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	56438	10.0.10.134
›	2021-05-28 14:02:13.286 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	44880	10.0.10.134
›	2021-05-28 14:02:40.028 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	60588	10.0.10.221
›	2021-05-28 14:10:55.179 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	58794	10.0.10.221
›	2021-05-28 14:27:19.419 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	60972	10.0.10.221
›	2021-05-28 14:27:21.996 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	43782	10.0.10.221
›	2021-05-28 15:21:45.299 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)	high	45.146.164.125	52934	10.0.10.221

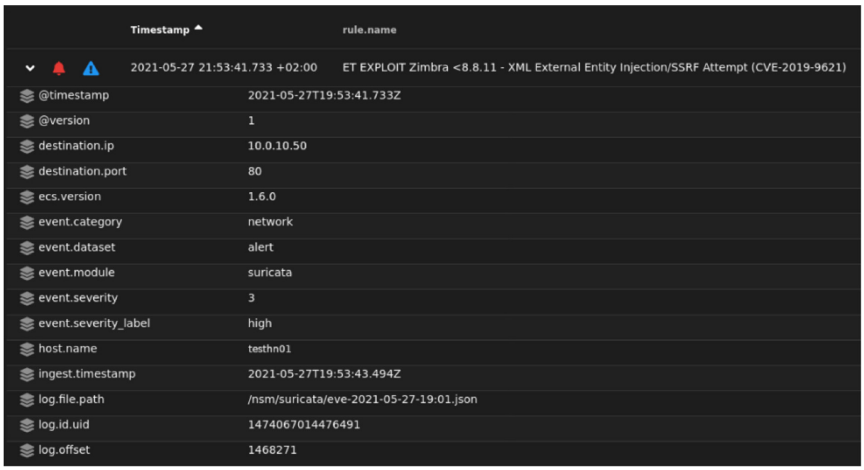
Figure 3. Security Onion Threat Alerts

The first step is to isolate the alarm and display only the alarm related to this malicious activity. As can be seen in Figure 3, all potential attacks came from the same IP address, while multiple IP addresses were targeted. In-depth analysis of the alarm message reveals detailed information about the target destination port, the type of event, the NIDS (Network intrusion detection system) which detected the attack, etc. First, a review of the local network should be done.

After research and other alarms, it is evident that only HTTP port 80 was targeted during the attack, as shown in Figure 4, which means that the attacker was targeting potential web servers.

Another important piece of information is the decoded packet which indicates that the POST header with the URL /Autodiscover/Autodiscover.xml link was sent to 10.0.10.50, and that the XML file tried to capture the /etc/passwd file, which is a file on Linux operating system that contains usernames, groups they belong to and similar essential information.

The threat was identified by the public CVE number 2021-2109, which can easily be searched and researched to learn more about this type of attack and methods of protection.



Timestamp	rule.name
2021-05-27 21:53:41.733 +02:00	ET EXPLOIT Zimbra <8.8.11 - XML External Entity Injection/SSRF Attempt (CVE-2019-9621)
@timestamp	2021-05-27T19:53:41.733Z
@version	1
destination.ip	10.0.10.50
destination.port	80
ecs.version	1.6.0
event.category	network
event.dataset	alert
event.module	suricata
event.severity	3
event.severity_label	high
host.name	testhn01
ingest.timestamp	2021-05-27T19:53:43.494Z
log.file.path	/nsm/suricata/eve-2021-05-27-19:01.json
log.id.uid	1474067014476491
log.offset	1468271

Figure 4. Detailed display of malicious activity alerts

After gathering some information about the attacker, the next step is to check if additional methods of intrusion were attempted from the same address. Thus, the sequence of movements and activities can be viewed chronologically. It can be determined where the attack started from, as well as when it happened. In this particular case, the first alarms were more informational and attempt to access non-existent web server pages were detected. This type of attack is mostly done with automated tools and scripts, so many alarms often appear, because it is a brute forcing technique in a way. After that, an attempt to establish sessions and communication from the target machine to the attacker was observed. And finally, there are attempts to exploit web server vulnerabilities. Further steps include the analysis of the web server itself, logs, data and scan for vulnerabilities and malicious files in order to determine whether there really was a breach, that is, whether the communication between the attacker and the target device was successful.

6. CONCLUSION

Collecting information in the form of recording and reading log messages is definitely the most important step in the entire problem solving process, and the accuracy of the information collected from log messages is of crucial importance.

Analyzing log messages directly from applications or text files is almost never done. For this purpose, log message management systems were created, as central points to which log messages are sent using log message collection agents. On these central systems, data is collected, the normalization process is carried out, and they are parsed and displayed in a readable

format for further analysis. In accordance with the company's policies and legal regulations (e.g. GDPR), the data is stored for a certain period and after the expiration of the period, the data must be deleted.

Then, standard systems for managing log messages are not adequate and SIEM solutions (such as Security Onion) are used since they include more advanced tools for detection (and rarely prevention) of malicious activities. Such solutions have numerous integrated tools and specific agents for collecting not only log messages but also network traffic (packets), as well as metadata and system registry files. HIDS and NIDS solutions perform additional analysis and scanning of files on devices and send data to the central server for further analysis. SIEM are mandatory components of a computer network for monitoring events as well as recording and analyzing log messages. Detailed plans and strategies are needed for data storage and backup. Continuous monitoring of the system is crucial. Finally, it is essential to stay up-to-date with the latest trends and threats to network security in order to improve SIEM solutions.

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Payment Security Issues and User Data in Online Commerce

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Keywords:
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User;
Security;
Payment;
Data

Abstract: *In recent years, there has been increased development of information and telecommunication technologies, which have a significant impact on the economic and social sphere on a global scale and, in particular, at the national level. In parallel, there are many challenges to the integration and use of digital technologies and the resulting issues of payment and data security in online commerce.*

This research is dedicated to revealing the nature of data privacy, the relationship between the regulator, consumers and retailers, and presenting the features of payment and data security in online commerce.

1. INTRODUCTION

Dynamic changes in the global aspect of the economy and changes in consumer tastes and preferences are only part of the factors for the creation and integration of new modern technologies. However, their implementation is a prerequisite for solving many specific problems, in particular the problems related to data security and payments in online commerce.

To examine the security of payments in online retail, we should first specify the role of data privacy. From there, let's emphasize the connection between this privacy and the security of payments specifically in online retail.

The purpose of the report is to highlight the security issues of payments and user data in online commerce.

2. DATA PRIVACY IN RETAIL

The study of data privacy in online retailing is closely related to the interrelationship between consumers, retailers, and law enforcement. In the conditions of digitization and technological improvement, they are undergoing significant transformations and, in parallel, they must manage to ensure the privacy of their data and improve the analysis of this data.

Retailers themselves process a large amount of data and many studies prove that they are always ready to increase their spending on new technologies and their personalization to track individual consumers and their location, recognize their faces, track their emotions and encode voices.

This leads to major problems in terms of the feeling of vulnerability on the part of the users (Martin et al., 2017).

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It is precisely this sense of vulnerability that is particularly important in conditions of challenges of a different economic and social nature (Brough & Martin, 2021).

Stakeholders and their interests in data privacy can be an essential part of big databases and privacy, creating both notable risks and threats to privacy and, in parallel, great potential for retailers.

Stakeholders themselves are looking for various ways to protect and expand user privacy, but these actions are entirely based on cooperation between them rather than contradictions and conflicts.

Researcher Martin and colleagues identify three emerging themes that are channeling collaboration and the increasing convergence between consumers, retailers and regulators regarding the collection and use of consumer data in retail. Primarily, these researchers justify the role of big data as a driver of customer relationships and customer performance because, according to them, it improves customer perceptions.

Next, they highlight the profound impact of regulation in shaping consumer-retailer interactions.

Third, but not least, they advance the idea of the potential of privacy protection as a proactive retail strategy that can provide an innovative source of competitive advantage to retailers.

All these studies and ideas are supported by quantitative and qualitative methods (Martin et al, 2017).

The conclusions reached by the researchers are that the regulatory body shapes the interaction between the consumer and the retailer. On the other hand, retailers must adhere to privacy regulations in dealing with consumers.

Next, they reach many conclusions that relate to the global perspective on data privacy. It is strongly emphasized that most studies focus on a single country or a specific company, depending on the empirical data. In parallel, privacy perspectives are determined by a country's culture, so the views of consumers, regulators and retailers on data privacy are inevitably influenced by their cultural country.

Furthermore, the cross-country and company emphasis is on demonstrating the specific case studies of retailers or regulatory approaches to data privacy and consumer response, which also establishes some frameworks for key tensions in global privacy perspectives to inform retail marketers to expand market share.

The term "privacy" itself is largely applied in specific contexts to consumers and regulators. Through the lens of the issue research, three themes emerged that involved consumers, regulators and retailers.

Researchers in this scientific field are proving that for users, large databases support increasing personalization. Bleier and Eisenbeis prove that online personalized ads improve click-throughs, especially in the early stages of purchasing decisions, but this over-personalization is only possible if customer preferences are volatile or change over time (Bleier & Eisenbeiss, 2015).

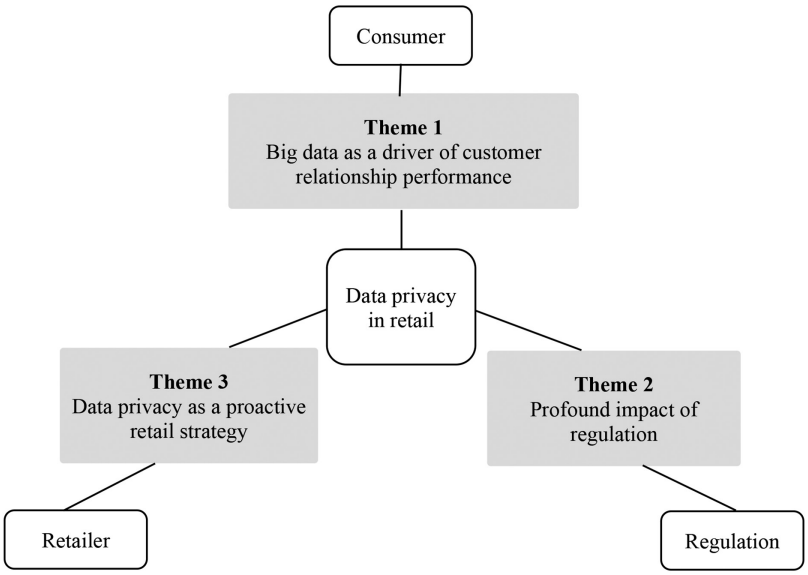

Figure 1

Source: Martin et al., 2017.

Another point of view is given by researchers Chung et al. (2016) who focus in their studies on adaptive personalization using social networks, or Tirunillai and Tellis on online communications and brand positioning (2014).

The very interaction between users and retailers depends on privacy rules. Such privacy policies can be a good proxy for the degree of transparency and control that businesses provide to their customers by notifying them then that they are providing this information (Martin et al., 2017). Along with this, stricter privacy policies can reduce the effect of the negative sides that are caused by a breach of data security, which is caused by competitors (Martin et al., 2018).

Given the purpose of the article, the security of payments in online commerce should also be analyzed.

3. SECURITY OF PAYMENTS IN ONLINE COMMERCE

In general, the targets of hacker attacks and theft of personal information and banking data are different: from the local supermarket to online shopping and providing personal data. Many companies and individuals believe that if they have antivirus software purchased and installed, they are sufficiently protected. In reality, this is not the case at all. Antivirus software is only one possible side of this problem and addresses only one threat or only one possible approach to information theft and destruction. For complete information security, additional actions of active and proactive protection are required.

When a means of payment is created, the responsibility for its protection is most often guaranteed by the one who issues it, but gradually, and especially these days, the commitment to maintaining security becomes shared and includes the entire set of participants in the payment process. Thus, in addition to the operator of the payment system, all bound users of the payment system can join the mechanism of countermeasures against attempts at malicious actions and better protection.

The problems related to the protection against fraud in electronic payments in online commerce are increasing. It is an indisputable fact that the evolution of payment systems and the technological

innovations that accompany them are the basis of the improved conditions for commercial exchange and its migration to a digital environment. A new step in the present and in the functioning of online commerce is the use of artificial intelligence, which allows positives to be drawn also in terms of protection against sales fraud. In fact, its integration enables real-time intelligent and automated analytical systems to monitor user activity and implement corrective actions if new and unknown schemes of abuse in commerce and payments are detected.

No less important are three important problems of public information about the real dimensions of crime in electronic payments in commerce. The first is related to the fact that a significant part of the frauds committed in digital payments remains unreported or unregistered by the victims. The second is that the proportion of fraud is sometimes left out of official reporting because the contingently unrealized pecuniary damage is significant. The third problem is related to the evolution of organized crime, which is outpacing the development of defense systems. A prerequisite for this is mainly the limited resource provision for the implementation of various improvements. This would help us summarize that the new reality requires alternative methods of countermeasures and security, leading to the emergence of a new class of electronic services related to the protection of information in digital payments (Stoyanov, 2019).

4. CONCLUSION

In conclusion, to achieve consumer satisfaction and to keep all stakeholders in online commerce satisfied, the security of payments and consumer data is paramount. However, this process is two-way and efforts should be made on both sides – companies and consumers. Only the future will tell what level of security will be required in online commerce and who, how and in what manner will process user data both globally and nationally.

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Impact of Risk Management in an Organizational Context

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Cybersecurity

Abstract: *In Portugal, the Council's Minister Resolution 41/2018, presents a complement to the General Data Protection Regulation (GDPR), which, in order to comply with it, defines technical guidelines for the Public Administration concerning the security architecture of networks and information systems. The objective of the paper is to present risk management in an organizational context. The adopted methodology is focused on the presentation of the research and obligations that the organizations have to take into account before the law and the regulatory authorities. International standards and how they can be applied in the context of the organization under study were analyzed, and the main results reached, aim to raise awareness within the organizations assertively, for the existing vulnerabilities and threats. Risk management was based on asset management and professional experience acquired over the years, as well as knowledge of internal procedures.*

1. INTRODUCTION

The Decree-Law 65/2021 applies to operators of critical infrastructure; operators of essential services and Public Administration entities, such as the organization under study, and defines the security requirements of network and information systems as well as the rules for incident notification. According to article 10º of Decree-Law 65/2021, entities that fall within the cited groups must consider all assets that ensure the functioning of the Information Systems and should carry out, at least once a year, an analysis of the risks associated with them.

Organizations have lately been targets of attacks, namely cyberattacks. This shows that there is a need, on the organization's part, to take action to avoid constraints on their operations. Therefore, it is preponderant that there is an understanding of the problem and finding ways to protect the organization and its assets (Santos, 2022).

All organizations must have security measures implemented; some of them imposed by legislation and others imposed internally, by knowledge of the cause and the need for protection. Security measures, especially legislated ones, may vary depending on the business area of the organization.

In that sense, this risk analysis should consider the Identification of threats; System failures; Natural phenomena; Human error; Malicious attacks; Failure to provide goods or services by a third party; Impact and probability of occurrence of the identified threats.

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2. RISK MANAGEMENT

According to the International Organization for Standardization (ISO), the norm aims to create standards for various activities of the organizations. ISO/IEC 27001:2018 enables organizations to implement an Information Security Management System (ISMS) through requirements suggested by the standard. The ISMS together with a risk management process increases the trust of stakeholders while preserving the confidentiality, integrity, and availability of information (ISO/IEC 27001, 2018).

Also, the norm ISO/IEC 27002:2022 - Information security, cybersecurity, and privacy protection - Information security controls, provides a set of generic controls in an ISMS scope, (ISO/IEC 27002, 2022). According to ISMS.ONLINE (2022) and compared to the previous version, it has a smaller number of controls, which are divided into four groups: People, Organization, Technology and Physical. The latest version of ISO considers compliance with regulations such as GDPR.

Supported by ISO/IEC 27001:2018 and ISO/IEC 27002:2013, ISO/IEC 27005:2018 was created to sustain an information security risk management platform, (ISO/IEC 27005, 2018). In this sense, ISO 31000:2018 also provides generic guidelines and a framework for risk management in organizations, independently of its sector. This standard aims to help organizations to identify opportunities, threats and how to treat risks. ISO 31000:2018 provides guidance for audit processes, whether internal or external. According to norm ISO 31000:2018, risk management must be considered in decision-making processes, as well as in all other organizational processes.

Risk criteria can be defined based on the internal and external contexts of the organization, such as the rules and existing laws. ISO 55000:2014 can be applied to all assets of an organization and all organizations, regardless of their nature. The guidelines of (ISO 55000, 2014) provide an overview of asset management.

Portuguese Public Institution, the Câmara Municipal do Barreiro (CMB), is responsible for the management of the municipality of Barreiro and provides services to citizens in the areas of spatial planning, social action, housing, transport and communications, energy, environment and basic sanitation, health, education, sports, consumer protection, civil protection, culture, and heritage.

The risk treatment will be defined based on the strategies: avoid, assume, remove, probability, consequence, share and retain defined in ISO 31000:2018, which are added the strategies of mitigating or transferring the risk referred to in the Quadro Nacional de Referência para a Cibersegurança (QNRCS) of Centro Nacional de Cibersegurança (CNCS), as described in Table 1.

Table 1. presents the strategies that can be followed in the process of treating the risk, as well as a brief description of each and what its source is. The responsible for the treatment of the risk should define the best strategy to be followed, considering all the various variables influencing it.

In the study conducted in an organizational context, 16 risks were identified in Table 2. Risk 03 is presented as it is considered that in the context of the paper, it can constitute added value. Risk 03 was identified by the fact that the Local Area Network (LAN) consists of nine /16 subnets, allowing 64516 hosts per subnet, making a total of 580644 hosts on the LAN. The LAN is

oversized, allowing too many hosts considering the CMB needs, which leaves a wide spectrum of Internet Protocols (IP) available, that can be used by intruders and given the size of the networks it becomes difficult to detect these intrusions.

Table 1. Risk treatment

Strategy	Description	Source
Avoid	Avoid the risk when deciding not to start or continue with the activity that origins the risk.	ISO 31000:2018 CNCS-QNRCS
Assume	Take on or increase the risk to pursue an opportunity	ISO 31000:2018 CNCS-QNRCS
Remove	Remove the source of risk	ISO 31000:2018
Probability	Change the odds	ISO 31000:2018
Consequence	Changing the consequences	ISO 31000:2018
Share	Share risk (e.g., through contracts, insurance purchases)	ISO 31000:2018
Retain	Retain risk by reasoned decision	ISO 31000:2018
Mitigating	Reduce the impact or likelihood of risk	CNCS-QNRCS
Transferring	Transfer impact to third parties	CNCS-QNRCS

Source: Santos, 2022.

Table 2. Possibility to connect external devices to the organization on the network

#03 – Possibility to connect external devices to the organization on the network	
Assets	Network
Responsible	GINT
Threat	Unauthorized access; Intrusion; Cyberespionage
Vulnerability	Insecure network architecture
Confidentiality	Yes
Integrity	Yes
Availability	Yes
Probability	3 - Average
Impact	5 – Very High
Risk Level	15
Treatment	Avoid
Action	Scale the LAN to CMB needs; Implement security by MAC Address
Responsible for the treatment	GINT
Cost	No

Source: Santos, 2022.

The impact defined as very high derives from the threats set into question the 3 principles of the triad of security, availability, integrity, and confidentiality. Given that connection of some non-CMB equipment has already been recorded in the internal network, it is understood that the probability of this happening is medium. This risk can be avoided by implementing security mechanisms, which validate the MAC address of equipment that is attempting to connect to the LAN and resizing the LAN to a subnet where the allowed IPs are adjusted to the real needs of the CMB.

It can be verified in Figure. 1 that 50% of the identified risks have a high impact and 19% of those are considered Very High impact. These levels of impact require action, as the result of their occurrence may be catastrophic.

It can also be verified that 31% of the remaining risks are of lower impact. The risk impact analysis is important, but its treatment must consider other variables, such as the probability of its occurrence, the activities in question, and the threats to which they are subject.

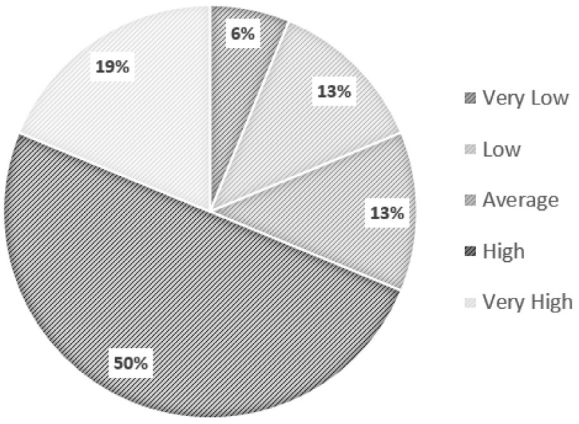

Figure 1. Risk Impact
Source: Santos, 2022.

The risks identified in this study were classified as well as analyzed to their impact on the organization. It was possible to conclude that some of these risks should be mitigated by finding solutions that can minimize the impact of their occurrence. Considering the specificity of the public organization under study, it was also verified that other risks should be assumed, and the risks that should be transferred to third parties were also identified.

3. FUTURE RESEARCH DIRECTIONS

The latest studies show us that vulnerability exploitation activities tend to increase in quantity, as well as should be increasingly sophisticated, and their impacts may have catastrophic consequences. As such, it is necessary to view Information Security Management as a continuing activity. In order to ensure high levels of security, it is necessary to define the steps to be taken in each process, which implies internal changes, such as transfers of employees, equipment, shared folders, or factors such as hiring employees and acquiring equipment.

These steps should include a detailed identification and analysis of each of these assets to identify which risks are associated with them and thus define how they should be treated. Risk mitigation can be facilitated by creating an internal security policy, based on ISO/IEC 27002:2022 controls and the recommendations of the Ministry Council Resolution 41/2018. The policy should be in place for the needs of the CMB, given that we are dealing with a public administration organization, with all its specificities.

4. CONCLUSION

The digital world and its benefits should continue to evolve, just as the threats will arise on a larger scale and in an increasingly elaborate way. It is necessary to monitor threats from all stakeholders, from security professionals to all other employees. There is a whole of laws in the sphere of information security and cybersecurity with which public administration organizations are not exempt from complying with them.

The compliance plan with these laws can be supported by the guidelines of the ISO standards studied and the QNRC of CNCS and can be adapted to real needs. Considering known threats, it is necessary to define strategies and act preventively before them. This means a deep knowledge of the organization, its processes, its assets, and its objectives.

In the definition of these strategies, it is essential to understand the impact of their implementation, because the sustainability of organizations may depend on the balance between the lack of investment in security mechanisms and how easily the organization can fall into the temptation to create rules in such a restricted way that makes it impossible to perform regular, daily tasks.

Risk management should be properly supported, and should indicate how those who have the task of making decisions about their treatment should act and manage it. However, in some cases, there is a need for critical analysis, and it may be necessary to put into practice the experience and know-how of the team, and the perception that it has about the organization and its functioning. Therefore, in conclusion, there is no exact way to perform the management of security information, it will always depend on the context in which it is inserted and who is treating and managing it.

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The Potential for Sustainable Tourism Development and Branding. Analysis of Krushevo and Elbasan Destinations

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Abstract: *UNWTO forecasted that international arrivals or outbound travelers worldwide will reach up to 1.8 billion by 2030, thus securing tourism as one of the fastest-growing economic activities fostering overall development, introducing new investments, and generating income and new employment. Tourism's overall impact on a nation also influences the local economy although it is quite challenging to measure this impact and its dimension. Over the last few years, tourism in Albania and North Macedonia has had ups and downs considering the Covid-19 pandemic situation which also determined the importance of sustainable tourism development and its influence in the tourism sector. The study provides a framework analysis of Krushevo and Elbasan as a single thematic tourism destination by using primary and secondary data and reveals evidence-based recommendations for local and national policymakers to design innovative tourism programs in these cities. The findings show that Krushevo and Elbasan have similarities mostly in the category of access points, attractions, and amenities and variations in the type and quality of the activities offered.*

1. INTRODUCTION

Tourism is considered one of the most profitable sectors in the economy. It plays an increasingly significant role in Albania's and North Macedonia's economies. The paper elaborates on the situation analysis of both destinations Krushevo and Elbasan, in line to set a joint strategic direction for further development of the destination of Krushevo and Elbasan as a single thematic tourism destination focusing on active and adventure tourism products. It is structured into five sections. The introduction section is followed by an overview of the potential of the tourism sector for economic development. The third section provides an analysis of the current situation regarding strategies and policies at local, regional, and national levels. The fourth section presents the used methodology in this paper and follows by results. The fifth section concludes and provides recommendations on how to solve some tourism problems in both destinations.

2. TOURISM SECTOR AND THE POTENTIAL FOR ECONOMIC DEVELOPMENT

Tourism plays an important role in the economic development of a country. Many governments see tourism as a suitable tool for improving the balance of payments, attracting foreign investments, and mitigating unemployment. Besides the direct effects of tourism, like increased income and growth of working places, the "multiplier effect of tourism "exists. This means that the right way to measure the overall impact of tourism on a country's economy must consider not only the direct beneficiaries of tourism income but also indirect beneficiaries.

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According to UNWTO (2019), "The international arrivals or outbound travelers worldwide will reach up to 1.8 billion by 2030, thus securing tourism as one of the fastest-growing economic activities fostering overall development, introducing new investments, and generating income and new employment". Before COVID-19 travel restrictions, evidence shows a growing popularity of Krushevo and Prilep as a destination for paragliding. This has visibly increased tourism in the area of Pelagonija. According to local providers' estimation in 2017, outside of paragliding championships, "Krushevo welcomed at least 1 000 international guests who visited for leisure paragliding activities or to prepare for upcoming competitions". Based on the interviews with the providers of accommodation in Krushevo (KET Project, 2022), which is supported by the official statistics as well, the greatest portion (up to 90%) of the total arrivals in 2021 count to the domestic tourism encompassing all market segments within the national economy: families, couples, friends, private groups, small organized groups; traveling per one-day visit, long weekends, holiday, event attending. Most visits included at least one physical activity like walking in nature, hiking, biking, and horseback riding. Below is presented in a table the number of overnights in Krushevo and Elbasan.

Table 1. The overnights in Elbasan and Krushevo

Year	No. of overnights in Elbasan	No. of overnights in Krushevo
2017	11756	46741
2018	12809	51526
2019	13654	56660
2020	10800	44273
2021	12300	52454

Source: Municipality of Elbasan, 2021 & MacStat database 2022

Due to its geographical position, Elbasan must rely upon specific types of tourism, mainly adventure, historical and health-related. Within Albania, Elbasan must compete with other regions with coastlines and regions that are already popular as mountainous destinations. Besides these, Elbasan has created the image of a polluted city for many years, where the main business activities focus on industrial production, not services or tourism. But not everything is grey from the perspective of Elbasan as a tourist destination. Being situated at the very center of Albania makes it easily accessible from the main entry points in Albania. It also is rich with potential tourism resources and has a long tradition of hospitality, which form a solid base to turn Elbasan into a distinctive tourism destination. Most tourist visits to Elbasan are related to thermal spas in Llixha (Tregan), about 7-to-10-night stays. These visits are active during spring and autumn when the weather is favorable for thermal-related health treatments. Another destination that involves overnight stay is Gjinar, a mountainous destination situated about 24 km from Elbasan. Although it is well known as a beautiful tourist destination, few activities are offered there, resulting in tourists staying no more than 1-2 nights. Most of them make a day visit, enjoying traditional food, clean air, and wonderful nature. Elbasan is known for organizing the "Summer Day" feast every year on March 14, also a national holiday. Thousands of visitors come that day or a day before to enjoy traditional food and outdoor picnics, creating a festive atmosphere in Elbasan and nearby surroundings. But the duration of tourists is not more than one night, and most are one-day visitors.

3. ANALYSIS OF THE CURRENT SITUATION REGARDING STRATEGIES AND POLICIES AT LOCAL, REGIONAL, AND NATIONAL LEVELS

The consulted literature presented in the table below sets the foundation for further development of the local destinations of Krushevo and Elbasan. It comprises a depth presentation of the local destination potential and their development directions from a strategic point of view. Both national and local level strategic documents align with current EU trends in tourism development in general. Several aspects specific to the local destination (active tourism, wellness tourism, rural tourism) are highlighted as the most potent touristic features for further destination development. Below is a summary of the strategic planning for the destination development of Krushevo and Elbasan, respectively.

	Organization	**Strategies/Plans/Research documents**
1	Municipality of Krushevo	Tourism Development Strategy of Municipality of Krushevo 2020-2025
2	Municipality of Krushevo	An integrated plan for local development of the municipality of Krushevo, 2019-2022
3	Centre for development of Pelagonija region	Program for development of Pelagonija region 2021 -2026
4	Centre for development of Pelagonija region	Study for the development of Pelagonija as a destination for adventure tourism "Pelagonija - Shaped for adventure"
5	Bureau for regional development of North Macedonia	National strategy for regional development 2021-2031
6	Ministry of Economy of North Macedonia, sector Tourism	National Tourism Strategy Republic Of Macedonia The Final Version Of Kohl & Partner, 2016-2021
7	Ministry of Economy of North Macedonia, sector Tourism Agency for Promotion and Support of Tourism in the Republic of Northern Macedonia	National Strategy for rural tourism 2012-2017
8	LRCP	Tourism Development Plans for Ten Destinations across North Macedonia Volume 1 – Methodology, Background, and Market Analysis 2016
9	LRCP	Tourism Development Plans For Ten Destinations Across North Macedonia Volume II – Destination Development Plans November 2016
10	LRCP	Destination Development plan No.3 Pelagonija, 2017
11	Ministry for local-self-government, North Macedonia	IPA CBC Programme the Republic of North Macedonia - Republic of Albania 2014-2020 IPA III CBC 2021-2027 Programming between North Macedonia and Albania
12	Municipality of Elbasan	Territory Development Strategy for Municipality of Elbasan
13	Municipality of Elbasan	Strategic Development Plan of the City of Elbasan 2010 - 2020
14	The Republic of Albania, Council of Ministers	National Strategy for Development and Integration (NSDI II) 2015-2020
15	Ministry of Tourism, Albania	The Strategy for Tourism Development in Albania for 2019-2023
16	Ministry of Tourism, Albania	Integrated Program for Rural Development (IPRD) - The program of 100 Villages

17	Law on Tourism	The Agency for Promotion and Support of Tourism in the Republic of North Macedonia Ministry of Economy, Republic of North Macedonia
18	Law on tourism	Albania
19	Legal and Institutional Framework on Tourism, Albania 2018	Investment Council Secretariat, Albania
20	Beyond Borders – Introducing Smart Tourism and Sharing Economy, an EU-funded project	Study of the natural and cultural heritage of the CBC region
21		Study of Sustainable Tourism in Cross-Border Region
22	Beyond Borders – Introducing Smart Tourism and Sharing Economy, IPA II CBC MK-AL funded project	Study on Supply of Available Tourist Services and Tourist Potential in Cross-Border Region

According to the Municipality of Krushevo (2020), "The Municipality of Krushevo claims to become one of the most visited tourist destination centers, both in North Macedonia and more widely in the Balkans and Europe". That is why this municipality was involved in a series of projects in the field of tourism, and the ultimate goal is the development of adventure tourism with which the city can grow into a destination visited throughout the year. Furthermore, Krushevo is recognized as a hard adventure destination (Krushevo, Prilep, and the surrounding areas) where there is sufficient market proof for the international competitiveness of the assets for paragliding. As per the analysis in-depth concerning the LRCP project funded by the EU and implemented by the World Bank, "growth in this segment, as well as diversification of the hard adventure offering with other activities such as rock climbing, bouldering, and others, has very strong potential to create new business opportunities and new high-skilled jobs".

Centre of Development stated that there is a very rich cultural and historical heritage of various kinds, of which the archaeological site of Heraclea, the city architecture of Bitola, and the traditional architecture of Krushevo, as well as numerous churches, monasteries, museums, urban and rural memorial units, etc., numerous natural sites, that represent a huge potential for developing different types of tourism (lake, mountain, monastery, village, etc.), and improving the economy in the region.

Albania is appreciated by many international operators and visitors for its beautiful nature and landscapes. Natural and rural areas in Albania offer opportunities for developing rural tourism, mountain tourism, ecotourism, and outdoor activities (rafting, paragliding, hang gliding, mountain biking, fishing, trekking, mountaineering, hiking, horseback riding, study tours, etc.). Some of these activities are the main motive for visits by foreign visitors to the natural areas.

Development of mountain tourism resulted in the stabilization of a considerable number of tours organized in Theth, Vermosh-Lepusha, Valbona, and Tropoja, in the Albanian Alps, Diber and Bulqiza area, in the mountainous area of Tirana, the mountainous area of Elbasan and Librazhd, the mountainous area of Korça, the mountain of Tomor, Llogara and Karaburun and the mountainous region of Gjirokastra and Permet. On the other hand, tourism in environmentally protected areas is also added to the category. This category includes several forms of tourism, such as agro-tourism, event and business tourism, cultural tourism (heritage, history, religion, etc.), ethno-gastronomic tourism, and health tourism (thermal, welfare, and medical).

According to the Ministry of Tourism (2019), "The Municipality of Elbasan is the main actor that coordinates and pushes tourism policies locally, in concordance with National Strategy for

Sustainable Tourism Development and there are efforts to promote Elbasan as a tourist destination, evidencing its main attractions and organizing several events and feasts during the year". Municipality of Elbasan (2010) stated, "According to the Territory Development Strategy for the Municipality of Elbasan, Elbasan has good potential for developing ecological, natural, agricultural, health, mountainous, and historical/cultural tourism". Some of the projects planned to be prepared are (i) a complete map with historical assets of the municipality of Elbasan; (ii) identification of needs for restorative interventions in historical assets and designing of respective technical projects; (iii) improvement of road infrastructure for main touristic destinations in Elbasan municipality.

4. METHODOLOGY

The primary goal of this document is to develop a robust understanding and elaborate possible opportunities for destination development and gain valuable insights into the actual situation of tourism in Krushevo and Elbasan. This paper adopts combined research methods using primary and secondary data. The primary data were collected using two methods; workshops and in-depth interviews.

Two joint cross-border workshops with the main tourism stakeholders were organized in North Macedonia and Albania to collect local experiences, possibilities, views, and ideas from relevant stakeholders and beneficiaries from Krushevo – Elbasan cross-border area. There were 48 participants (32 men and 16 women), all representatives from tour operators, hospitality businesses, local government, non-profit organizations, cultural institutions, and academia.

The in-depth interviews were organized after the workshops. The participants took part in structured interviews held in the framework of this study. In-depth interviews were useful for fully understanding the opinions, experiences, and suggestions of the main actors of the tourism sector in Krushevo and Elbasan. During these interviews, the following list of themes and questions were covered:

- How can be Krushevo and Elbasan viewed as tourist attractions? What is its identity?
- What events and activities have been done about tourism in Krushevo and Elbasan, and what can be done more?
- How to improve the marketing of Krushevo and Elbasan as tourist destinations? How can it be promoted?
- How to improve the tourist infrastructure?
- What can be done to improve tourism services in general?

The secondary data were also part of the research input. Extensive desk research was conducted through analysis and review of the whole documents, plans, and strategies available in the field. Desk research was mainly employed to create a general view of Krushevo and Elbasan's local destinations and their tourism potential.

5. RESULTS

The analysis of the primary data gathered from in-depth interviews and joint discussions at the cross-border workshops and the secondary data from consulting relevant literature supported forming a general situation analysis of tourism development potentials in Krushevo and Elbasan.

In general, both Krushevo and Elbasan can be perceived as adventure & active destinations following the above analysis regarding the ATTA definition of adventure tourism as a trip that includes at least two of the following three elements: physical activity, natural environment, and cultural immersion.

Furthermore, the extensive analysis of the 5As, presented above, on the key elements of the destination: access, accommodation, attractions, activities, and amenities revealed:

- Similarities mostly in the category of access points, attractions, and amenities;
- Moderate consistency in the variety of accommodation capacities, and
- Variations in the type and quality of the activities offered.

Regarding amenities, both Krushevo and Elbasan offer standard and regular internet access coverage at satisfying levels and health protection institutions. There is a lack of locally organized transport.

The conducted research contributed to identifying some of the problems and challenges for further development of tourism in Krushevo and Elbasan:

- Lack of a distinctive strategy for tourism development at Elbasan Municipality.
- There is no one-stop-shop - Tourist Info Centre in Krushevo offering systemized and promotional information on touristic offers in the town;
- There is no systemized and integrated touristic offer in the form of ready-to-use products, such as guided tours to attractions in Krushevo and Elbasan;
- There is a great lack of certified local guides in multiple languages, even in English;
- Waste management requires improvements;
- Capacity building for hospitality service providers is required to meet travelers' expectations.
- Modernizing the curriculum in the high school for hospitality and upgrading the cooperation with the private sector are needed;
- No digital access for self-guided tours (biking and hiking) in multilanguage is available;
- There is no dedicated directory for tourism development and policies in the Municipality of Elbasan;
- Poor road infrastructure to main tourist points of interest.

6. CONCLUSION

The COVID-19 pandemic period influenced in decreasing number of tourists in Albania and North Macedonia. The restrictions of COVID-19 made tourism pause for some months and the number of tourists was lower compared with previous years. Because of its interdependence with other sectors of the economy, from one side, tourism triggers development across the local economy. On the other side, it is quite challenging to determine the exact economic impact tourism as a sector has on the local economy. In addition, it is also a complex exercise to determine which investment is purely touristic related when once investing in road or health infrastructure, the destination benefits as well in regards to more accessible and safer tourist areas to visit.

Amenities are of particular interest to adventure tourism development as they include safety logistics, internet access, health insurance, and access to first-aid facilities, etc. Recent developments due to COVID-19 introduced anti-spread amenities, including special measures for cleaning the accommodation and transport facilities, public spaces, and sites of great attraction.

Based on the results stated in the paper, Elbasan and Krushevo have so many touristic places to be visited by foreigners and so many activities they can do there. Though, those cities do not offer a very comfortable infrastructure, along with the impossibility of having multilanguage guides, missing additional tourism information from the central and local government, or even non-existent.

Krushevo offers clean air and an unpolluted natural environment due to its specific location and lack of transport. Food is of great attraction potential as well as both territories can still offer healthy and homemade food, whether served in traditional restaurants or B&Bs.

Increased infrastructural investments in Krushevo and Elbasan highly contribute towards the attractiveness of the local destinations in terms of accessibility to sites for adventure, fostering the overall economic development in the cross-border area, which leads to more jobs, higher income, and higher export of services.

To conclude, Krushevo and Elbasan will not have only a project together to promote sustainable tourism, but also a change, a development, and a solution to the tourism problems in those cities.

7. RECOMMENDATIONS

Following the above analysis of the two local destinations and investigating possibilities for developing joint adventure touristic packages, it is conclusive that both Krushevo and Elbasan should follow further tourism development in adventure travel, as their greatest potential is that specific type of tourism.

In that regard, both destinations share elements that are base for linking the offer at the current situation and use that as a foundation for further development, following the recommendations below:

- Setting up local DMO for Krushevo (municipality),
- Developing USP and UVP for Krushevo (DMO),
- Developing consistent and unique promotional messages for all-year-round adventure Krushevo (DMO),
- Developing and implementing a national advertising campaign on Krushevo (a joint effort of all stakeholders),
- Developing and promoting digital tools (web-based) for self-guided hiking and biking tours in Krushevo,
- Further marking of hiking and biking trails in Krushevo,
- Introducing downhill biking trails during the summer on the ski runs (private concessioner, municipality),
- Further improvement of the paragliding infrastructure, extra take-off spot, and large facility at the site,
- Further refinement of the road network, focus on road access to attractions: Meckin Kamen and Adventure Park,
- Building long and greater capacity zip line in Krushevo,
- Establishing a dedicated directory for tourism and tourism policies and development in the Municipality of Elbasan,
- Developing a dedicated web page for tourism in Elbasan,
- Evidencing, signaling, marking and promoting hiking and biking trails in Elbasan.

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European Strategies for Sustainable Tourist Destinations, Problems & Prospects – The Case of Vlora, Albania

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Abstract: *Although tourism is a priority development scenario, Albania is struggling to select a competitive development model. The country's entry into the international market is producing increased visits primarily driven by curiosity, a motivational factor that hardly ensures repeated visits. Physical development is present, pressure on resources builds on and barely any coordinated actions are taken by regions in the name of long-term competitiveness and sustainability. Initiatives such as pilot testing European Tourism Indicator System for sustainable management at the destination level in the Vlora region in South Albania, a territory high in demand for tourism services, produced substantial information about the state of development and strategic documents. This paper aims to shed light on regional strategies for sustainable development and the level of tourism private sector engagement. This serves not only to evaluate the adaptation of the European strategic framework, but it sets the ground for the mobilization of local enterprises and individuals towards their implementation.*

1. INTRODUCTION

Over the last 3 decades, the potential of tourism for Albania has been studied, appraised, and confirmed by economy professionals. Even though tourism is a priority development scenario, Albania struggles to choose a competitive development model. The entry of a country into the international market produces increased visits driven primarily by curiosity, a motivational factor that hardly ensures repeat visits. Physical development is present, the pressure on resources is increasing and the regions are hardly taking any coordinated action in the name of long-term competitiveness and sustainability.

A recent analysis of the sector governance shows that despite the equipment with strategic documents Albania still lacks a competitive model of sustainable tourism development. Although it acknowledges the significance of sustainable tourism, Albania›s draft «National Strategy for Sustainable Tourism Development 2018-2022» does not specify any rules or benchmarks for sustainability. It is worth noting that in spite of the fact that the strategy comprises nineteen priority interventions and five intervention areas, all of them deal with investments, diversity, seasonality, human resources, and marketing (Niented & Shutina, 2018, p. 98).

The European Tourism Indicators System (ETIS), a unified set of indicators for the sustainable management of tourism destinations, was introduced by the European Commission in 2013 (European Commission, 2013).

Referring to Nientied and Shutina (2018) "the concern for sustainable tourism in Albania is yet quite small. Furthermore, local tourism destination administration is still in the early stages of

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development. Together, these elements make the environment unfavorable for establishing concerted action for sustainable tourism" (p. 94).

Based on the information mentioned above the aim of this study is to zoom into the regional strategies for sustainable development of tourism to analyze the level of EU strategic framework adaptation and particularly the engagement of local enterprises and individuals in this process. It highlights prospects and challenges and sets the ground for the mobilization of local enterprises and individuals toward their implementation.

2. LITERATURE REVIEW

"It has been shown recently that tourism can contribute to major environmental changes that can harm local economies as a result of the escalation of climate change research" (Tudorache et al., 2017, p. 1). This aspect emphasizes the importance of sustainable tourism. "Tourism that fully accounts for its current and future economic, social, and environmental implications, fulfilling the requirements of visitors, the industry, the environment, and host communities", is how UNEP and WTO (2005) describe sustainable tourism (p. 12).

Moreover, the beginning of the twenty-first century found the world with 6.1 billion people and nowadays we are officially 8 billion people. Every year about eighty-three million individuals are added to the world population. "Projections show that in 2050 the globe will be populated by 9.7 billion people" (Desa, U. N., 2019, p. 1). Most of this increase in population occurs in developing countries. The main natural resources are under greater strain due to population expansion, economic development, and climate change. As a result, sustainable resource management has risen to the top of the list of priorities for local and national government policies. According to Ritchie and Crouch (2003), sustainable development has become a necessity also in the field of tourism as well as in other activities; in recent years, it has even been asserted that a tourist destination cannot become competitive if it is not sustainable. Based on the above and on the crucial role that tourism plays for the EU economy, special importance is given to sustainable development indicators applied in the field of tourism.

A revised tourism policy was approved in March 2006 by the Commission of the European Communities with the primary goals of boosting the competitiveness of the European tourism industry and generating more and better jobs.

In this light, the European Commission introduced The European Tourism Indicators Systems (ETIS) in 2013, a unified system of indicators for the sustainable management of tourism destinations. According to Tudorache et al. (2017), "this system was developed to promote sustainable destination management while also serving as a comprehensive tool to monitor, manage, and advance sustainable tourism growth." (p. 2).

According to ETIS Toolkit (2013), "since the quality of tourist destinations is greatly impacted by their natural and cultural environments as well as their integration into a local community, the competitiveness of the tourism sector is tightly tied to its sustainability" (p.8).

To meet those obstacles, wise decisions must be made based on relevant facts. This data may come from particular indications that go beyond just counting customers or other discrete business metrics.

The ETIS Toolkit (2013) states that ETIS consists of seven phases, which are as follows (p. 19): **Step One:** Raise awareness; **Step Two:** Create a destination profile; **Step Three:** Form a stakeholder working group; **Step Four:** Establish roles and responsibilities; **Step Five:** Collect and record data; **Step Six:** Analyze results; **Step Seven:** Enable on-going development and continuous improvement.

The ETIS is a comprehensive management system built on a set of sustainability indicators. It includes 43 core indicators as well as a preliminary set of supplemental indicators, such as maritime and coastal tourism, accessible tourism, and transnational cultural routes (ETIS Toolkit, 2016, p. 12). ETIS's 43 key indicators are divided into four categories: **Field 1:** Destination management; **Field 2:** Economic value; **Field 3:** Social and cultural impact; **Field 4:** Environmental impact. According to (Delgado & Saarinen, 2014; Tudorache, et al., 2017) ETIS is not the first set of indicators to existing for sustainable tourism (Nientied & Shutina, 2018, p. 97). There are several sets of territorial governance indicators for sustainable tourism, but based on the study of Nientied & Shutina (2018), "in Albania and elsewhere in the Western Balkans, it makes little difference whether a set of indicators is the best (technically speaking)" (p. 97). According to them, getting started and, if needed, adjusting the list of indicators is the most critical point. For the authors cited above, ETIS appears to be a promising alternative because it is a system that includes processes and approaches rather than just a list of indications.

Vlora County in South Albania represents a region with a confirmed potential for sustainable tourism development. The territory is high in demand for tourism services and generates 23% of the total income in the economy from tourism, which is faced with the challenge of developing sustainably. The analysis of the tourism sector at the governance level for this region has demonstrated the same features mentioned in the general literature review. There is neither a clear perception of the "sustainable" concept of tourist destinations nor a translation into strategic documents for the region. "The regional strategic documents fail to explain what is meant by sustainable tourism development and most tourism-related objectives and economic outputs are concentrated in already overcrowded and depleted areas, such as the coast" (Ciro, 2019, p. 82). "Coastal tourism", also known as "Mass tourism" in Vlora developed according to a responsive and spontaneous model to demand. Although it has played a leading role in the economy of the Vlora region, all this physical development to cater to the growing numbers has been accompanied by irreversible consumption of environmental and cultural values.

3. METHODS

The choice of ETIS as a method was justified by the need to follow the EU initiatives in the field of sustainable tourism policy. A reminder here that Albania is on the current agenda for future enlargement of the European Union (EU). It applied for EU membership on April 28, 2009, and has been an official candidate for entry since June 2014.

The research is applicative and was conducted in the highly potential tourism area of Vlora county in South Albania. From this applicative approach, the research paper aims to contribute to the literature by illustrating the results of ETIS in a county of Albania and also the challenges and difficulties that this tourist destination has to face in the process of implementing ETIS.

A survey was conducted with a total of 2000 questionnaires distributed throughout the municipalities of Vlora county. Questionnaires had on focus four different groups of respondents including Destination Marketing Organizations (DMOs), visitors and residents, enterprises and

local government units. Questionnaires were completed through face-to-face interactions conducted mainly in public areas. The survey of DMOs had the lowest response rate, due to the lack of genuine DMOs in this district. In surveys of enterprises, the main data were collected through emails and direct phone calls[3].

In order to select the relevant and appropriate indicators of sustainable tourism in Vlora county that would consequently be taken into consideration during our research paper, we created focus groups involving 15 persons. We invited into those focus groups hotel managers, specialists from local government units, tourism specialists, travel agency owners and specialists from civil society organizations. The sampling criteria considered were occupation, age and the sex of respondents. The duration of each meeting was 60 minutes.

As a result of this research, a collection of 44 indicators was created from the studied indicators, the majority of which are optional indicators (70%). Percentages of ETIS indicators calculated for each category of the ETIS are shown in the table below.

Table 1. Percentages of ETIS indicators calculated for each category of the ETIS.

Category	Percentage
Destination management	89%
Social and cultural impacts	72%
Economic value	50%
Environmental impact	62%

Source: Authors' calculations

4. RESULTS

Data collected from visitors indicated that nearly all tourists and same-day visitors (88.8%) were highly content with their whole experience in Vlora (indicator A.3.1) and more than half of respondents (57%) had visited it at least once during the last 5 years (indicator A.3.1.1). It was noticed that a very small percentage of surveyed tourists (16.8%) were aware of destination sustainability efforts (indicator A.4.1). It is also worth noting that a very low percentage of tourists (19.1%) were satisfied with the accessibility of the destination for those with disabilities or specific access requirements (indicator C.3.2.1). From the results of the surveys with the visitors, it was noticed that the average nights of stay for tourists at the destination were 4.1 days (indicator B.2.1.) and average length of stay of 'same day' visitors is 5.6 hours (indictor B.2.1.1). The average daily spending of visitors is about (31.8 €) and that of tourists (53.3 €) were considered two of the most important evaluated indicators. Number of 'same day' visitors in the high season and low season in Vlora was 25.1%. The evaluation of indicators relating to the environmental dimension revealed that a very small percentage (12.8%) of respondent tourists used different modes of transport to reach the destination (indicator D.1.1), but most tourists (55.3%) used local/ "soft" mobility/public transport services to travel around the destination site (indicator D.1.1.1).

Referring to surveys with residents, we found that although most residents felt that their involvement in tourism planning and development was minimal. Percentage of residents satisfied with their involvement and their influence in the planning and development of tourism was about 36.2%. We also found that percentage of residents who have positive thoughts on the impact of tourism on destination identity and percentage of residents who are satisfied with tourism in the destination per season are very high, respectively: 85.8% – (indicator C.4.1.1) and 75.4% - (indicator C.1.1.1)

[3] The contact database for enterprises was provided by Albanian Tourism Association (ATA).

Table 2. ETIS Indicators for 'Vlora' County

Data Source	Indicator Code*	Destination Results
Tourists / 'Same day' visitors	A.3.1	88.8 %
	A.3.1.1	57 %
	A.4.1	16.8 %
	B.1.1.3	31.8 €
	B.1.2	53.3 €
	B.2.1	4.1 No. of nights
	B.2.1.1	5.6 No. of hours
	B.2.1.2	17.8 %
	D.1.1	12.4 %
	D.1.1.1	53.5 %
Residents	A.1.1.1	36.2 %
	C.1.1.1	75.4 %
	C.4.1.1	85.8 %
Enterprises	A.2.1	7.5 %
	A.2.1.1	2.8 %
	A.4.1.1	17.8 %
	B.2.1.2	17.8 %
	B.2.2	56.8 %
	B.2.2.1	25 €
	B.3.1.1	40.7 %
	B.3.1.2	0 %
	B.5.1.2	29 %
	C.2.1	52.1 %
	C.2.1.1	21.6 %
	C.3.1	8.4 %
	D.2.1	94 %
	D.2.1.1	95 %
	D.2.1.2	14.1 %
	D.3.1.1	8.5 %
	D.5.1	174 L
	D.5.1.1	31.5 %
	D.5.1.2	2.8 %
	D.6.1	3 %
	D.6.1.1	84.5 %
	D.7.1.1	10.3 %
DMOs	A.1.1; A.1.1.2; B.5.1.1; C.3.1.1; C.4.1; C.4.1.2; D.3.1; D.4.1; D.5.1.3; D.7.1.2; D.8.1; D.8.1.1	This group of indicators is not calculated in this paper.[3]

* The indicators that are not mentioned in this table are not applicable in our case study for Vlora County.

** The reasons for not calculating these indicators are explained in the last paragraph of the results section.

Source: Authors' Calculations

A relatively small percentage (7.5%) of tourism businesses and establishments in the destination use voluntarily certified certifications or labels for environmental, quality, sustainability, and/or CSR practices, but the number of tourism enterprises/establishments with sustainability reports in accordance with the Global Reporting Initiative (GRI) remains even lower (2.8%). A greater effort on the part of businesses can be seen in communicating their sustainability efforts to visitors in their products, marketing, or branding. The percentage of enterprises that apply this strategy is 17.8%. The percentage of tourism enterprises that sourced a minimum of 25% of food and drink from local/regional producers at their businesses was 29%.

Looking at the impact of businesses on the environment, it is worth mentioning that the percentage of businesses involved in climate change mitigation schemes—such as: CO2 offset, low energy systems, etc.—and "adaptation" responses and actions was relatively high - 94% (indicator D.2.1). For 95% of surveyed respondents, the destination was included in climate change adaptation strategy or planning. As per water management, the percentage of tourism enterprises that are using recycled water is very low (2.8%) – (indicator D.5.1.2), but an improvement appears in the percentage of tourism enterprises with low-flow shower heads and taps and/or dual flush toilets/waterless urinals. About 32% of surveyed businesses used the mechanism mentioned above. It is also worth noting that 84.5% of tourism enterprises have switched to low-energy lighting.

In light of our goal of analyzing the ETIS implementation, in this section, we have also observed the major issues and problems faced throughout the period of evaluating the indicators. In some cases, the lack of qualitative and quantitative data affected the reliability of the indicators. "The lack of reliable local and regional tourism statistics and the necessity to address conceptual concerns in various tourist locations (such as how to operationalize the idea of sustainability) make the environment for ETIS implementation relatively difficult" (Nientied and Shutina, 2018, p.101). Also, as discussed in the methods section, due to the small number of DMOs in the entire territory of Vlora, only a very small percentage of them answered the questionnaire, resulting in the invalidity of the randomness of the sample. And, in the cases of the given answers, due to the incompleteness of some of them, we could not get a stable and reliable assessment for indicators such as: A.1.1, C.3.1.1, C.4.1, C.4.1.2, D.3.1, D.4.1, D.7.1.2, and for the basic indicator D8. In this case, we were unable to apply any technique to overcome the missing data problem. Therefore, this group of indicators is not calculated in this paper. The lack of data received from DMOs prompts the design of an objective to increase the interaction and awareness of DMOs on the importance of sustainability practices in relation to their customers.

5. CONCLUSION

The development of metrics for assessing the effects of tourism on host communities has received a lot of attention. In this paper, we presented the results of the survey that was conducted in Vlora County in South Albania by administering the ETIS questionnaire to a sample of 2000 respondents. One of the most important findings from our research was that nearly all visitors (about 90%) are satisfied with their overall experience in the destination, but local people denounce their lack of involvement in the decision planning. Although most residents felt that tourism helps to protect and enhance its local identity, cultural heritage, and assets (85.5%), they also felt that their involvement in tourism planning and development was relatively low (36.2%). Our findings contribute to a better understanding of ETIS for a country like Albania that aims to be part of the EU. In our case study, it is observed that the region of Vlora, although it clearly has great potential in tourism, has not yet embraced and developed this tool enough to achieve tangible results that reflect the growth of sustainable cultures at local levels.

From the above analysis, government action at the central and local level would be recommended to promote sustainable tourism, but this does not seem to be enough; Tourism providers (enterprises), the community (residents), and DMOs should be involved to improve sustainable tourism and destination governance. Policies related to the sector of tourism, which should be translated into action plans according to the municipalities of Vlora County, should be based on a platform of cooperation between the public sector, the private sector, individuals/local community and DMOs, however, underrepresented any of the above links may seem.

This experience shown also that the lack of data at the local level and the lack of reliability in the data collected by the DMO can damage the quality of several indicators. This is significant in ETIS since it is designed as a tool for implementing and monitoring sustainable policies at the local level. "To be efficient in policy planning at the local level, indicators must be reliable and accurate" (Modica et al., 2018, p. 16). According to Modica et al. (2018) "the lack of resources makes the indicators less reliable and therefore less used, which can be detrimental to local planning policies" (p. 16). This is one of the most important recommendations that should be taken into consideration in the future.

Another important recommendation remains the improvement of the perception of the 'sustainable' concept by organizations that draft strategic documents for the tourism sector and update the regional strategic plan as a whole.

Our findings contribute to a better understanding of ETIS for a country like Albania that aims to be part of the EU. In our case study, it is observed that the region of Vlora, although it has great potential in tourism, has not yet embraced and developed this tool enough to achieve tangible results that reflect the growth of sustainable cultures at local levels.

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The Tourist Image of the Protected Landscape of Biambare, Sarajevo

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Keywords:
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Tourist impressions;
Satisfaction;
Loyalty;
Promotion

Abstract: *The protected landscape (PL) of Biambare is one of the most famous green sites for local visitors and tourists of Sarajevo. This area is distinguished by beautiful Bosnian Alps (Dinarids) meadows and plenty of spectacular natural phenomena, especially caves; the Central Biambare Cave is currently the most popular. The terrain is situated at an elevation range of 915–1044 m above sea level, so it mostly has a pleasant pre-mountain climate, etc. Therefore, tourism supply is based on different products and activities: speleology; walking in nature; bicycling; riding; hiking; alpinism; fishing; hunting; skiing; and collecting medicinal herbs and mushrooms. The aim of the paper is to represent the Biambare tourist image based on identifying its central natural attributes and according to the evaluation of the visitor's experience. The two relevant parameters for understanding tourist impressions are: "satisfaction" and "loyalty". These are higher among foreign than resident visitors, particularly among Middle Eastern tourists, who favour this site above many others in Canton Sarajevo.*

1. INTRODUCTION - THEORETICAL BACKGROUND

According to Tapachai & Waryszak, "the destination images are perceptions or impressions of a destination held by tourists with respect to the expected benefit or consumption values" (Rayesh, 2013). It's „mental concept formed from a set of impressions" (Beerli & Martín, 2004). Beerli & Martin (2004 also define "image as tourists' perceptions of the brand and brand associations stored in their memory" (Žunić, 2018). It can also be understood as „an interactive system of thoughts, opinions, feelings, visualisations, and intentions toward a destination" (Tasci et al., 2007).

"Types of the destination image are:

- *Organic*- opinions of friends, magazines, newspapers, news, reports, etc.;
- *Induced*- image proffered by commercial information sources, i.e., marketing efforts of various commercial agents to publicise a destination;
- *Affective*- visitor's feelings or emotional responses toward it;
- *Cognitive*- knowledge of and beliefs regarding a place" (Huete-Alcocer & Lopez-Ruiz, 2019).

Factors of a destination's image can be different attractions: nature, culture and art, recreation, tourists and other infrastructure, the environment, and the atmosphere (ambience). Each of them can be the reason for tourists' satisfaction, but it's usually a complex of various things in the destination that participate in creating our feeling toward the visited place. Therefore, the image is the product of a very complex and, at the same time, personal visualization toward a destination. But when visitors share their experiences related to their holiday in a particular destination, we can generate and evaluate their level of satisfaction. The higher the level of visitor satisfaction, the faster the popularity of the destination grows.

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The relationship between destination image and tourist satisfaction worldwide is explored by numerous authors. According to Javier & Bing, "destination image has a direct relationship with perceived quality, satisfaction and intention to return and willingness recommend others" (Rayesh, 2013). Tourist impression is a powerful generator of destination image because visitors share their positive experiences and stimulate travels and new visitors (Urry & Larsen, 2011).

- *Tourist satisfaction* is "a person's feelings of pleasure or disappointment resulting from comparing a product are perceived performance (or outcome) in relation to his or her expectations" (Kotler & Keller, 2012). Customer satisfaction is a post-purchase attitude formed through a mental comparison of the product and service quality that a customer expected to receive from an exchange (Kim, 2012). *Attributes of satisfaction* could be: attractions, accommodation, accessibility, amenities, activities, efficiency, service quality, social value, play, aesthetics, perceived monetary cost, perceived risk, time & effort spent and perceived value.

Besides tourists' satisfaction, loyalty and *WOM* marketing are also countable as relevant parameters of the destination image assessment. Surely, there's a strong relationship between satisfaction, loyalty, and *"Word of Mouth"* promotion, as they affect each other and contribute to the complete tourist perception of a place.

- *Loyalty* is the quality of being faithful in your support of someone or something (Oxford). When it comes to tourists' loyalty, we can simply understand it as visitors who are faithful to a certain destination, which practically means that they are returning visitors. "Loyal customers as those who re-buy a brand, consider only that brand, and do no brand-related information seeking" (Newman & Werbel, 1973). According to Reynolds and Arnold (2000), "customers aim to dedicate all of their purchase categories to a particular service provider" (Jones & Taylor, 2007). *Attributes of loyalty*, according to G. Prayag, are: comfort facilities, safety & infrastructure, cultural attractions & shopping, tourist attractions & ambience and variety & accessibility. Tourist loyalty depends on the satisfaction of tourists and meeting expectations (Rayesh, 2013).
- *WOM marketing* is practically free *"Word of Mouth"* promotion of a destination. Therefore, it's one of the most desirable effects of tourist satisfaction. "It plays a vital role in marketing strategies, tourist spending, revisits intention and the overall image of the destination" (Yoon & Uysal, 2005). As stated by Urry & Larsen (2011), positive tourist impressions result in travelers sharing their experiences and stimulating new visitors. Furthermore, *word of mouth* has the strongest impact when it comes from a friend or other familiar person who has already visited the destination because of the inclination to listen to their perspective.

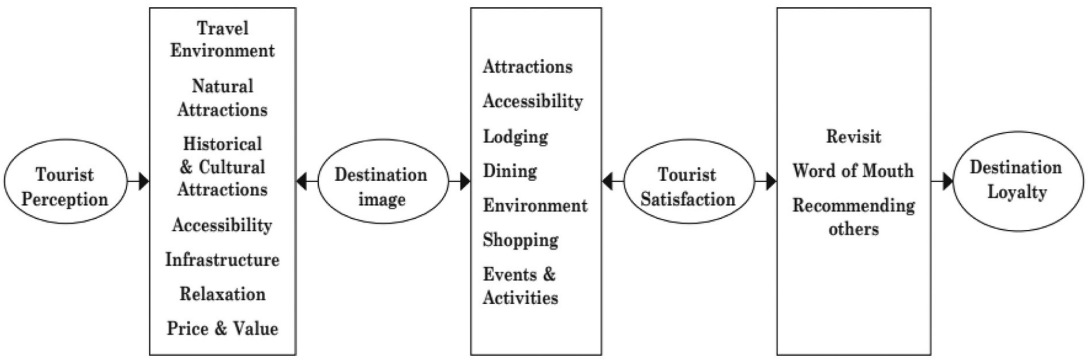

Figure 1. Rajesh's holistic model for destination loyalty

Source: Rayesh, 2013.

2. METHODOLOGY

The research aims to present the protected area of PL Biambare and evaluate its touristic image through the perceptions and impressions of visitors. The paper is divided into two main sections: *"Tourist-geographical profile of PL Biambare"* and *"Evaluation of the tourist image of PL Biambare."* Relevant parameters for the tourist image are „satisfaction"- *„pleasant environment and positive experience"*, „loyalty"- *"return visitors even if the ticket price increases"*, and „WOM marketing"- *"recommendation and persuasion"*. Field work included observations, map interpretation, surveys, and interviews (June-Sept. 2022). A closed-ended questionnaire was directly administered to visitors at two points: *a)* at the main entrance to the PL Biambare and *b)* at the entrance to the Central Cave. The structure of respondents counted foreign visitors at 53% and domestic visitors at 47% (total 72 = 100%). The intensity of the visitor's impression was measured on a Likert scale (1–5). The statistical presentation of results is percentage mod, AM. The overall picture of the tourist *"affective"* image of PL Biambare is positive, meaning this site represents a significant tourist resource.

3. TOURIST-GEOGRAPHICAL PROFILE OF PL BIAMBARE, ILIJAŠ, SARAJEVO

PL Biambare is located between two smaller bosnian towns: Olovo and Srednje, but it's also near Sarajevo, the capital of Bosnia & Herzegovina, as it's well connected by the magistral road Sarajevo-Tuzla (M18). PL Biambare takes the NE slopes of Ilijaš municipality (1 of 9 municipalities at Canton Sarajevo), which is surrounded by mountains: Zvijezda (N, NE), Ozren (S, SE), and Čemerska mt. (W, SW). Geomorphologically, it's situated between the villages of Nišići and Krivajevići, on the northeast area of the Black River plateau. This area includes the smaller plateau of Nišići (1500 m), which is located between Biambare Caves (N) and the hills Motika (E), and Duge Strane, Borka (S).

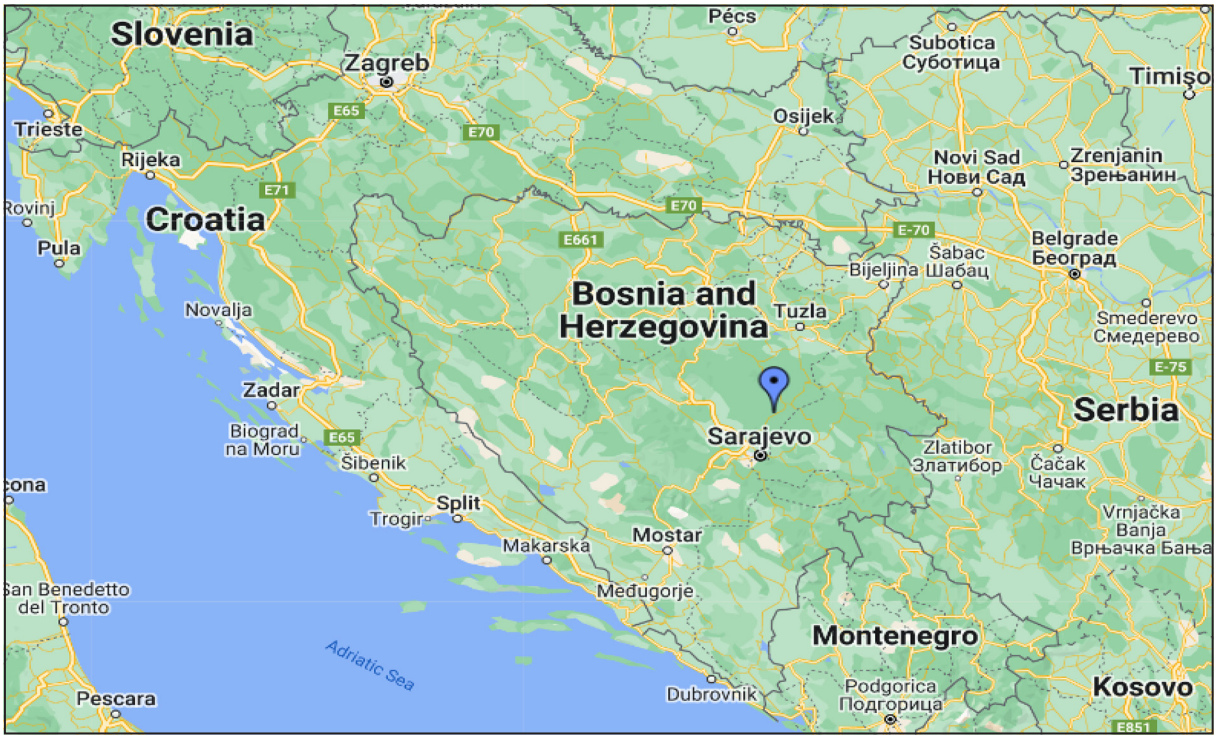

Figure 2. Location of PL Biambare in the Bosnia & Herzegovina and the region SE Europe

Source: Google Earth Maps

Table 1. The basic geographic data of PL Biambare

IUCN-category: **V**	***Protected landscape*:** area with significant ecological, biological, cultural and scenic value and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values
Total area	367,36 ha
Year of establishment	2003
State	Bosnia & Herzegovina
Entity	Federacija BiH
Canton	Sarajevo
Municipality	Ilijaš
Distance from the city centre	Sarajevo- 40 km, Tuzla- 80 km

Source: Nezirović et al., 2017.

According to the *Spatial Plan of Biambare,* this site is divided into 3 functional zones:

A. *Zone I (nucleus):* 133,83 ha, includes the caves as the karst objects with the highest value;
B. *Zone II (buffer zone):* 141,04 ha, includes well-preserved areas for research, education, and recreation, while the main features are: sinkholes, springs, 128 floristic endemic species, honey herbs, mushrooms, willows and trees e.g., *Salix fragilis & alba*, etc.;
C. *Zone III (transitional zone):* 92,49 ha, includes panonic meadows, sinkholes and channels with hydrological and floristic value, while it allows activities in the field of forestry, agronomy, tourism and hospitality, based on the principles of sustainable development.

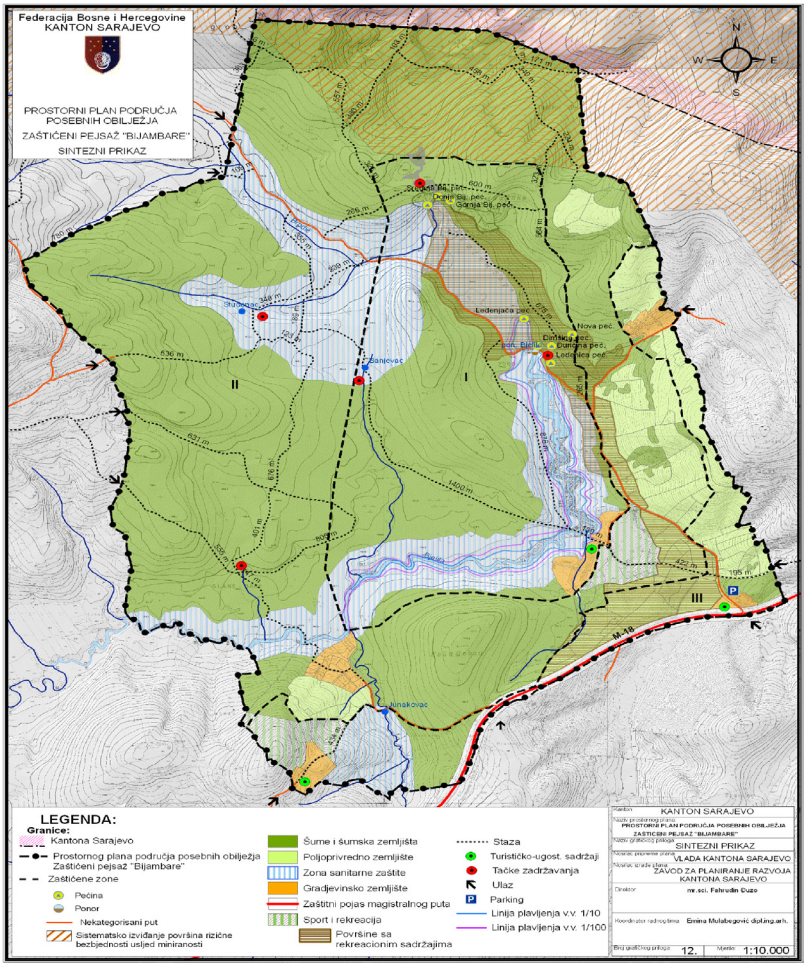

Figure 3. Spatial Plan of an Area of Special Characteristics "Protected Landscape of Biambare"

Source: Development Planning Institute of the Sarajevo Canton, 2009.

Table 2. Cave objects in the protected area—PL Biambare, Sarajevo

Name	Length (m)	Depth (m)	Height (m)
1. Central/Main Cave	533	-24	959
2. Ledenjača/ Freezing Cave	323	-51	935
3. Donja/ Down Cave	148	+6/-11	930
4. Đuričina Cave	142	-28	950
5. Gornja/ Upper Cave	112	+10	980
6. Dimšina Cave	108	-30	935
7. Ledenica/ Ice Cave	41	-18	940
8. Nova/ The New Cave	28	-12	980

Source: Nezirović et al., 2017.

The Central Cave has been a popular tourist spot and a speleological site for a long time. It's 420 m long only in the basic direction without individual branches but longer than 500 m. It has four halls with rich ornaments of all known creation forms: lateral blocks, stalactites, casts, stalagmites, and curtains. The fourth hall is the biggest (around 60 m in diameter and 15–30 m in height). It is also called the *"Music Hall"* for its acoustic effects.

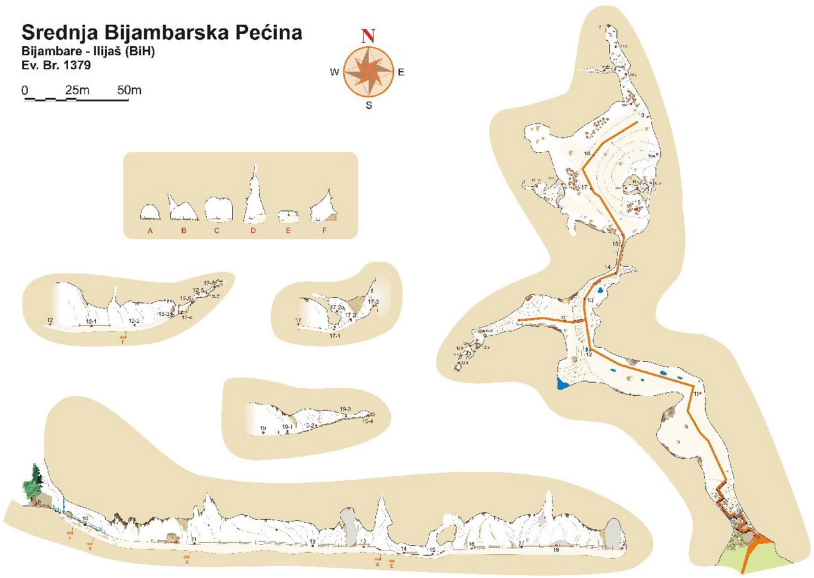

Figure 4. Plan of the Central Biambare Cave

Source: Milanolo & Mulaomerovic, 2007-2008.

Figure 5. The Central Biambare Cave and the „amazed" visitor by its stalactites

Source: Author's private collection

Area of Biambare is not popular only because of its caves, but there are many other attractions and various activities to be done: speleology & cave tours; walking in nature; cycling; riding; hiking & alpinism; fishing; hunting; skiing; collecting medicinal herbs and mushrooms; the playing yard for the kids *"The Wood City"*. Above all, it provides impressive scenic views.

Figure 6. Impressive landscape at Biambare: the *view of the coniferous (Picea abies) forest from the cave door*

Source: Author's private collection

4. EVALUATION OF THE TOURIST IMAGE OF PL BIAMBARE

The evaluation of the tourist image of PL Biambare was based on a survey directly conducted among 72 visitors (53% foreign, 47% residents). In the structure of respondents, dominant participation by arrivals counts Bosnia and Herzegovina (residents) at 47% and Kuwait at 35%.

- ***Satisfaction,*** which is determined by ***"pleasant environment and positive experience,"*** is majority positive (78%), while it's highest among visitors from the Middle East region (Kuwait, Bahrain, and the UAE), Australia, and Bosnians. At the same time, satisfaction is higher among foreign visitors than among domestic visitors (4.15 vs. 3.93).

Most foreign tourists came to Sarajevo because of its interesting culture, and they didn't even expect they would have the opportunity to enjoy such a beautiful green site as Biambare, which is only about 1 hour away from the city. Furthermore, this site is rich in karst phenomena, such as caves, and it is vastly different from their living environment; for example, people in the Middle East live in desert cities. As a result, and given that Arab visitors constituted the majority of foreign visitors, the expectation for them is even higher than for locals who are already accustomed to this type of attraction. Arabian tourists generally prefer green areas, while the Biambare site delighted them with a fresh boreal climate, coniferous forests, fascinating meadows, caves, water, and impressive scenic views. Previous research also showed that tourists from the Middle East favor Biambare (besides Baščaršija) among other Sarajevo tourist attractions because "they are missing green sites in their origin places" (Žunić, 2018). Stanković (2000) also stated that "green areas are a particularly desirable attraction for Arabian visitors, as they come

from arid desert areas". Protected areas around Sarajevo have been increasing in number lately, and they present a most valuable addition to the urban tourist supply as they combine cultural and nature tourism, while tourists' preferences for green sites are growing too.

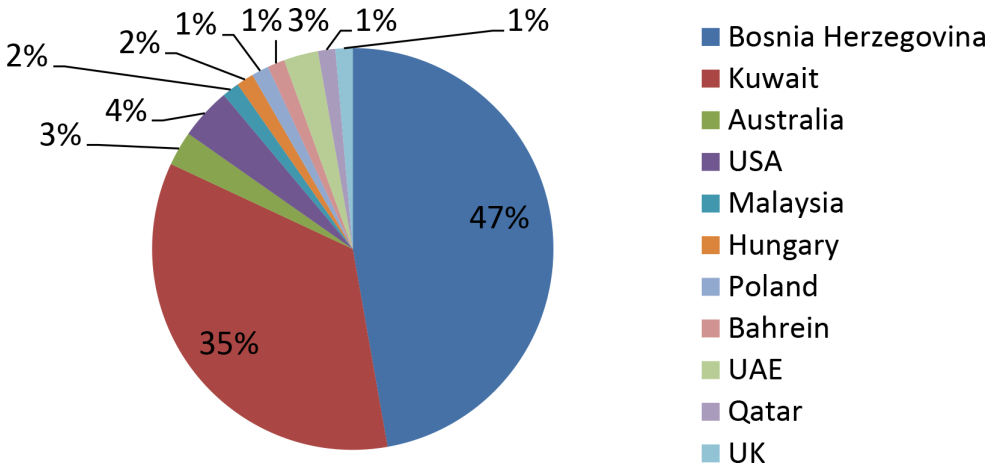

Figure 7. The structure of respondents by arrivals

Source: Own research

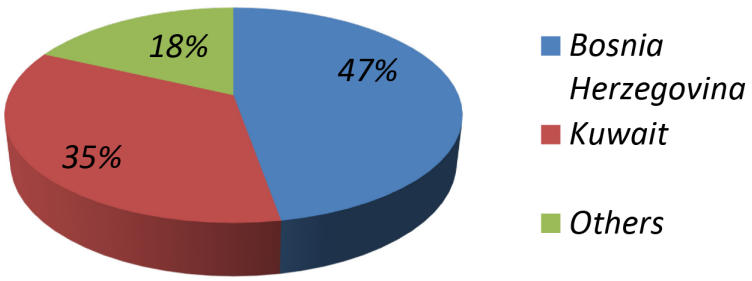

Figure 8. The structure of respondents by dominant participants in the survey

Source: Own research

Table 3. Total satisfaction (%)

Positive	78
Neutral	12
Negative	10

Source: Own research

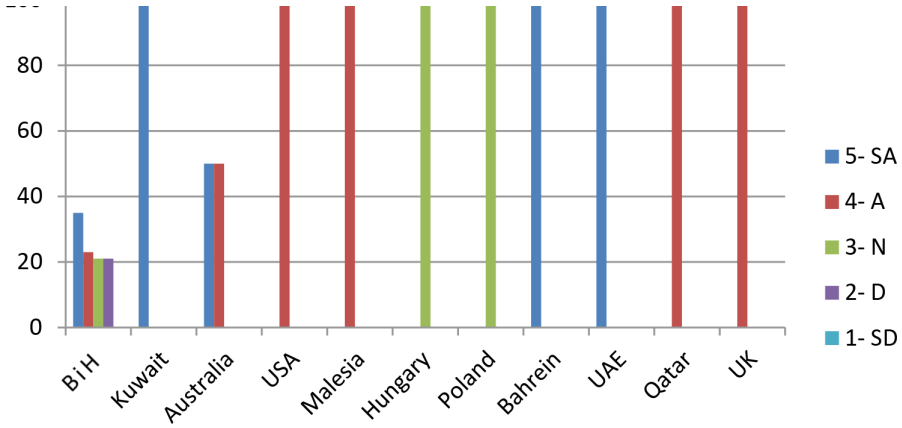

Figure 9. Total satisfaction by the arrivals (%)

Source: Own research

Table 4. Arithmetic mean as an indicator of satisfaction

Marks (x)	Frequency (f, %)	Product (fx)	AM ($\bar{x}$)
5	56	56*5=280	4.24
4	22	22*4=88	
3	12	12*3=36	
2	10	10*2=20	
1	0	0*1=0	
	∑f=100	∑fx=424	

Source: Own research

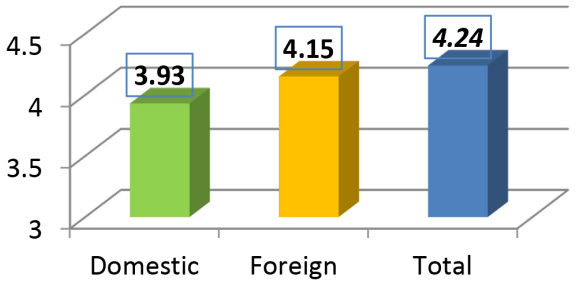

Figure 10. The origin structure of satisfaction

Source: Own research

- ***Loyalty,*** which is determined by ***"return visitors even if the ticket price increases,"*** is a majority positive (67%), but it's some lower than total satisfaction (78%). It's highest among visitors from the Middle East region (Kuwait, Bahrain, the UAE, and Qatar) and the USA. In both cases, these are tourists from well-developed countries with higher life and economic standards than Bosnia's, so the ticket price is not as important as their level of comfort. That means they could still easily afford it, and they would do so gladly because they are satisfied with the product. Because most Arabian visitors are *"desert-city people"* and families, they prefer long days spent in a fresh nature setting that also includes a playground for children, etc. Although the sample of Americans here was small, the fact is that they are mostly *"concrete-city people"* (people who live in well-built and urbanized areas; for example, New York is popularly known as the "concrete jungle"), so the site of Biambare is an indispensable attraction.

It's important to note that among American visitors, some are actually of Bosnian origin, who have a strong connection to their native place and visit it often during the summer season. PL Biambare is an important site in their stay program, despite the fact that nature is not their primary motivation but rather VFR. There are several reasons why Bosnian Americans are returning visitors to Biambare (as they mentioned in the interview): quality time in nature; the availability and simplicity of a protected area; socialization; looking for an opportunity to find a partner from the same culture. In their opinion, open green areas are more practical than closed ones (cafés, etc.) for establishing new contacts. They even compared the availability and utilization of some protected areas in the *United States* to those in *Bosnia and Herzegovina,* and *Sarajevo*, and pointed out that *PL Biambare* is more suitable because of the short distance from the city; as well it enables a safe stay and an independent walk in a tamer forest; the ticket is cheaper; and the site is much nearer their residence.

Foreign tourists from faraway countries such as Malaysia and Australia are understandably neutral, given the enormous geographical distance and the fact that their primary motivation for

visiting Sarajevo was its multicultural image as *"European Jerusalem"* rather than a green city. Plus, some of them stated they count themselves as *"world tavelers"* and prefer to meet new sites rather than visit the same ones.

When it comes to residents, the dominant contingent of respondents strongly disagreed that they would stay loyal to this site if the ticket price increased. It's mostly local people who live in the surrounding area (Krivajevići, Nišići, Olovo, Ilijaš, etc.) and have lower economic standards. Therefore, an expensive ticket could be a limitation for them to visit Biambare as their priority site.

Table 5. Total loyalty (%)

Positive	67
Neutral	8
Negative	25

Source: Own research

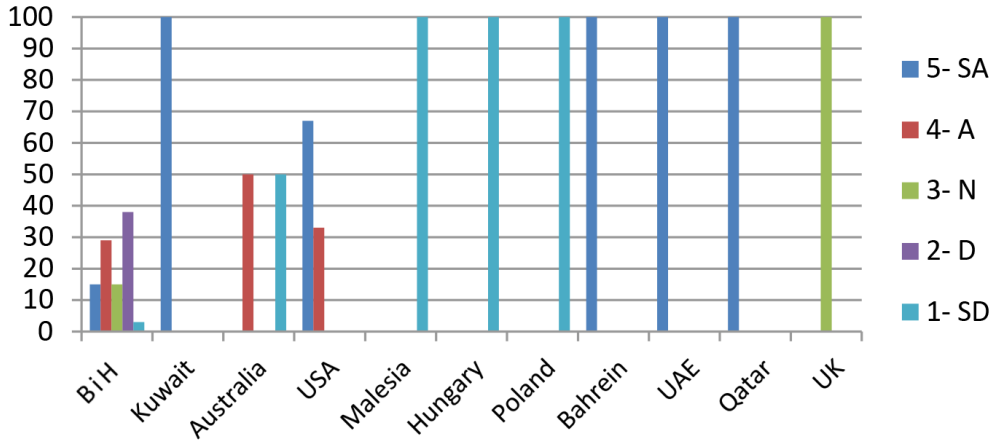

Figure 11. Total loyalty by the arrivals (%)

Source: Own research

Table 6. Arithmetic mean as an indicator of loyalty

Marks (x)	Frequency (f, %)	Product (fx)	AM ($\bar{x}$)
5	50	50*5=250	3.85
4	17	17*4=68	
3	8	8*3=24	
2	18	18*2=36	
1	7	7*1=7	
	∑f=100	∑fx=385	

Source: Own research

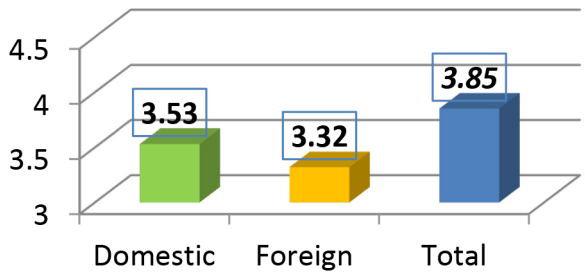

Figure 12. The origin structure of loyalty

Source: Own research

However, loyalty is higher among domestic visitors than foreign ones (3.53 vs. 3.32), which is logical because protected areas are the biggest benefit for locals (return visitors), as they provide a pleasant stay in nature close to home. The green sites are preferable for weekend recreation and socialization, as well as for health improvement. Leung et al. (2014), EEA (2012), Žunić (2022), and other sources state numerous benefits of protected areas for local people: „socio-cultural", „economic", „environmental", and, in the first place, an improvement of health and quality of life. „Protected areas provide a set of health activities called "green exercises": recreation, joy, relaxation, walking, staying in nature, meditation, stress relief, and immunization" (Žunić, 2022). According to information at the Biambare reception, most frequent domestic visitors are from Olovo and Sarajevo. Their primary motive is to stay in nature, but family visitors favor this site because of its landscapes and available facilities for children (*the Wood city*, sports fields, playhouses, walking paths, and eco cart/ „train"). Most of the local respondents consider that staying at Biambare is useful time well spent because family and friends gather in a healthy environment, generating numerous benefits such as recreation, socialization, games and fun, health, etc.

- ***WOM marketing,*** which is determined by ***"recommendation and persuasion,"*** is majority positive (82%), and it's generally the dominant share of strongly agreeing on attitudes among three measured parameters (satisfaction, loyalty, WOM). It's even higher among foreign than among domestic visitors (4.35 vs. 3.93).

Table 7. Total WOM marketing (%)

Positive	82
Neutral	3
Negative	15

Source: Own research

According to the structure of respondents by arrivals, the highest intensity of promotion intention (SA) is found among the visitors from the Middle East, USA, UK, and Australia, but it's also positive for Malaysians and residents. Their *word of mouth* will be an effective stimulant for new visitors to the Biambare site in the future.

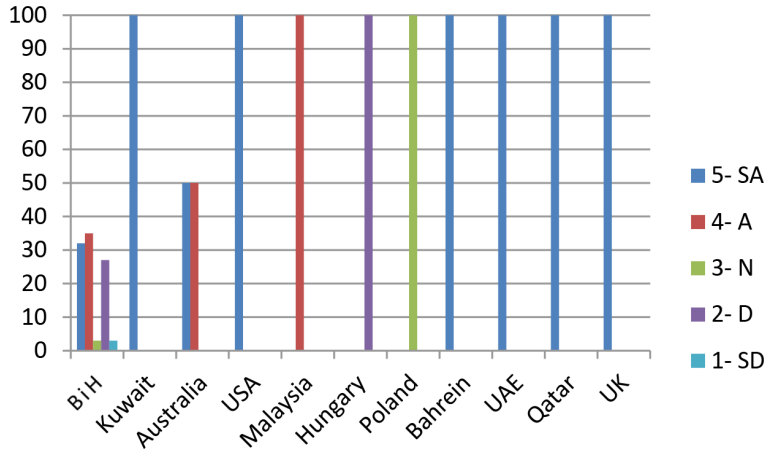

Figure 13. Total WOM by the arrivals (%)

Source: Own research

The fact is that the number of tourists from the Middle East at Biambare is growing lately, and they are the best living example of the type of visitors who are actually well inclined and stimulated by the recommendation of their friends and relatives, as Urry & Larsen (2011) emphesized. This is exactly what they responded to when they were asked about their way to deciding

to visit Sarajevo and Biambare. Evidence of WOM effects on Arabian visitors of Sarajevo was confirmed by tourist employers who work with these clients as well (Žunić, 2018). USA visitors are also affected by WOM's promotion of Bosnia, Sarajevo, and Biamabre, not only by Bosnian Americans but also by other Americans who shared their positive impressions; some of them even announced them in the most popular daily magazine, *The New York Times*, which says "Bosnia is no longer a taboo destination, but a destination worth visiting" (Johanson, 2014).

Table 8. Arithmetic mean as an indicator of WOM marketing

Marks (x)	Frequency (f, %)	Product (fx)	AM ($\bar{x}$)
5	63	63*5=315	4.29
4	19	19*4=76	
3	3	3*3=9	
2	14	14*2=28	
1	1	1*1=1	
	∑f=100	∑fx=429	

Source: Own research

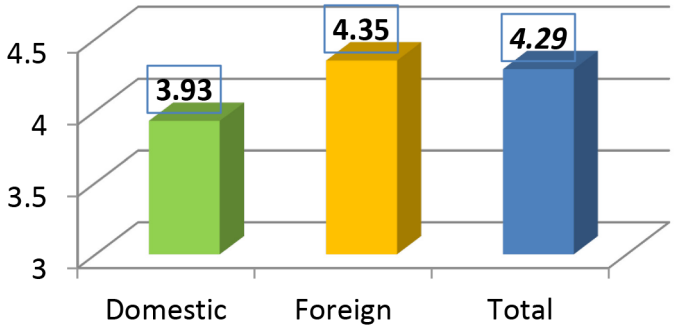

Figure 14. The origin structure of WOM marketing

Source: Own research

Table 9. Sum parameter evaluation

AM ($\bar{x}$)	Domestic	Foreign	Total
Satisfaction (S)	3.93	4.15	4.24
Loyalty (L)	3.53	3.32	3.85
(WOM) Promotion	3.93	4.35	4.29
Total average:	***3.80***	***3.94***	***4.13***

Source: Own research

From the table of sum parameter evaluation, we can conclude there's a strong relationship between S-L-WOM, especially between "satisfaction" and "WOM marketing," while "loyalty" could be more dependent on the profile of tourists. The overall tourist image of Biambare is positive. Obviously, this is a popular Bosnian green site with higher tourist value. Carballo et al. (2015) stated that „the image is a fundamental element in the promotion of tourism destinations since what differentiates one destination from another is key to its success" (Huete-Alcocer & Lopez-Ruiz, 2019).

5. FUTURE RESEARCH DIRECTIONS

Future research should focus on more specific attributes of satisfaction, loyalty, and WOM promotion, as well as on the aspects of loyalty in relation to the tourist profile. The study was based on a simple questionnaire to understand three relevant parameters of the site's image. It was

conducted directly on the site, and it was important to save visitors' valuable time. Additional information was collected in a more casual way during the parallel interview with respondents. As a result, future research should be divided into phases to separately measure each of the examined indicators, and the survey should include precise variables (attributes) defined selectively for satisfaction, loyalty, and WOM marketing. This type of research should significantly impact the further development of Sarajevo and the Biambare tourist supply.

6. CONCLUSION

Biambare's protected landscape has a positive tourist image. It's a popular Bosnian green site with rising tourist appeal. To improve the overall quality of satisfaction, PL Biambare's future development should focus on receptive content and the creation of special programs. Camping and well-organized thematic tours, such as guided forest hiking or herb and mushroom picking, are still lacking. There are also a limited number of rest areas (shadirwan, benches, and a cafe) and parking spots. Some general satisfaction barriers observed on the site include:

- parking deficiency;
- a lack of benches and "shade fountains" (shadirwan);
- a scarcity of well-marked forest trails;
- a lack of hospitality (catering);
- a lack of special programs (e.g., picking mushrooms and medicinal herbs with a tour guide, etc.);
- unexplored or insufficiently explored caves (Central Cave is the only well-organized cave for visitor tours).

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The Role and Importance of Women in the Revitalization of Intangible Heritage in Order to Maintain the Competitiveness of the Destination

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Gender

Abstract: *Within the Croatian intangible cultural heritage, traditions and customs, due to their specific functions, occupy a unique place in tourism. The oral transmission of tradition, the culture of memory is manifested in the contemporary application of traditional customs as the most vital model of duration, regardless of the new way of life in which traditional customs have lost their significance. This paper aims to highlight women's role in tradition's transference - a practice that belongs to women within the framework of intangible cultural heritage, but also female creativity which is closely related to sustainable tourism. Protected cultural goods of intangible heritage represent forms of cultural expression of particular importance in a certain area. Their historical roots testify to their exceptional value from a historical, artistic, ethnographic, sociological, anthropological, linguistic, or literary point of view. Intangible cultural heritage, which is passed down from generation to generation, provides a sense of identity and continuity and thus promotes respect for cultural diversity and human creativity. The paper aims to point out the role of intangible cultural heritage as a generator of destination development and the active role of women.*

1. INTRODUCTION

Cultural tourism, although one of the oldest selective forms of tourism, still today remains one of the forms that cannot be precisely defined. The activities and places that were visited, which today are called cultural content and the type of travel that is now called cultural tourism, were traveled as far back as the time of the ancient Romans who traveled to Greece and Egypt. Such trips, which included sightseeing at historical sites, and visits to festivals, events and museums, were part of a wider lexicon of sightseeing activities that formed a complete tourist experience (Du Cros & McKercher, 2015). Cultural tourism enables visitors to get to know different aspects of a certain culture in the destination they are traveling to and thus enriches tourists with new knowledge, and possibly the local population with knowledge on the part of visitors and a better understanding of tourism demand as a whole. *Cultural heritage includes artifacts, monuments, groups of buildings, and sites that have different values, including symbolic, historical, artistic, aesthetic, ethnological or anthropological, scientific, and social significance.* (Richards, 1996:25)

Man has always belonged to a horde, a tribe, or, later, a nation. All that time within a certain nation meant the development of specific customs and the creation of its own traditions. This, in turn, favored the development of different cultures of expression, behavior, and work that become the identity of the people themselves, that is, they represent part of the cultural heritage of the people. *Cultural heritage can generally be divided into tangible and intangible. Intangible heritage is mainly created by the transmission from generation to generation and the oral*

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transmission of customs of a certain group of people in a certain geographical location, while tangible cultural heritage represents what man has made with his own hands or found in nature. (Horvat Majzek, 2018:69)

One of the very detailed definitions of intangible cultural heritage explains - *That "intangible cultural heritage" means the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artifacts, and cultural spaces associated therewith that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature, and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity. (Scovazzi, 2012)*

The sustainable development of tourism is based on the balanced management of ecological, socio-cultural, and economic development that will preserve the socio-cultural identity of the local community, improve their quality of life and ensure their well-being, while the development of quality tourist products and services will improve the quality and experience of tourists' satisfaction. and all this with the rational use and preservation of resources for the long-term generation of the aforementioned and the possibility of future generations using these resources. (Klarin, 2018)

When talking about the typology of cultural tourism, considering its diversity and complexity, it can be divided into several categories. For example, Smith distinguishes in his book (Smith, 2009):

- heritage tourism,
- art tourism,
- creative tourism,
- urban cultural tourism,
- rural cultural tourism.

Heritage tourism refers to everything that is material. These can be castles, buildings, palaces, monuments, archaeological sites, etc. Heritage tourism also includes intangible cultural and historical heritage, i.e. ceremonies, festivals, customs, manifestations, etc. Tourist destinations try to attract tourists by presenting their past, showing through different cultural and historical values. In this way, they try to create a specific and unique image of what the destination offers tourists, introduce tourists to its traditions, and enable them to gather new knowledge and experiences. The role of women has changed throughout history. When it is correlated with the creation of cultural heritage in the past, women can be viewed from an ideological and cultural point of view, according to which it is considered that women are more in touch with the emotional sphere. From a socioeconomic point of view, women are placed in the area of reproduction, education, and household care. The relationship between women and the revitalization and protection of material cultural values can be viewed from two aspects: from the aspect of women as active creators in the creation of cultural tangible and intangible heritage, and the second is the role of women in transmitting knowledge in the creation of tangible and intangible cultural heritage. The distinction between male and female roles, "typically female roles" is the subject of this paper.

Gender has become an important factor in the economic processes of globalization, a criterion on which the world economy counts and by means of which certain market-economic relations and forces in that market are shaped and/or restructured. Gender is one of the main categories of social

life as one of the oldest characteristics of people. Historically looking at gender roles, men were seen as leaders, financial caretakers, and heads of the house, while women were the ones who did the shopping, maintained the home, and provided care and emotional support. Gender salience, as an important factor in the activation of stereotypes, indicates the extent to which a person's gender is highlighted. For example, if we see a woman with an extremely stereotypical appearance, we are more likely to expect that she has "typically female" personality traits and a "female role". Considering gender roles today, it is the woman who desperately tries to remove the stain from her favorite dress, chooses the best hair shampoo to attract "all the men", and chooses the healthiest biscuits for her children, while the man helps the neighbor with household repairs, knows which bank offers the most favorable loan, and he gets a raise, but with it "flexible working hours". Historically speaking, women were the ones who made Lepoglav lace, whose role and significance in the framework of sustainable tourism is the subject of this research.

2. RESEARCH OBJECTIVES AND DISCUSSION

In sustainable tourism, women have a significant role in preserving intangible heritage, given the fact that throughout history they have created it. Natural and cultural heritage, as the basis of life and identity, is a permanent problem in societies. Women have made great progress within the formal labor market during the last quarter of the 20th century, which is the result of, among other things, women's resistance to the system of inequality and policies that allowed gender discrimination in the labor market, various dimensions of labor discrimination are still present in that market, and when it comes to sustainable tourism, they are expected to play a significant role in the protection of tangible and intangible cultural heritage. Croatian society is a modern society, but it has a number of characteristics of traditional culture, which was historically created by the collective action of people in different localities (regions), hence the diversity and wealth of heritage. Tradition has provided us with numerous material, social and spiritual goods that form cultural heritage. Tradition is not the past but *preserved progress, progress is continued tradition* (Weizsäcker, 1988).

Traditional societies are slowly changing, reproducing societies with an unchanged natural and cultural environment, in which the role of women is clearly defined. That is why they are able to accumulate and use the inherited assets and value system as cultural heritage. It may be contradictory, but it was in that society that most of the cultural heritage was created - from the construction characteristic of the wealthy class to social (marriage, customs, the relationship between men and women) and spiritual traditions (beliefs, religion, ethos). Tradition consolidates and preserves cultural heritage, especially intangible, but over time it acts selectively, so some "products" of culture fall into oblivion.

The skills, knowledge, and technologies of making today's significant cultural products are not devoid of identity. The classifications of trades have changed over time, but the basic division in this sphere is based on gender identity. The division into men's and women's trades originates from the oldest period of human history. Some authors call women's crafts "occupations". The products of women's craftsmanship come from domestic craftsmanship. They were rarely intended for the market, they mainly served to meet the needs of the family or the cooperative.

According to the above, defined research objectives:

- the current tourist offer focused on intangible cultural heritage is based on the gender division of traditional crafts and skills, which economically encourages the development of the local community;

- a key role in the promotion of modern and sustainable tourism in the local context and the expression of identity is played by traditionally female crafts and skills;
- the local community through the organization of events, education and other content becomes an active participant in economic progress and gender inclusion using the variety of intangible cultural heritage;
- intangible cultural heritage becomes a generator of local community development, increasing gender inclusiveness and familiarity with the destination itself.

Hypothesis One: Cultural heritage is one of the instruments of cultural identity and promotion of diversity and it is impossible to present it without intangible cultural heritage.

Hypothesis Two: The gender approach to intangible cultural heritage additionally affirms cultural heritage, and at the same time makes women step out of the sphere of invisibility and become an agent of development and an important stakeholder in sustainable tourism.

3. METHODOLOGY

The scientific method used to collect primary data was a survey, and respondents gave their answers anonymously. The research was conducted on a deliberate random sample of all visitors who have stayed in Lepoglava at some point and based on their experience have an experience of Lepoglava as a tourist destination. The research was conducted on 253 respondents who stayed in Lepoglava and know the elements of making Lepoglav lace. The sample consisted of 253 respondents. Regarding gender, there are 162 (64%) women and 91 (36%) men. The majority of respondents are aged 36-45, 92 of them (36.4%), 32 (12.6%) are under 25, 57 (22.5%) are between 26-35, 38 (15%) respondents are aged 46-55, 26 (10.3%) respondents are 56-65 years old, while 8 (3.2%) respondents are over 66 years old. According to the level of education, 87 (34.4%) of the respondents have a higher professional degree/master's degree, 80 (31.6%) have a second professional degree, and 68 (26.9%) have a higher professional degree/bachelor's degree. The least number of respondents, 8 (3.2 %) have a doctoral degree, and only 10 (4.0 %) have completed elementary school. At most, 174 (68.8 %) respondents are employed persons, 22 (8.7 %) are retired, 16 (6.3 %) are students, 11 (4.3 %) are postgraduate students, while there are a smaller number of respondents with their own OPG, craftsmen or subjects of some other employment. According to the number of household members, 125 (49.4%) respondents live in a household with 4-7 people, 124 (49%) with 1-3 people, while only 4 (1.6%) respondents stated that they live in a joint household with 8 and more people. 101 (39.9%) respondents have incomes higher than HRK 7,001, slightly less, 54 (21.3%) of them have incomes from HRK 5,001 to HRK 7,000, 38 (15%) respondents have incomes from HRK 3,001 to HRK 5,000, and up to HRK 3,000 per month, there are 28 (11.1%) respondents. 32 (12.6%) of the respondents stated that they did not have their own income.

Table 1. Measures of mean and dispersion, and coefficient of internal reliability (Cronbach Alpha) of the rating scale of Lepoglav attractions according to personal taste

	N	Arithmetic middle	SD	Minimum – maximum	Cronbach Alpha
Days of Lepoglav lace	253	4,10	1,1	1-5	0,806
Mineral fair - Lepoglav gate	253	3,86	1,2	1-5	0,806
An extinct volcano	253	3,82	1,2	1-5	0,806
Pauline culture	253	3,70	1,2	1-5	0,806
Penal correctional facility in Lepoglav	253	3,04	1,4	1-5	0,806

Source: Own research

Means and dispersion of ratings of Lepoglav attractions according to personal taste are shown in Table 1. We notice that the most attractive is Lepoglav lace, arithmetic mean of 4.10 (standard deviation SD 1.1), mineral fair - Lepoglav agate arithmetic mean of 3.91 (SD 1,1), the Pauline culture with an arithmetic mean of 3.86 (SD 1.2), the extinguished volcano of an arithmetic mean of 3.82 (SD 1.2), then the Pauline culture with an arithmetic mean of 3.70 (SD 1.2), and the least attractive Penal correctional facility in Lepoglavan with arithmetic mean rating of 3.04 (SD 1.4). The Cronbach Alpha internal reliability coefficient for the rating scale of Lepoglav attractions according to personal taste is 0.806, which means that it is a good tool for evaluating individual attractions according to personal taste in our sample.

In Table 2, we can see that 138 (54.5%) respondents bought a souvenir that exudes and tells the story of Lepoglava culture while visiting Lepoglava, and 179 (70.8%) of them stated that they were satisfied with the souvenir and repeated the purchase. 29 (11.5%) respondents bought souvenirs in the tourist community, at a fair or event in Lepoglava and 75 (29.6%) respondents, and 28 (11.1%) outside the city of Lepoglava. 121 (47.8 %) respondents bought the souvenir elsewhere. When asked which of the souvenirs seen tells the story of the town of Lepoglava as a tourist destination the most. 92% of respondents stated that the Lepoglav lace is the most expressive souvenir and without it, it is impossible to imagine the city of Lepoglava as a destination.

Table 2. Distribution of respondents according to whether they bought a souvenir, where they bought it, and whether they were satisfied with the souvenir and repeated the purchase

	Number (%) of respondents
When visiting Lepoglava, did you buy a souvenir that exudes and tells the story of Lepoglava's culture?	
NO	115 (45,5)
YES	138 (54,5)
If your answer is yes, where did you buy the souvenir?	
To the Tourist Board	29 (11,5)
At a fair or event in Lepoglava and its surroundings	75 (29,6)
At a fair or event outside the city of Lepoglava	28 (11,1)
Else	121 (47,8)
Are you satisfied with the souvenir and repeat the purchase?	
NO	74 (29,2)
YES	179 (70,8)

Source: Own research

Using the Student's t-test, we tested the existence of a difference in the assessment of familiarity with certain attractions in relation to whether they had visited which landmark of Lepoglava. We set the significance level at $\alpha = 0.05$. All probabilities (p) are lower than the level of significance, and we can say that there is a significant difference in the evaluation of all attractions according to whether the respondents visited one of the sights or not, that is, hypothesis H1 is accepted, which reads: The experience of Lepoglava as a prison town by the general public of Croatia has changed. As we can see from Table 3, the respondents who visited one of the sights of Lepoglava gave a significantly higher rating to the knowledge of certain attractions compared to those who did not visit the sights. Those who visited one of the sights rated their knowledge of Lepoglav lace significantly better ($t = -4.5$, $df=121$; $p < 0.001$), the mineral fair - Lepoglav agate ($t = -5.3$, $df=251$; $p < 0.001$), an extinct volcano ($t = -4.5$, $df=251$; $p < 0.001$), Pauline culture ($t = -6.9$, $df=251$; $p < 0.001$), and KPD Lepoglav ($t = -2, 2$, $df=251$; $p < 0.001$). The highest score for knowledge of individual attractions was Lepoglav lace with a score of arithmetic mean of 4.13 (standard deviation of 1.1), and the extinct volcano was the least known, with a score of arithmetic means of 3.05 (standard deviation of 1.04).

Table 3. Knowledge of individual attractions of the City of Lepoglava in relation to whether they have visited any of Lepoglava's landmarks

Have you visited any of the sights of the city:		Number of the respondents	Arithmetic Middle (SD)	Difference	95% range reliability FROM TO	t (df)	P*
Days of Lepoglav lace	NO YES	80 173	3,33 (1,4) 4,13 (1,1)	-0,808	-1,2 -0,5	-4,5 (121)	<0,001
Mineral fair - Lepoglav gate	NO YES	80 173	2,19 (1,3) 3,17 (1,4)	-0,986	-1,4 -0,6	-5,3 (251)	<0,001
An extinct volcano	NO YES	80 173	2,21 (1,3) 3,05 (1,4)	-0,840	-1,2 -0,5	-4,5 (251)	<0,001
Pauline culture	NO YES	80 173	2,41 (1,3) 3,58 (1,2)	-1,171	-1,5 -0,8	-6,9 (251)	<0,001
Penal correctional facility in Lepoglav	NO YES	80 173	3,46 (1,3) 3,84 (1,2)	-0,376	-0,7 -0,05	-2,2 (251)	0,026

Note: *Student's t-test

Source: Own research

Preservation of natural and cultural heritage is part of the national awareness of its identity past and present, but also part of the heritage that belongs to global movements for the protection of natural and cultural diversity. Heritage is what is inherited (locally, nationally, globally) from the past and a number of previous generations and its interpretation in the touristic sense are impossible without the role of women. Preservation of heritage is a relationship between tradition and the future - future generations. Protection and preservation guarantee the affirmation of some values of tradition and accessibility in use.

Table 4. The connection between women and intangible cultural heritage through the prism of respondents about Lepoglav lace

Your opinion on the role of women in the creation and preservation of cultural intangible heritage on the example of Lepoglav lace	
Elements	Pearson correlation coefficient (r)
The role of Lepoglava lace in cultural events	0,302**
The connection of Lepoglav lace with other works of art from Lepoglava	0,399**
Lepoglav lace in the myths and legends of the region	0,473**
Lepoglav lace has a religious meaning for the inhabitants of Lepoglava	0,458**
Lepoglav lace has a metaphysical meaning for the inhabitants of Lepoglava	0,442**
Lepoglav lace is recognizable beyond the borders of Croatia	0,716**
Lepoglav lace is a reflection of female creativity and skill	0,464**
Love for the land is woven into the Lepoglav lace	0,499**
In history, Lepoglav lace represented a way of using free time	0,506**
Making Lepoglav lace today is a matter of preserving tradition	0,435**
Lepoglav lace should be used more in the production of other clothing products	0,325**
Making Lepoglav lace is exclusively a women's craft	0,531**
Lepoglava lace is an original souvenir of the Lepoglava region	0,488**

Note: ** $p < 0,01$

Source: Own research

The centuries-old tradition of making lace in the Lepoglav area gave birth to and has preserved to this day a distinctive form of lacemaking, which is primarily recognizable thanks to the talent of Danica Brossler. Her talent was followed by a large number of hard-working women - lacemakers who knew how to translate her ideas into a finished product - which we recognize today as Lepoglav lace (Vrtiprah, 2006). Only women participate in the production of Lepoglav lace, and with their knowledge, skills, and techniques, they represent the character of Lepoglava and Varaždin County and the spirit of the local population of the entire county. Women's jobs included the

making of clothes and other items, which often went beyond their use value and became part of a valuable heritage in the household, church, or monastery. The authors of valuable items and decorations made of lace and embroideries of high artistic value most often remained anonymous, and their products made of sensitive and consumable materials, canvas, wool, silk, and thread were easily destroyed. In the skill of embroidery, the nuns in the monasteries took the lead and made and decorated church and priestly vestments from fine and expensive materials (silk, silver and gold threads, pearls). Table 4 shows the relationship between women and Lepoglav lace. Table 4 indicates a positive correlation between the role and importance of women in the production of Lepoglav lace. The value of the correlation coefficient from 0 to 1 is a positive correlation and indicates a balanced relationship between women, the making of Lepoglav lace, its importance in national identity, and the necessity of preservation. The role of Lepoglav lace in cultural events r=0.302; Correlation of Lepoglava lace with other works of art from Lepoglava r=0.399; Lepoglav lace in myths and legends of the region r=0.473; Lepoglava lace has a religious meaning for the inhabitants of Lepoglava r=0.458; meaning for the inhabitants of Lepoglava r-0.442.

Due to the size of the community (spatial and population), as well as the fact that the town of Lepoglava hardly has a person who is not in some way or another directly related to Lepoglava lace (be it a family member, fellow resident, acquaintance, etc.), the culture of the Paulines (priests) who recognized the beauty of lace so many years ago, today represents a very specific cultural phenomenon.

With the great division of labor in the past, it was women who stood out, whose skill was recognizable and enabled them to have better living conditions through lace making. Craftsmanship was highly valued in all time and space units. In our country, even today, it is said that "a craft is worth its weight in gold", and one who "creates what he sees with his eyes" is regarded as very capable.

In the era of industrialization, some trades are gradually dying out, and some are disappearing. Their products, which are still used, evoke nostalgic memories of the "good old days". What makes craftsmanship, and especially the art of making Lepoglav lace, specific compared to other categories is their non-national character. Namely, the making of Lepoglav lace is conditioned by the skills of natural resources, and the social life of the Lepoglav region, and is therefore tied to the identity of the local community, which was created and preserved from decay by women.

4. FUTURE RESEARCH DIRECTIONS

Future trends of personalization and niche markets in tourism can be used to strengthen further and emphasize the importance of intangible heritage and women's role in it. Each destination could built-on on its USP and become more prominent and attract high-ticket clients. Providing finance for young scientists to dig deeper into these themes and with research results give precise answers to their communities, regions, local businesses, and women because they have skills but do not have the resources and knowledge to make a good living from these skills. There are numerous examples like Lepoglav in Croatia because of our rich history and handy people/women. For instance: Korčula's cake Lumblija or Strudelfest in a small village near Karlovac. Both examples are part of an intangible heritage passed by women; mother to daughter for centuries. In this way, it is possible to strengthen the local economy, and the significance of some niche destinations, keep young women in smaller towns and ensure their secure existence and independence. Traditionally women's crafts and skills play a key role in the promotion of modern and sustainable tourism in the local context. This hypothesis could be further investigated.

5. CONCLUSION

Observing concrete opportunities on selected examples and interesting ones exposed to strong depopulation, especially in rural areas, it is essential to achieve communication with young people who are a necessary element in defining a general and gender approach to cultural heritage. The educational system plays a particularly important role in this, through which it is possible to influence the change of the cultural model. Changing consciousness and patriarchal patterns is a long-term process that requires the involvement of all social structures. At the level of the local community, it is necessary to analyze cultural practices in detail and harmonize them with the own dynamics and development plans of the tourist destination. By introducing a gender perspective into local tourism policies, it is possible to influence the speed and efficiency of establishing gender equality. The manner and dynamics by which knowledge and skills will be affirmed as unused capacities of women, especially in rural areas, will establish the process of embedding this approach in the entire cultural heritage as an indispensable cultural and touristic product. To be yourself, to find your uniqueness, to harmonize the experiences of the elderly and the needs of the young, to nurture and be proud of tradition, to transform resources into a sustainable economy - this is the imperative of preserving women's heritage, as shown by examples and conducted research.

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Global Stagflation Shocks: Macroeconomic Challenges and Repercussions

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Keywords:
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Abstract: *This paper analyses key macroeconomic repercussions of the global pandemic and geo-political crises in terms of growing recessionary and inflationary pressures, and finally, the potential occurrence of stagflation. Primarily, stagflation shocks in the 1970s are analyzed and compared to the current crisis for the period January 2020 - July 2022 in the example of selected economies (the United States, Germany and France). Descriptive analysis showed that in the observed period, inflationary and recessionary pressures existed in USA, Germany and France; however, those pressures could not be identified as stagflation, since they did not happen simultaneously. Namely, during the pandemic crisis, recessionary pressures were present, since the GDP growth decreased till the first quarter of 2021 in analyzed economies, while inflation rates were stable. On the other hand, with the recovery of economies in the second quarter of 2021 inflationary pressures were stronger, intensified by the geopolitical crisis. Therefore, it seems that the most visible anomaly of the global economic system in 2022 is the presence of inflationary pressures.*

1. INTRODUCTION

This paper investigates the realization of targeted macroeconomic goals in the circumstances of global discontinuities, which could lead to stagflation pressures. Namely, the focus is on the achievement of stable, sustainable and permanent economic growth and development of the observed economies when a high dose of uncertainty and insecurity in the global environment exists.

For the policymakers, the observation and improvement of three macroeconomic indicators are of primary importance: an increase in gross domestic product, a low unemployment rate and low inflation. These indicators are mutually intertwined as will be discussed. So far, it has been assumed that it is almost impossible to ensure a strong pace of GDP growth without reducing unemployment or without suffering inflationary pressure. Namely, conducting an anti-inflationary policy would come at the expense of a slightly lower gross domestic product with a higher unemployment rate. The bottom line is that there is bad news as well as good news. Current circumstances, which are a reflection of exogenous health shock and the current geopolitical crisis, lead to an even more complicated situation. Namely, nowadays economic policymakers are faced with the simultaneous pressure of inflation and recession, which can be recognized as stagflation.

Stagflation occurs when the economy experiences a halt or decline in production, a drop in overall output and an increase in unemployment, as well as high inflation. Hence, all three macroeconomic indicators are going in the wrong direction, and the economy is simultaneously threatened by output decline and inflationary adjustment. Furthermore, in the presence of stagflation pressure, high inflation and a stagnant economy can fully coexist, or low inflation and a growing economy, which has not been the case so far. Thus, the arrival of stagflation was something completely new, and far more complex for the functioning of the entire macroeconomic

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system that requires completely new solutions with a comprehensive approach and analyses (Boesler & Graffeo, 2022).

The goal of this paper is twofold: (1) to elaborate a review of the stagflationary shocks of the 1970s and (2) to conduct a descriptive analysis of potential stagflationary pressures in the period 2020-2022 during the pandemic and geo-political crises, evaluating the key macroeconomic indicators of the United States of America (USA), Germany and France. Hypotheses analyzed in the paper are: (H_1) recessionary pressures are present in the USA, Germany and France in the period January 2020 - July 2022; (H_2) inflationary pressures are present in USA, Germany and France in the period January 2020 - July 2022; (H_3) stagflationary pressures are present in USA, Germany and France in the period January 2020 - July 2022.

The rest of this paper is organized as follows. After the introduction, section 1 presents the literature review, section 2 deals with the speculative analysis of stagflation, and section 3 discusses the stagflation shock during the 1970s. Section 4 tests the functioning of the global economy through the presence of fear of stagflation caused by the emergence of Covid-19, and the prolonged escalation of geo-political relations between Russia and Ukraine. Concluding remarks are summarized within the last section.

2. LITERATURE REVIEW

The emergence of stagflationary pressures is a current and increasingly omnipresent topic that is discussed vigorously on a global scale. It directly affects the functioning of the state, the development of the economy, as well as the economic standard of individuals. Taylor (2022) explains stagflation as the worst experience of the 70s of the last century, indicating that the economic environment needs more than a decade to revitalize its constructs. Torry (2022) points out that the effects of stagflation shocks are seen as a trap through which the world's economy passes, due to the negative trends that stagflation brings with it, such as the radical destruction of the macroeconomic system. Koenigsberg (2022) explains the phenomenon of stagflation as a nightmare faced by economies, which has a harsh effect on key macroeconomic variables. Shipman and Tomlinson (2022) indicate that this far-reaching problem reflects chronic problems at the global level, emphasizing a high dose of stagflation fear, which resulted in a "flood" of ministerial resignations (mainly Ministers of Economy). Accordingly, only those countries which start working hard "today" and make extremely difficult decisions will be able to overcome the crisis.

Koegh (2022) emphasizes that the world's number one problem when it comes to the macroeconomy is rapidly growing inflation, describing its distorting effect on the purchasing power of the population; namely, this is explicitly reflected in the goods market's demand reduction, which spills over into the labor market's demand decline and consequently brings down the entire aggregate supply. Accordingly, problems of such proportions should be suppressed at the moment of creeping growth, and not at the moment when they take on galloping proportions. Rossouw (2022) indicates that at the moment the biggest problem of the global economic system is rising inflation because people on fixed incomes such as pensioners are getting poorer over time. As inflation rises, their purchasing power decreases.

Hawkins (2022) believes that "inflationary psychology" is a phenomenon that currently represents the foundation of the macro-economic problems; hence, the expected rise in prices tomorrow accelerates consumption today, automatically reflecting on damaging aggregate demand and price

accumulation. Therefore, the reaction of the economic authorities, which is "required" to curb inflation through higher interest rates and reduce government spending, just pushes the economy into recession. Granville and Martin (2022) point out that the decline of economic activities is a crucial problem, believing that the form of the recession cannot be accurately predicted. However, one is certain, the recovery will not be fast, and that the economies will have to make a lot of efforts to return to the level of economic activity before the emergence of Covid-19.

Dolar (2022) indicates that the eventual continuation of the tightening of relations between Russia and Ukraine would lead to an increase in the price level of oil derivatives, which would increase global inflation, moreover a gradual entry into the phase of recession, i.e. possible stagflation. Olney (2022) explains that the presence of inflation is an enormous problem that can occur due to two reasons. The first reason is that there is an increase in demand that results in an increase in the price level, while the second reason refers to disruptions in the supply chain. Furthermore, he points out that the limited supply of oil derivatives, electricity, or agricultural inputs could be recognized as a stagflation generator, highlighting the fact that people nowadays buy less at higher prices.

Katić (2022) indicates that the global economy has reached the highest level of uncertainty and that almost all economic activities are getting out of control. Namely, some „hidden hand is pushing us into ruin", referring to the "state that thinks", with the active intervention of the state apparatus to remove the negative consequences of the market model of the functioning of the economy.

Kapoor (2022) points out that an eventual rise in interest rate levels by Central Banks in response to a rise in price levels would have the effect of wreaking havoc on household budgets. The author also asserts two essential reasons that preceded the current condition of the global economy - first, the decline in industrial production caused by the emergence of Covid-19, and second, the effects of events on the territory of Ukraine.

3. THEORETICAL FRAMEWORK OF STAGFLATION

The theoretical framework of stagflation analysis can be based on the application of the AS-AD model, on which basis, it is possible to see the dynamics of changes and the effects of shocks caused by stagflation movements. To analyze the effect of external shocks and macroeconomic repercussions, diagram 1 is presented. Diagram 1 shows two axes (X and Y). On the Y-axis is the price level within one economy, that is, the economic system, while on the X-axis is the movement of output, that is, the produced quantity of products in a time interval of one year in one country.

Diagram 1 shows three curves:
- Supply curve AS,
- Supply curve AS'
- AD demand curve.

At the point where the demand curve and the original supply curve intersect, the equilibrium point (E) is read and defines the given price level (p) and the given output level (q). In a situation where there is a negative shift in the supply curve (AS), i.e. moving to the left (or up) and creating a new supply curve (AS'), a new intersection with the original demand curve (AD) creates a new equilibrium point (E'). E' is formed on a new, higher, price level (p') and it is defined with a new, lower, quantity of output (q').

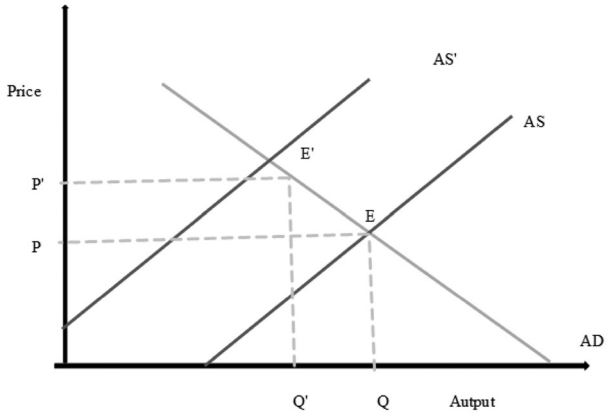


Diagram 1. Stagflation

Source: Author, based on Bajracharya (2018)

The conclusion is that in the new equilibrium point, a smaller amount of products is produced at higher prices, which indicates stagflationary pressures. The question arises, what factors cause a negative shift in the AS supply curve and consequently stagflation? Stagflation most often occurs when there is a supply-side shock, if the supply structure of a key factor of production, such as the supply of labor, electricity or oil, is disrupted. Oil, as one of the key sources of energy, can be used as input and output for almost all existential and business activities. Certainly, the primary importance of understanding a very complex topic is that if a country faces a shortage of the mentioned production factors, it will automatically be reflected in an increase in prices, along with a decrease in production.

Overcoming the situation explained in Diagram 1, refers to the active role of the state and policymakers. In terms of recession, policymakers apply an expansive fiscal policy to initiate and stimulate production in order to return the economy to a state of economic balance. Another high-frequency situation is the occurrence of inflationary pressure. The problem itself was overcome by the gradual application of a restrictive monetary policy, i.e. by withdrawing the money supply from circulation and increasing the reference interest rate, in order to minimize the harmful aggregate demand. When the economy is faced with inflation and recession simultaneously, the application of expansive fiscal and monetary measures would certainly lead to the recovery of the economic environment; however, then inflationary pressure could lead to a hyperinflationary problem, which is certainly not the goal. On the other hand, although restrictive adjustment measures application would return inflation to economic normality, the economy would move from recession to depression and face an even more catastrophic macroeconomic scenario.

The complexity of these problems could be stressed by the fact that stagflation is a rare economic situation; thus, there is no standard solution for overcoming it, especially having in mind that current stagflation is a consequence of war and global economic uncertainty.

4. REVIEW OF THE STAGFLATIONARY SHOCKS OF THE 1970S

The question arises whether any economy has experienced stagflationary consequences so far, i.e. the so-called supply-side shock. The last time such a situation, which economists also call a nightmare, happened in the United States of America (USA) was in the 70s of the last century. Namely, it was a period in which energy prices rose incredibly. The USA is an economy that in

the 1960s and 1970s imported enormous amounts of petroleum products in order to strengthen its macroeconomic structure, accumulate industrial production and generally meet the needs of the population. Jackson (2022) pointed out that everything was completely normal, functioning smoothly until the appearance of the embargo by the Organization of the Petroleum Exporting Countries (OPEC).

At that moment the US economy in a short period simultaneously experienced an increase in the consumer price index, above 10% (such an increase has not been recorded in the US almost since the Second World War), while unemployment jumped from 4.6% in 1973 to 9% in 1975, and GDP plummeted. The OPEC countries continued to increase the oil price in the following period, thus, this was automatically reflected in the fact that inflation grew from year to year, and the economy sank into recession. Doubtless, the USA, as one of the most developed economic systems, tried to minimize the effects of the increase in oil-derivate prices. The USA government changed Americans' lifestyles through policy measures, which was reflected in increased savings and rationalization of the consumption of an irreplaceable energy source (Krugman, 2022).

Table 1. Trends in the rate of unemployment, inflation and GDP in the USA (1968 - 1983)

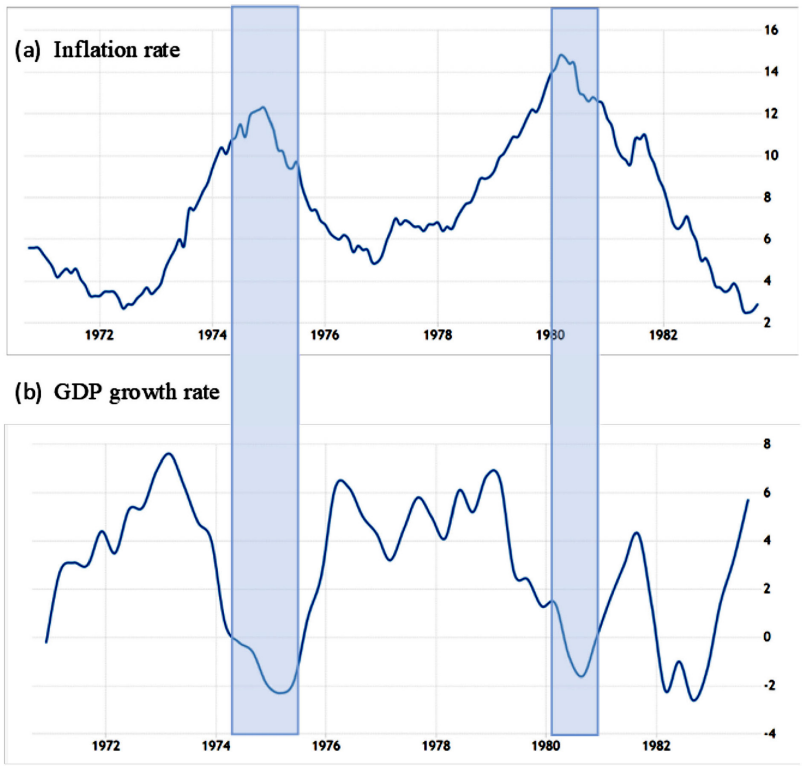
Year	Unemployment rate %	GDP %	Inflation Rate %
1969	3.5	3.1	6.2
1970	6.1	0.2	5.6
1971	6.0	3.3	3.3
1972	5.2	5.3	3.4
1973	4.9	5.6	8.7
1974	7.2	-0.2	12.3
1975	8.2	-0.5	6.9
1976	7.8	5.4	4.9
1977	6.4	4.6	6.7
1978	6.0	5.5	9.0
1979	6.0	3.2	13.3
1980	7.2	-0.3	12.5
1981	8.5	2.5	8.9
1982	10.0	-1.8	3.8
1983	8.3	2.2	3.6

Source: Trading economics (2004)

A strong US economy, which employs hundreds of millions of people, has huge industrial production and has ambitions for further growth and development. If the oil supply on the market decreases, it would automatically lead to an increase in the price level (inflation), while on the other hand, producers would reduce the aggregate supply. Further, a reduction in supply would lead to a decline in national production, with a rapidly growing unemployment rate.

Based on Table 1, it could be concluded that from 1969 until 1982, unemployment rose from 3.5% to 10%. While in the observed time interval, the level of inflation rose from 6.2% to the highest 13.3%. This certainly indicated that the US economy was facing stagflationary movements.

Graph 1 shows that two stagflation episodes were identified, due to two oil shocks, in 1974 and 1979-1980. Beginning with a recession, the 1970s was a decade of pessimism and ended very painfully with the Vietnam War. Memories of the Great Depression made economic policymakers reluctant to use contractionary monetary and fiscal policies to curb inflationary pressures, as it was believed that an increase in unemployment would be completely unacceptable, meaning that the American population would experience additional deflationary adjustment.



Graph 1. Stagflationary shocks in the USA (1969-1983)
Source: Author, according to Trading economics

Graph 1, (panel a) shows the movement of the inflation rate, while (panel b) shows the movement of the GDP growth rate in the United States of America in the time interval 1969 -1982. The conclusion is that the American economy faced simultaneous inflationary and recessionary pressure twice, the first time in the period 1974 - 1975, while the second time was in 1980, which indicated the presence of stagflation.

5. DESCRIPTIVE ANALYSIS OF STAGFLATIONARY PRESSURES DURING THE PANDEMIC AND GEO-POLITICAL CRISES (2020-2022)

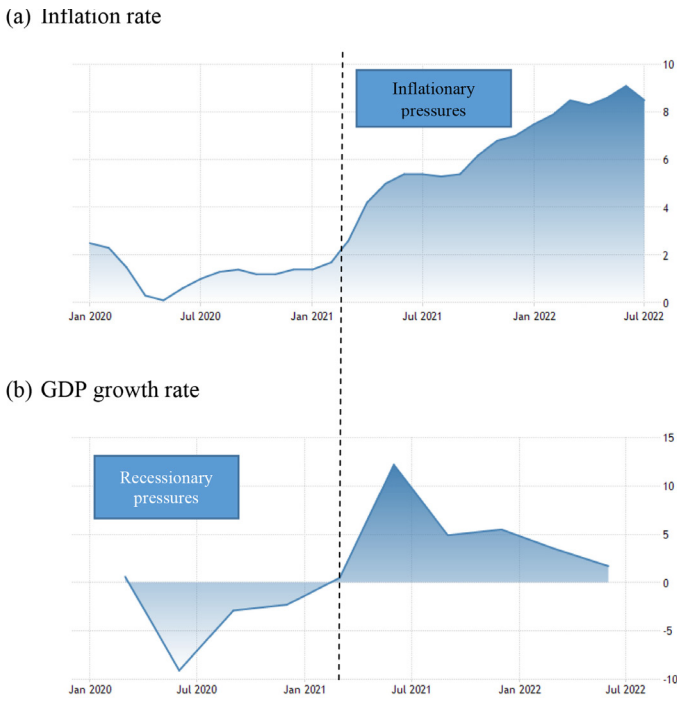
Fifty years after the 1970s, fears of stagflation are vivid again. The combination of rising inflation and slowing economic growth after the initial strong recovery from the Covid-19 crisis has been challenging for major economies around the world. It is expected that the conflict in Ukraine further raises global inflation and further dampens growth momentum. Moreover, in order to make a comparative analysis of the crisis that happened in the 1970s and the one that is happening today, it is necessary to observe from several years back. In the first months of its origin, the coronavirus was considered exclusively as a health problem. However, the speed of its spread which caused the lockdown of economies had final effects in slowing down economic activities. Certainly, it imprinted on the economic context of 2020. Global connectivity, intertwined relations between

countries, dependence on production factors, as well as the high mobility of labor, capital, goods and services, rapidly led to a negative impact on the macroeconomic indicators of almost all countries of the world (Mitchell & Duehren, 2022). The decrease in production was followed by a decrease in demand in the labor market, which was reflected in the increase in the unemployment rate. The decrease in industrial production is mostly noticeable in Germany (almost the most developed economy of the European Union before the pandemic crisis), the USA, and France, but also in the rest of the world. Russia's invasion of Ukraine which began on February 24, 2022, directly complicated enough complex situation for the functioning of the global economy. Ukraine is one of the most important producers of basic food that is an inevitable part of everyone's consumer basket. That country fulfills almost half of the world's needs for sunflower oil, 15% of corn and 10% of wheat. The lack of food was especially felt in the large number of European economies that are directly dependent on Ukrainian imports, grains and edible oil. However, the consequences are far greater. In May 2022, the United Nations warned that the level of hunger in the world had reached a "new high" and that tens of millions of people could face long-term hunger because of the war. As of May 2022, 23 countries have imposed food export restrictions. Until the beginning of the war on the territory of Ukraine, the Russian Federation was the leading supplier and main source of energy for the whole of Europe. They ranked first when it comes to natural gas exports to the world market, second when it comes to crude oil and third when it comes to supplying coal. In 2020, Russian oil, gas and coal accounted for a quarter of energy consumption in the European Union (Schifferes, 2022).

The description of the situation and pressures after the pandemic crisis and the crisis in Ukraine is irresistibly reminiscent of the period of oil shocks and stagflation in the 70s - inflationary pressures are rising again caused by the same triggers in the context of rising energy prices, with a decline in economic activity. In order to analyze whether stagnation pressures are real, it will be analyzed the level of GDP and inflation on the example of the US, German and French economies. Since that stagflation is analyzed for the US economy in Section 3, stagflation pressures are analyzed in the present period in the USA, followed by an analysis of stagflation pressures in the largest European economies, Germany and France.

The US's inflation rate increased to 8.7% in May 2022 (Graph 2, panel a). In the US economy, there is an increase in the price level of almost all products. The prices of energy products increased by 34.6%, due to the increase in the price of gasoline (48.7%), fuel oil (106.7%, the largest recorded increase), electricity 12%, and natural gas (30.2%, the highest since July 2008). The costs of the most basic existential activities increased by about 10%. A large increase was recorded in the prices of meat, fish and eggs (14.2%). Other increases were also seen in accommodation costs (5.5%), used cars (16.1%) and airfares (37.8%). The citizens of one of the most developed economies in the world are facing a significant reduction in purchasing power caused by inflationary pressure. The gross domestic product of the USA (Graph 2, panel b) indicated complete stability until the emergence of Covid-19. In 2020, there will be a "negative growth" of the observed indicator by 3.4%. After the fall, the US manages to consolidate its public finance, refusing recession pressures.

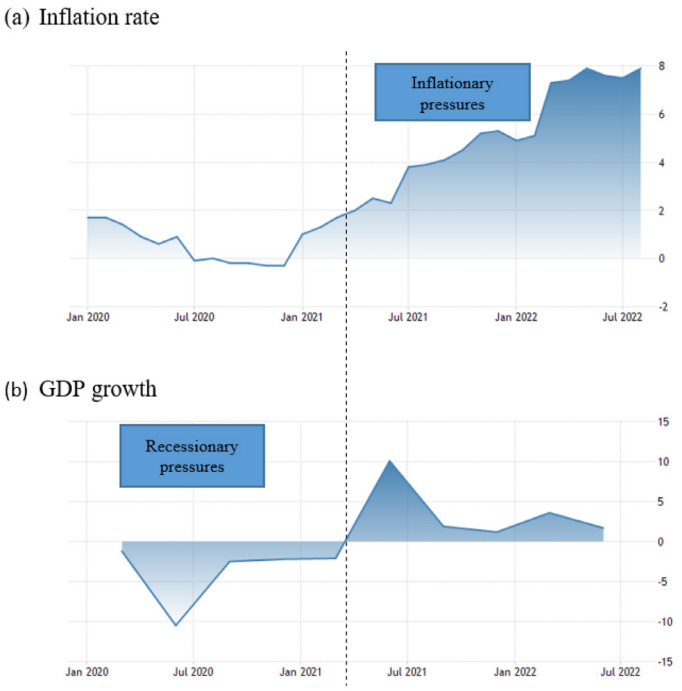
As can be seen from Graph 3 (panel a), the annual inflation rate in Germany was confirmed at 7.9% in May 2022. It was the third consecutive month of record-high inflation since German reunification, also it was the highest since 1973/1974, driven mainly by faster increases in energy (38.3%) and food (11.1%) prices. Energy prices rose sharply, especially fuel oil (94.8%), motor fuel (41.0%) and natural gas (55.2%), reflecting the impact of Russia's invasion of Ukraine.



Graph 2. Inflation Rate and GDP growth rate in the USA (2020 – 2022)

Source: Author, according to Trading economics (2022)

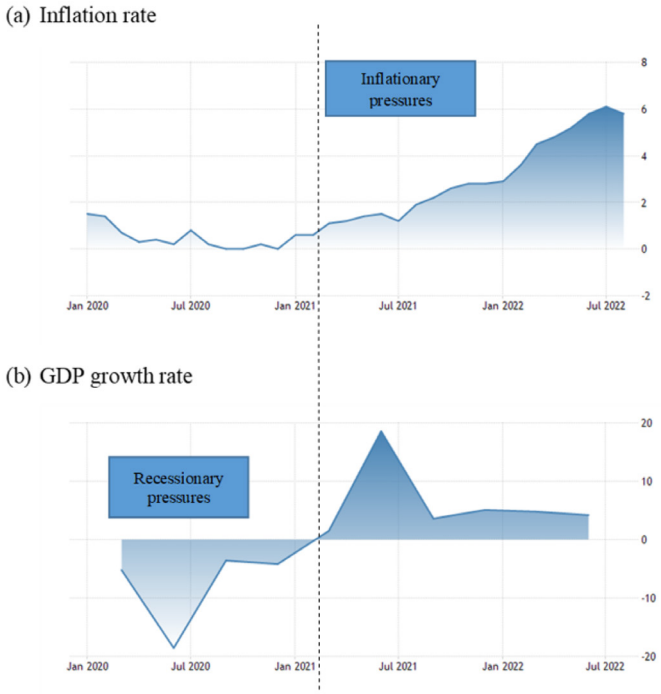
Based on Graph 3 (panel b), although it is visible that the presence of Covid-19 had a direct impact on the reduction of GDP in 2020 to an almost record level, in the next few months, by conducting a responsible policy, Germany's macroeconomic environment returned to a state of stability, which repeated the average growth during the last decade of 3.6%. It seems that the reduction of GDP in Germany had character as a structural break, and therefore could not be identified as recession and stagflation, although stagflation pressures are still present.



Graph 3. Inflation rate and GDP growth in Germany (2020 – 2022)

Source: Trading economics (2022)

The annual inflation rate in June 2022 was changed to 5.8% (Graph 4, panel a). This increase in inflation is linked to an increase in the price level of energy products (27.8%), especially oil derivatives (36.7%), diesel (35.2%), gasoline (24.2%) and gas (55.0%). As far as the price of electricity is concerned, there is a slight decrease (6.5%). The prices of agricultural and food products have accumulated by about (5%). Until the emergence of Covid-19, France had a stable GDP growth of about 4%, until experienced a steep decline in the second quarter of 2020 (Graph 4, panel b). Also in the second quarter of 2021, France achieves recovery. In comparison to Germany and the USA, France had a similar dynamic of GDP growth and inflation rate, although, the decline of GDP in the second quarter of 2022 was deeper. On the other hand, inflationary pressures in France are lower in comparison to Germany and USA, achieving maximum inflation of 6 %.



Graph 4. Inflation rate and GDP growth in France (2020 - 2022)
Source: Author, according to Trading economics (2022)

Based on the previous analyses, we can conclude that in the observed countries (USA, Germany and France) similar dynamics of GDP growth and inflation rate exist in the period January 2020 - July 2022. Namely, during the pandemic crisis, the GDP decreased till the first quarter of 2021 in all analyzed economies, which could be recognized as recessionary pressures. In that period inflation rate was stable, below 2%. However, with the recovery of economies, in the second quarter of 2021, the inflation rate started to increase, while inflationary pressures were stronger in each quarter till July 2022. Therefore, the conclusion drawn is that although in the observed period, inflationary and recessionary pressures existed in USA, Germany and France, those pressures could not be identified as stagflation, since they did not occur simultaneously. Although no country has recorded major discontinuities in economic activities that would indicate chronic macroeconomic problems, the dose of insecurity and danger of current period is certainly at a high level. What is evident is that the impact of the conflict between Russia and Ukraine is already showing itself in sharply higher prices of key goods. Many developing countries that are highly dependent on food imports are now even more vulnerable. Whether the geo-political crisis will have more far-reaching effects on the functioning of the global economy remains to be seen.

6. CONCLUSION

Based on the described and empirically documented problem of stagflation, taking into account experiences from stagflation in the 1970s, it could be concluded that the global economy is currently in an unenviable situation. The increase in inflation with a short-term decrease in economic activities was reflected in current macroeconomic variables. Descriptive empirical analysis showed that a similar dynamic of GDP growth and inflation rate occurred in USA, Germany and France in the period January 2020 - July 2022. Namely, during the pandemic crisis, recessionary pressures were present, since the GDP growth decreased till first quarter of 2021 in analyzed economies, while inflation rates were stable, below 2%. On the other hand, with the recovery of economies in the second quarter of 2021, inflationary pressures were stronger in each quarter till July 2022. Therefore, the conclusion is that inflationary and recessionary pressures existed in USA, Germany and France in the period January 2020 - July 2022; however, those pressures could not be identified as stagflation, since they did not occur simultaneously. Namely, according to the descriptive analysis conducted, hypotheses, H_1 and H_2 are confirmed: recessionary and inflationary pressures were present in USA, Germany and France in the period January 2020 - July 2022; while hypothesis (H_3) is rejected: stagflationary pressures were not present in USA, Germany and France in the period January 2020 - July 2022.

It seems that the most visible anomaly of the global economic system is the presence of inflation, which is partly caused by the emergence of Covid-19, and then prolonged by the military conflict in Ukraine. Consequently, it is important to highlight the quote of economist Katić (2022): „When the tide of printed money recedes, only then will you see who was swimming in it". Namely, the real cost of living for the largest part of the world's population very often exceeds statistical inflation rates. If the states decided to return the price level to normal and "rein" inflation, then interest rates would increase, money would stop being printed, and governments would borrow less, but there would be a certain danger of deflationary adjustment and a potential collapse of the financial system. Certainly, the coming crisis will make low-developed and poor economies dissatisfied, since big capital will withdraw even faster, protecting high-profit rates, industrial production will melt, and states will be powerless because their economic capacities will hardly be able to support their economy.

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Assessment of the Economic Situation of Post-socialist EU Countries

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Unemployment rate;
Work productivity;
Inflation;
Public administration balance

Abstract: *The economic development of Slovakia, as well as other former socialist countries, was largely marked by the transition from a centrally planned economy to a market economy. This process was long and difficult. Post-socialist countries were forced to adopt a broad complex of political, social, economic and institutional reforms that made the business environment in the country more attractive and strengthened economic growth. This process of transformation continues and despite progress there is room for further improvement even in the most developed post-socialist countries. In addition, the economy of individual countries, as well as the world economy, is currently significantly affected by the ongoing pandemic, and it has also been negatively affected by the war conflict in Ukraine and the emerging energy crisis.*

In the article, we will focus on evaluating and comparing the development and economic situation of former socialist countries that have since become members of the European Union. Based on selected macroeconomic indicators, we will assess the level of the economy of individual countries. Subsequently, we will use the ranking method and compile and evaluate the ranking of the analyzed countries.

1. INTRODUCTION

The economic situation has recently been subject to turbulent developments. The pandemic has affected economic development worldwide. The object of our investigation will be the evaluation of the state of development of basic macroeconomic indicators in post-socialist countries that are currently members of the European Union. These are the following countries: Bulgaria, the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and the Slovak Republic. The economic development of these countries was marked by the existence of the communist regime in the past.

The recovery of the economy from the consequences of the centrally controlled economy was difficult and took many years. Also, for this reason, the mentioned countries became member states of the European Union. We will compare the economic strength of countries in the period of 2012-2021, focusing on selected macroeconomic indicators.

Based on a wide range of data from the Eurostat databases, we selected the following comparable indicators: GDP per capita, employment rate, unemployment rate, nominal productivity per employed person, purchasing power parity, public administration deficit/surplus and inflation. These macroeconomic indicators are statistical data that express the current state of the

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economy of a certain country, or they assess the level of development of the economy. The goal of this contribution is to analyze, compare in the mentioned time interval and create a ranking of these countries using selected macroeconomic variables.

2. ANALYSIS OF SELECTED INDICATORS

For an objective comparison of different countries, we analyze GDP per capita. We can express it as the share of the total GDP production in constant prices to the population of the selected country (Bayerová, 2021). Through this indicator, we can monitor how many products per inhabitant on average.

Table 1. GDP per capita (€)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	5 390	5 390	5 470	5 700	5 910	6 120	6 330	6 630	6 380	6 690
Czechia	15 170	15 160	15 480	16 290	16 670	17 490	17 990	18 460	17 400	18 020
Estonia	12 320	12 540	12 960	13 230	13 620	14 410	14 970	15 510	15 010	16 260
Croatia	10 420	10 420	10 430	10 770	11 240	11 750	12 200	12 700	11 730	13 460
Latvia	9 680	9 980	10 260	10 750	11 110	11 590	12 140	12 530	12 130	12 800
Lithuania	10 330	10 810	11 290	11 620	12 070	12 760	13 400	14 050	14 030	14 690
Hungary	10 120	10 330	10 800	11 220	11 500	12 030	12 690	13 270	12 710	13 660
Poland	9 980	10 100	10 440	10 890	11 240	11 790	12 420	13 020	12 750	13 580
Romania	6 500	6 770	7 040	7 290	7 670	8 280	8 700	9 120	8 820	9 380
Slovenia	17 360	17 160	17 620	17 990	18 550	19 440	20 240	20 720	19 720	21 260
Slovakia	13 180	13 250	13 600	14 300	14 550	14 960	15 510	15 890	15 180	15 660

Source: Eurostat

In the monitored period, we noted a growing trend for the GDP per capita indicator in all countries. The highest increase in the last year of the mentioned period compared to the first year was recorded by Romania, by 44.3%, and Lithuania by 42.2%. Slovakia and the Czech Republic increased the value of GDP per capita by only 18.8%, which represented the lowest increase of the mentioned countries. For all countries, a slight decrease in the indicator between 2019 and 2020 can be seen, which was probably caused by the onset of the pandemic and subsequent socio-economic measures that also affected the economies of these countries.

Table 2. Employment (%)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	62.4	62.9	64.4	66.5	67.0	70.6	71.7	74.3	72.7	73.2
Czechia	71.5	72.5	73.5	74.8	76.7	78.5	79.9	80.3	79.7	80.0
Estonia	73.1	74.1	75.0	76.7	77.0	79.2	79.7	80.5	79.1	79.3
Croatia	58.1	57.2	59.2	60.6	61.4	63.6	65.2	66.7	66.9	68.2
Latvia	67.9	69.5	70.6	72.5	73.0	74.6	76.8	77.3	76.9	75.3
Lithuania	68.5	69.9	71.8	73.3	75.2	76.0	77.8	78.2	76.7	77.4
Hungary	63.8	65.2	68.7	70.9	73.7	75.4	76.7	77.6	77.5	78.8
Poland	62.9	63.2	64.9	66.3	68.2	70.0	71.4	72.3	72.7	75.4
Romania	56.8	56.9	58.0	59.2	60.3	62.7	63.9	65.1	65.2	67.1
Slovenia	67.8	66.7	67.3	68.6	69.5	72.9	74.9	75.9	74.8	76.1
Slovakia	66.9	66.9	67.8	69.6	71.8	73.2	74.5	75.6	74.6	74.6

Source: Eurostat

Another indicator we examined is employment, or the employment rate. In all countries surveyed, we have seen an upward trend in employment rates. A slight decline was observed

between 2019 and 2020 for several of the following indicators. This was due to the global pandemic and the measures associated with it.

Unemployment is a macroeconomic as well as a societal problem, reflecting the state of the economy when those able and willing to work cannot find employment (Čaplánová & Martincová, 2014). It is a manifestation of an imbalance in the labor market where the able-bodied population offers more work than firms are willing to employ. One of the most used indicators to measure the severity of this phenomenon is the unemployment rate. It explains what percentage of the available population in a country (aged 15-64) is out of work (Muchová, 2021).

Table 3. Unemployment (%)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	13.3	13.9	12.4	10.1	8.6	7.2	6.2	5.2	6.1	5.3
Czechia	7.0	7.0	6.1	5.1	4.0	2.9	2.2	2.0	2.6	2.8
Estonia	9.9	8.6	7.3	6.4	6.8	5.8	5.4	4.5	6.9	6.2
Croatia	16.0	17.3	17.3	16.2	13.1	11.2	8.5	6.6	7.5	7.6
Latvia	15.1	11.9	10.9	9.9	9.7	8.7	7.4	6.3	8.1	7.6
Lithuania	13.4	11.8	10.7	9.1	7.9	7.1	6.2	6.3	8.5	7.1
Hungary	10.7	9.8	7.5	6.6	5.0	4.0	3.6	3.3	4.1	4.1
Poland	10.4	10.6	9.2	7.7	6.3	5.0	3.9	3.3	3.2	3.4
Romania	8.7	9.0	8.6	8.4	7.2	6.1	5.3	4.9	6.1	5.6
Slovenia	8.9	10.1	9.7	9.0	8.0	6.6	5.1	4.4	5.0	4.8
Slovakia	13.9	14.1	13.1	11.5	9.6	8.1	6.5	5.7	6.7	6.8

Source: Eurostat

In all countries surveyed, we have observed a downward trend in the unemployment rate. A slight increase was observed between 2019 and 2020. We observed the lowest unemployment rate in all subjects in 2019.

Table 4. Nominal labor productivity per person employed (%)

year / country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	44.0	43.1	44.3	44.7	45.9	46.2	46.2	49.1	50.7	51.3
Czechia	77.0	77.8	80.0	80.5	80.5	82.5	82.5	85.6	86.0	85.0
Estonia	73.4	73.5	75.1	71.9	73.3	74.5	74.5	77.8	80.7	84.5
Croatia	74.9	76.3	73.3	73.2	74.7	74.9	74.9	74.4	71.5	74.7
Latvia	63.2	62.5	64.7	64.8	65.7	67.4	67.4	69.0	70.0	73.1
Lithuania	73.2	74.3	74.6	72.9	71.9	75.2	75.2	78.8	81.7	83.0
Hungary	73.5	73.4	71.8	71.4	68.1	67.9	67.9	70.6	71.5	72.2
Poland	74.0	73.7	73.5	74.6	74.2	75.0	75.0	79.5	81.9	82.6
Romania	55.5	56.2	56.9	58.6	63.0	66.0	66.0	72.5	75.0	84.2
Slovenia	80.7	81.2	81.6	80.7	81.0	81.8	81.8	82.5	82.6	83.9
Slovakia	83.4	84.1	84.2	83.7	77.1	73.9	73.9	72.5	73.3	72.6

Source: Eurostat

Labor productivity is a measure of a country's competitiveness and economic performance. In most countries in the monitored period, we can observe an increase in labor productivity per person. We recorded the highest increase in Romania, by almost 30% and in Estonia by less than 10%. A balanced course was recorded in Croatia. In Slovakia, as the only country studied, we recorded a drop in productivity of more than 10%.

In analyses of economic developments, the phenomenon of inflation must also be given due attention. We can speak of consumer inflation if there is a general increase in the prices of goods and

services included in the consumer basket in the economy. It should be noted that this phenomenon is not natural for the economy in the long term. In fact, if there were no inflation of the money supply, the prices of consumer goods and services should naturally fall in the long term because of scientific and technological progress. We interpret price fluctuations through the inflation rate, measured by the consumer price index (CPI for short) (Čaplánová & Martincová, 2014).

Although the phenomenon of inflation from an economic point of view can also bring some positive effects (at a low level), its existence brings an increase in costs to households due to a reduction in the purchasing power of the monetary unit. For this reason, it is desirable that the European Central Bank and the political representatives of the given state take responsible measures. Interventions to control inflation/deflation can leave more damage to the economy than the manifestations of the phenomena. Before the regulation itself, however, it is necessary to know the current and past issues. Economic analyzes also serve these purposes. The issue of comparability of data from the CPI in European countries was because each country reported a different number of representative items in the consumer basket and also different item weights. For this reason, the Harmonized Index of Consumer Prices (abbreviated as HICP) was created for the purpose of comparing changes in consumer prices (Habánik, 2021). The aim of its creation was not to establish an identical consumer basket, but to apply the same principles and rules for all countries, taking national differentiation into account. Its results are naturally slightly different from the CPI, but its informative value when applying the comparison of several different countries is significantly higher.

Table 5. HICP - inflation rate (%)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	2.4	0.4	-1.6	-1.1	-1.3	1.2	2.6	2.5	1.2	2.8
Czechia	3.5	1.4	0.4	0.3	0.6	2.4	2.0	2.6	3.3	3.3
Estonia	4.2	3.2	0.5	0.1	0.8	3.7	3.4	2.3	-0.6	4.5
Croatia	3.4	2.3	0.2	-0.3	-0.6	1.3	1.6	0.8	0.0	2.7
Latvia	2.3	0.0	0.7	0.2	0.1	2.9	2.6	2.7	0.1	3.2
Lithuania	3.2	1.2	0.2	-0.7	0.7	3.7	2.5	2.2	1.1	4.6
Hungary	5.7	1.7	0.0	0.1	0.4	2.4	2.9	3.4	3.4	5.2
Poland	3.7	0.8	0.1	-0.7	-0.2	1.6	1.2	2.1	3.7	5.2
Romania	3.4	3.2	1.4	-0.4	-1.1	1.1	4.1	3.9	2.3	4.1
Slovenia	2.8	1.9	0.4	-0.8	-0.2	1.6	1.9	1.7	-0.3	2.0
Slovakia	3.7	1.5	-0.1	-0.3	-0.5	1.4	2.5	2.8	2.0	2.8

Source: Eurostat

The development of the HICP was fluctuating during the monitored period. Comparing the first and last year of the monitored period, we can state that the values returned to the same, or comparable level. However, the year 2022, even if the worst period of the pandemic is behind us, appears to be the most problematic. It is a consequence of the fading anti-epidemic measures and, war conflicts in Ukraine. As a result, the EU imposed several embargoes on imports and exports to Russia, which also affected the economies associated with Ukraine and Russia. In August 2022, according to Eurostat data, the average inflation in the EU zone is at the level of 9.1%. Double-digit HICP values were recorded in the monitored countries. The highest was in Estonia 25.2 %, Lithuania 21.4 %, and Latvia 21.1 %.

The balance (i.e., deficit or surplus) of the general government budget is the difference between total revenue (excluding credit revenue) and total expenditure (including interest service) of the general government, more precisely of the general government sector, in a given budget period,

usually a calendar year. It is most often expressed as a percentage of the gross domestic product (ŠTATISTICKÝ ÚRAD SR). A negative figure indicates a situation where government expenditure exceeds government revenue - a deficit is created. A positive number indicates a situation where revenue exceeds expenditure - a surplus is generated. A general government budget deficit means an increase in government debt (Habánik, 2021).

Table 6. General government deficit/surplus (Percentage of gross domestic product)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	-0.8	-0.7	-5.4	-1.9	0.3	1.6	1.7	2.1	-4.0	-4.1
Czechia	-3.9	-1.3	-2.1	-0.6	0.7	1.5	0.9	0.3	-5.8	-5.9
Estonia	-0.3	0.2	0.7	0.1	-0.4	-0.5	-0.6	0.1	-5.6	-2.4
Croatia	-5.5	-5.5	-5.5	-3.4	-0.9	0.8	0.0	0.2	-7.3	-2.9
Latvia	-1.4	-1.2	-1.6	-1.4	0.0	-0.8	-0.8	-0.6	-4.5	-7.3
Lithuania	-3.2	-2.6	-0.6	-0.3	0.3	0.4	0.5	0.5	-7.3	-1.0
Hungary	-2.3	-2.6	-2.8	-2.0	-1.8	-2.5	-2.1	-2.1	-7.8	-6.8
Poland	-3.8	-4.2	-3.6	-2.6	-2.4	-1.5	-0.2	-0.7	-6.9	-1.9
Romania	-3.7	-2.1	-1.2	-0.6	-2.6	-2.6	-2.8	-4.3	-9.3	-7.1
Slovenia	-4.0	-14.6	-5.5	-2.8	-1.9	-0.1	0.7	0.4	-7.8	-5.2
Slovakia	-4.4	-2.9	-3.1	-2.7	-2.6	-1.0	-1.0	-1.3	-5.5	-6.2

Source: Eurostat

The resulting deficits in all countries have been affected by increases in expenditure (including COVID measures, of which the largest share is accounted for by "first aid" measures) as well as reductions in general government revenue in the most recent years under review (Vlachynský, 2022).

3. EVALUATION OF RESULTS

We used the simplest method to evaluate the results - the quick ranking method. This method evaluates the position of countries according to a ranking scale given by the number of subjects.

Table 7. Ranking method in 2012

Indicator/ country	Employment	Unemployment	GDP per capita	General government deficit/surplus	HICP - inflation rate	Nominal labor productivity	∑	Average
Bulgaria	9	7	11	2	2	11	42	7.00
Czechia	2	1	2	8	6	3	22	3.67
Estonia	1	4	4	1	8	7	25	4.17
Croatia	10	11	5	11	5	4	46	7.67
Latvia	4	10	9	3	1	9	36	6.00
Lithuania	3	8	6	5	4	8	34	5.67
Hungary	7	6	7	4	9	6	39	6.50
Poland	8	5	8	7	7	5	40	6.67
Romania	11	2	10	6	5	10	44	7.33
Slovenia	5	3	1	9	3	2	23	3.83
Slovakia	6	9	3	10	7	1	36	6.00

Source: Own processing

The ranking is determined from 1, 2,…n according to the number of countries so that the subject with the best score gets the lowest value. The final ranking is obtained by summing the achieved values of each indicator for a particular country. The specific sum is divided by the arithmetic mean, or weighted arithmetic means, and the country's ranking is assigned on that basis.

Table 8. Ranking method in 2021

Indicator/ country	Employ-ment	Unem-ployment	GDP per capita	General government deficit/surplus	HICP - inflation rate	Nominal labor pro-ductivity	Σ	Average
Bulgaria	9	5	11	5	3	11	44	7.33
Czechia	1	1	2	7	5	1	17	2.83
Estonia	2	7	3	3	7	2	24	4.00
Croatia	10	10	8	4	2	7	41	6.83
Latvia	7	10	9	11	4	8	49	8.17
Lithuania	4	9	5	1	8	5	32	5.33
Hungary	3	3	6	9	9	10	40	6.67
Poland	6	2	7	2	9	6	32	5.33
Romania	11	6	10	10	6	3	46	7.67
Slovenia	5	4	1	6	1	4	21	3.50
Slovakia	8	8	4	8	3	9	40	6.67

Source: Own processing

Using the data in Tables 7 and 8, we have constructed country rankings in 2012 and 2021 to compare changes in the ranking of these countries.

Table 9. Comparison of ranking using the ranking method

	ranking		
year / country	**2012**	**2021**	**change in ranking**
Bulgaria	8	9	-1
Czechia	1	1	0
Estonia	3	4	-1
Croatia	9	8	+1
Latvia	7	10	-3
Lithuania	5	5	0
Hungary	6	6	0
Poland	4	3	+1
Romania	7	8	-1
Slovenia	2	2	0
Slovakia	4	7	-3

Source: Own processing

By examining and comparing selected economic indicators between 2012 and 2021, we see that the Czech Republic and Slovenia performed best among the post-socialist EU Member States. These countries retained the first and second positions in our ranking. Thus, there was no change in location in the compared years in the Czech Republic and Slovenia, and also in Lithuania and Hungary. The mentioned countries are consistently placed in the first half of the table. The biggest drop was recorded by Latvia and Slovakia, which moved down three places in 2021. This put Latvia in last place on the table. Croatia and Poland recorded a positive shift (up one position). This moves Croatia from last place in 2012 to closer to the middle of the table and Poland to third place in 2021.

4. CONCLUSION

The transition of the countries of Central and Eastern Europe from socialism to the current establishment is considered an economic success story, even if it was accompanied by many difficulties. After thirty years of transformation, the best economic situation is clearly in the Czech Republic and Slovenia. In the ranking of countries, which we compiled using the ranking

method, they retained the first and second places. These two countries have the highest gross domestic product per capita, the indicator most often used to measure a country's economic strength. At the same time, they also maintain the highest standard of living of residents from post-socialist countries. Although Bulgaria and Romania have taken a big step forward, they remain the poorest members of the EU.

The Slovak Republic entered the transformation as a moderately developed country. During the analyzed period, Slovakia dropped in the ranking by 3 places. Among other things, the reasons can be found in the absence of the rule of law in the past, which led to the distortion of the business environment. Without a healthy economic environment, businesses have no incentive to move forward and invest. One of the fundamental problems is the unpredictability of the business environment (frequent changes to key laws), which reduces the competitiveness of the Slovak Republic in the long term.

A high-quality business environment creating conditions for achieving long-term sustainable economic growth is a basic prerequisite for business development and increasing the competitiveness of the Slovak Republic on an international scale. Therefore, it is necessary to focus on removing unjustified regulatory and financial barriers, bureaucracy, cost, and time burden, on ensuring the stability and predictability of the business environment.

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Business Power and Mobility to Workplaces in Italian Regions during the First COVID-19 Wave

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Abstract: *The diffusion of the pandemic and the severity of COVID-19-related measures were very uneven across regions; however, the intensity of the restrictions was not always tightly linked with the strength of the pandemic. Economic interests and business power might have played a role in defining political responses at the local level, which are in turn able to shape the intensity of work-related mobility. This article aims at investigating whether regional variations in the stringency of COVID-19-related measures have actual impacts on work-related mobility and whether there is an independent effect of the pressure exerted by unions and businesses, assuming mobility to be governed concurrently by stringency, pandemic intensity, and pressure. Through the analysis of original regional-level indicators of stringency and public pressure, we demonstrate that trade unions' pressure is associated with a decrease in work-related mobility during the first COVID-19 wave in Italy.*

1. INTRODUCTION

Italy was the first western country to be severely hit by the COVID-19 pandemic, leading to the imposition of a national lockdown beginning on the 10th of March 2020 (Dell'Omo et al., 2021). Citizens were thus obliged to stay at home – unless it was urgently needed – and all non-essential production activities were forced to close. The economic activities deemed to be essential (e.g., pharmacies, bakeries, etc.) were authorised to carry on with their work – and their employees were accordingly allowed to keep going to work. Some firms involved in the production of non-essential goods, however, could continue to operate after filing a derogation request to the local government authorities. Deviations from the national rules applying to specific sectors were implemented by most regions.

The lockdown was eased since the 4th of May when most economic activities slowly started to reopen. The key aspect of the lockdown strategy was to limit contact between people (and, therefore, infections). Hence, the observance of the restrictions and the adherence of citizens to the government's prescriptions was the keystone of the whole pandemic-containment operation during the first COVID-19 wave (Panarello & Tassinari, 2022).

In examining the dynamics of the restrictions, however, it must be borne in mind that trade unions kept pushing for stricter containment measures and closure of non-essential workplaces, caring for workers' safety, while business organisations were skeptical about implementing harsh restrictions and exerted considerable pressure intending to relax them, to avoid adverse impacts on the economy. Such pressure was particularly relevant at the regional level. Policymakers can be expected to be influenced by the preferences of business organisations regarding

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lockdown stringency, both to preserve business confidence and future investments and to prevent them from mobilising their resources through lobbying or public media campaigns (Culpepper, 2015; Fairfield, 2015).

The aim of our investigation is to verify whether regional-level variations in the stringency of COVID-19-related measures have actual impacts on variations of mobility towards workplaces on the ground (i.e., whether regional stringency really matters to what happens in the real economy) and whether there is an independent impact of the preferences and pressure of organised economic interests – unions and business organisations – and the specificities of the local economies.

2. MODEL AND VARIABLES

The main hypothesis of this work is that mobility toward workplaces is governed concurrently by the stringency of COVID-19-related measures, by the intensity of the pandemic, and by the pressure exerted by unions and business organisations.

The key variable, which is used as the dependent variable in the estimations, is mobility toward workplaces (Figure 1), taken from Google's Community Mobility Reports (Google LLC, 2020), capturing the percentage change in the number of visitors to workplaces compared to a pre-pandemic baseline, referring to the period going from the 3rd of January to the 6th of February 2020. From the daily data provided by Google, we computed an average value for each analysed weekly time point.

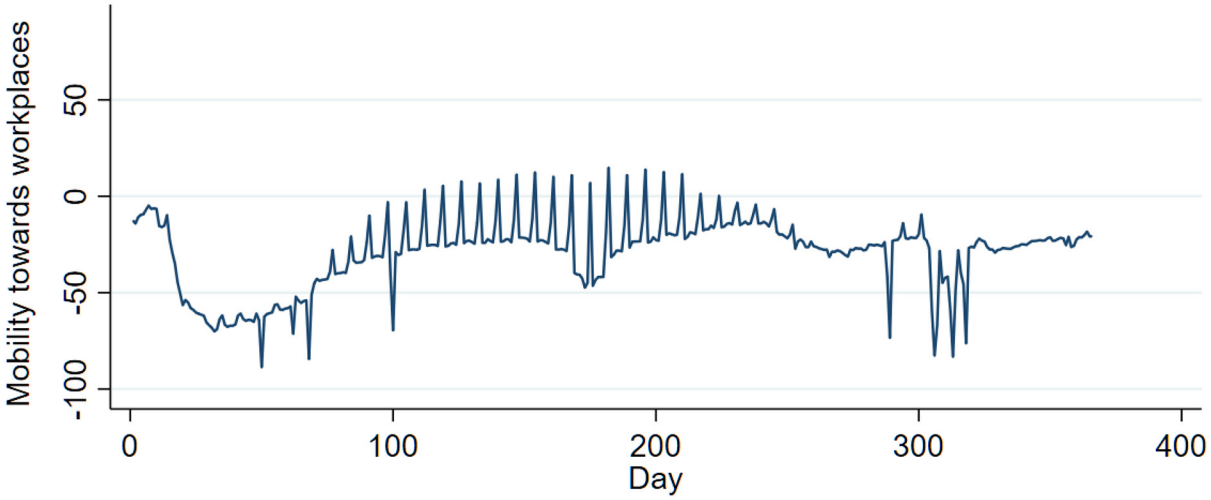

Figure 1. Daily percentage changes in mobility toward workplaces in Italy (first year of the COVID-19 pandemic)

Source: Google LLC, 2020.

We built an original regional-level stringency index for Italy, tracing the over-time policy responses of Italian regional governments to the pandemic outbreak at weekly intervals in the period February-June 2020. We coded all the regional ordinances and regulations concerning non-pharmaceutical responses to the pandemic, capturing the regional-level deviations from the national rules concerning the operation of specific economic sectors. Then, we developed a composite indicator following the methodology developed by Hale et al. (2020) for their Oxford COVID-19 Government Response Tracker's Stringency Index, assigning a different stringency score to each weekly time point and region.

We also constructed two indicators of public pressure by analysing the 28,331 tweets published by business organisations and trade unions in the period of interest. Specifically, we conducted a dictionary-based sentiment analysis (Moreno & Iglesias, 2020) of all the social media communications posted on Twitter by the regional divisions of the main organised business groups and trade unions in Italy in the period February-June 2020. For what concerns COVID-19-related communications, we categorised them into positive, negative, and neutral tweets, through the use of three polarised dictionaries. The two pressure indexes – one concerning trade unions and one concerning business organisations – were computed by dividing the number of COVID-19-related tweets with a negative meaning by the total number of tweets published in the same period, to measure the relative importance of the COVID-19 issue over the usual communication. As a robustness check, we also use the absolute number of COVID-19-related tweets with a negative meaning in lieu of the pressure indexes in some of the models, to consider the absolute impact of the social media activity of trade unions and business organisations on public opinion and, consequently, on policymakers' orientations.

To capture the intensity of the pandemic over time, we collected the distribution of COVID-19 deaths, released by the Italian Civil Protection (Dipartimento della Protezione Civile, 2020). For each time point and region, we divided the cumulative number of regional deaths recorded on the last day of the considered time point by the regional population.

Finally, we make use of the quarterly unemployment rate and eight time-invariant variables describing the socio-economic and political characteristics of the regions, provided by the Italian National Institute of Statistics (Istat): proportion of large firms (10 or more employees) over the total number of firms; political spectrum of the regional government (dichotomic variable taking value 0 for left or centre-left, and 1 for right or centre-right); electoral cycle (dichotomic variable taking value 1 if regional elections are going to take place within the following twelve months); number of employees in manufacturing over the regional population; number of employees in hotels, restaurants and retail over the regional population; per capita gross domestic product; services value-added over GDP; and manufacturing value-added over GDP.

We estimate four GLS panel regression models of the percentage change in work-related mobility compared to the pre-pandemic period, using various combinations of the above-mentioned characters as explanatory variables, whereby stringency and cumulative deaths are always included as regressors. All the models incorporate time fixed-effects.

3. RESULTS

The outcomes from the four estimated models are presented in Table 1. In these models, we have missing values in the first two weeks of the dataset and time-varying variables with two lags: therefore, two time periods (42 observations) get lost overall, leading to 378 available observations.

Out of the estimated models, the second one appears to best reflect the variability of work-related mobility, being characterised by the largest R-squared between. Therefore, we will only comment on the results from this model. Both the regional stringency and the public pressure exerted by trade unions are highly significant, with a negative sign, as could be expected in accordance with our hypotheses. Among structural variables, only GDP per capita is significant, with a negative sign, which likely reflects the diffusion of remote working in high-value-added jobs. All the coefficients related to time fixed-effects (omitted for the sake of brevity) are significant, with p-values lower than 0.01.

Table 1. Results from Models 1 to 4

Variable	Coefficient (Model 1)	Coefficient (Model 2)	Coefficient (Model 3)	Coefficient (Model 4)
Stringency (lag 2)	-0.117**	-0.121**	-0.123**	-0.127**
Cumulative deaths by population (lag 2)	-793.835	344.023	-784.623	364.989
Pressure: Trade unions (lag 2)	-4.851*	-4.558*		
Pressure: Business organisations (lag 2)	2.149	1.921		
Absolute number of Trade unions' negative COVID-19-related tweets (lag 2)			-0.127***	-0.131***
Absolute number of Business organisations' negative COVID-19-related tweets (lag 2)			0.047	0.062
Percentage of firms with 10+ employees	-1.201**	0.300	-1.370***	0.312
Unemployment rate	0.209*	-0.183	0.210*	-0.196
Political spectrum (0=centre-left; 1=centre-right)	0.920	0.207	0.483	-0.228
Electoral cycle (1=regional elections taking place within 12 months; 0=otherwise)	0.268	0.604	0.208	0.527
Thousands of employees in manufacturing over regional population	37501.906**		47334.001**	
Thousands of employees in hotels, restaurants and retail over regional population	1.26e+05***		1.27e+05***	
Per capita GDP		-0.000*		-0.000*
Services value-added over GDP		-0.361		-0.338
Manufacturing value-added over GDP		-0.309		-0.250
Intercept	-8.996**	35.908	-8.626**	34.427
Observations	378	378	378	378
R-squared (within)	0.988	0.988	0.989	0.988
R-squared (between)	0.318	0.488	0.285	0.479
R-squared (overall)	0.983	0.984	0.983	0.984

Note: *, ** and *** stand for $p < 0.10$, $p < 0.05$ and $p < 0.01$.

4. CONCLUSION

Our results clearly show that an increase in stringency directly brings about a reduction in mobility toward workplaces, disturbing economic activity. This is an indicator of the fact that the level of stringency does in fact matter in terms of affecting developments on the ground as regards workplace/economic activity. Hence, it shows that there are good reasons why employer groups would care about influencing the intensity of regulations at the regional level. The models additionally show that trade unions' pressure is also associated with a decrease in work-related mobility. We must underline that the two pressures – related to employers and trade unions – have opposite signs, albeit the first one is not significant. Most structural variables pertaining to the socio-economic context are not significant, except for the employment-related variables in Models 1 and 3 as well as per capita gross domestic product in Models 2 and 4.

Indeed, the specifications shown in Models 1 and 3 highlight interesting results. Here, as we would expect, the coefficients pertaining to the share of employees in manufacturing and hospitality-related sectors are both significant and with a positive sign. The unemployment rate is also significant and with a positive sign, which can be rationalised as a reason for regional governments to be less "stringent" in the execution of COVID-19-related restrictions so as not to negatively affect employment dynamics. Lastly, the percentage of large businesses (firms with ten or more employees) has a negative relationship with work-related mobility. This can be interpreted as a consequence of the fact that larger firms are also more structured and can organise remote working easier compared to the smaller ones.

As regards per capita GDP (Models 2 and 6), it must be borne in mind that the activities characterised by the highest value-added (business services, banks, insurance companies, service activities incorporated in manufacturing businesses) are easily transferable into a remote-working model, which obviously results in mobility reductions. By contrast, non-teleworkable, material-type production activities have a lower per capita value-added.

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Covid-19's Impact on Supply Chain Practices in the Republic of Serbia

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Abstract: *This paper focuses on supply chain practices before and after the COVID-19 pandemic. Supply chain disruptions due to COVID-19 on the supply, demand, and logistical side are thoroughly explained and presented. The paper addresses how the pandemic exposed the vulnerabilities and deficiencies of the lean, JIT global supply chain model. This paper also presents short- and long-term strategies that companies have taken to mitigate supply chain disruptions. As a contribution to the paper, results from the research on COVID-19 impacts on the Serbian economy and business, that the Serbian Chamber of Commerce has conducted, are shown. The paper aims to highlight the most important supply chain measures and strategies needed to stay competitive during any pandemic.*

1. INTRODUCTION

The COVID–19 pandemic emerged at the beginning of 2020. It has disrupted global activities across all economic sectors and industries. The disruptions occurred as consequences of the global lockdown measures adopted and implemented by countries to mitigate the impact of the pandemic's spread on the human population. The COVID-19 lockdown measures, according to Erhi (2020), caused production halts, restrictions on people and goods movement, border closures, logistical constraints, and a slowdown in trade and business activities. All the above-mentioned factors have led to severe supply chain disruptions (SCDs), i.e., many supply chains (SCs) worldwide (86%) have been seriously impacted by the COVID-19 pandemic, stated Van Hoek (2020). In the pandemic conditions, demand became highly unpredictable, there was a supply shortage, and suppliers could not meet delivery agreements. Some sectors witnessed a decline in demand, while others saw a sudden spike in demand, found Raj (2022). Before COVID-19, many SCs were focused on JIT (Just-in-Time) and lean concepts. JIT may result in leaner SCs and lower inventory costs, but it has been shown to be ineffective during times of crisis, according to Belhadia (2021) and Zhu (2020). The way COVID-19 has impacted global SCs has increased the importance of risk management and mitigation strategies. SC strategies, designs, and dependencies across organizations need to be reevaluated to avoid improvised reactions to future natural disasters and create resilient SCs. Oldekop (2020) shown that work from home, i.e., online work, and digitally organized logistics have mitigated the negative impacts of COVID-19. The questions are 1) what strategies can deal most effectively with which impacts, and 2) what are the challenges and requirements associated with the implementation of resilience strategies?

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2. SUPPLY CHAIN DISRUPTIONS

Craighead (2007) defined SCDs as unplanned and unpredicted events that disturb the flow of goods and services across the SC. According to Mishra and Sharma (2021), the effects of COVID-19 on global SCs have affected three different sides: supply, demand, and logistics.

2.1. Supply Shocks

According to Panwar (2022), supply shortages during the pandemic have been both a cause and a manifestation of SCDs. Due to social distancing and global lockdowns, the movement of people and business operations were affected. This has led to an unexpected change in the supply of products. Many production facilities were closed because of the lockdown. As a consequence, manufacturers and retailers have not had access to enough raw materials and products for their businesses, or the lead times have become too long. Production and manufacturing capabilities decreased, so supply shocks occurred, found Magableh (2021). Most companies were not prepared to meet new demands or to deliver at new demand points. Even worse, companies could not sustain their normal production levels. Many factory workers, especially those in developing countries, have returned to their hometowns. The factories became devoid of both raw materials and workers.

2.2. Demand Shocks

Demand shocks can be defined as sudden changes in demand. The COVID-19 pandemic has triggered the most dramatic consumer behavior and consumption patterns in recent history. Due to health reasons, demand for household cleaning products, disinfectants, vitamins, health supplements, and face masks spiked up, whereas demand for home hair colors and similar products increased due to closed businesses. Working from home became the norm, thus, demand for at-home caffeine products, and home-office equipment sharply increased. Even for products where demand has not changed drastically, points of demand have. Also, consumers tried to reduce the risk of exposure to the virus and decrease demand for products and services that involve close contact with others, claimed Kiers (2022).

2.3. Logistical Side

The restrictions on the movement of people and goods have led to a decline in exports and imports. In some countries, vessels that were entering the country's waters were required to observe a mandatory 14-day quarantine period before clearing or discharging goods. This has impacted the shipment, and the arrival of goods found Erhie (2020). Consumers were unaware of a supply shortage since information and data from partners were non-transparent. This has led to an increased volume of orders. Customers are usually not willing to wait for long deliveries, especially when substitute products are available. COVID-19 has led to restrictions on the transportation and movement of goods, especially through areas that are under restricted or containment categories. Since public transportation hasn't yet been reopened, there were problems with transporting people to work. Social distancing measures were the cause; available vehicles could not be utilized at full capacity. These transportation issues have led to unprecedented delays in the delivery of consignments to end customers and can disturb the smooth functioning of SC, found Raj (2022). During the pandemic, consumer optimism has declined across the country, and it is expected that consumers will continue to reduce their spending, claimed McKinsey (2020). This could result in

overstocking of materials at warehouses waiting for demand to pick up at a future date. Overstocking for indefinite periods will lead to potential damages, perishability issues, and working capital blockages, leading to liquidity issues across SCs. During the wake of the pandemic, most organizations have responded to customer requirements to minimize physical touchpoints and are seen to be redesigning their SCs. To attract customers, brands were either choosing to go with fully captive in-house delivery services or integrations with last-mile delivery partners. Even if products do make it to the point of delivery, the transporter may have to navigate through an affected zone and select an alternate route, leading to delivery delays.

3. MITIGATION STRATEGIES

To restore competitiveness, organizations must redesign their supply chain management (SCM) models. Kiers (2022) claimed that as of mid-October 2021, companies are focused on establishing more resilient SCs. Short-term and long-term strategies regarding supply, demand and logistical shocks are presented below.

3.1. Supply Side

Raj (2022) identified inconsistency of supply as one of the most prominent challenges that is related to the uncertainty of supply from upstream vendors, irregular and indefinite lead times, and price volatility. For Paul (2020), a short-term strategy for mitigating supply disruption can be the identification of crucial components and raw materials, which carry a major interruption risk. Companies should explore alternate vendors to ramp up production in case of sudden surges in demand. Also, a retrospective analysis of the unpredictable demand and available supply can be used. That way, optimum manufacturing conditions for future batches or cycles can be reinstated. In the long-term, companies need to put together and periodically revisit their Business Continuity Plan (BCP) stated Queiroz (2020). According to Belhadia (2021), BCP includes strategies for risk mitigation that are aimed toward setting up alternate suppliers closer to the main manufacturing facility to prevent inconsistency in the supply of critical raw materials. Companies are moving from selecting the most cost-effective vendor to the most responsive vendor with the shortest lead times. Companies started engaging in value-sharing with their suppliers, allowing them to keep a portion of the profit. Panwar (2022) found that due to these benefits, suppliers are more inclined to prioritize the company's interests in times of crisis, thereby improving SC resilience. Resources, information, and technology sharing between different stakeholders, including firms, suppliers, and customers, is crucial for creating synergy and recovering from disruption to remain competitive. Diversification and dual sourcing are also possible strategies. Companies were warned not to rely too heavily on any single source, thereby diversifying their risks. Having multiple suppliers for a product reduces the supply risk, as stated by Kiers (2022). Another possible strategy is the vertical integration of SCs. "Vertical integration allows a company to streamline its operations by taking direct ownership of various stages of its production process instead of relying on external suppliers", said Hayes (2022).

3.2. Demand Side

Gartner (2020) found that changing patterns in buying behavior combined with misinformation on goods have led to demand disruptions. An immediate measure would be to provide end-to-end transparency to customers. Mishra (2021) stated that during times like the COVID-19 pandemic, companies need to reassure their consumers that their products are being handled safely

and hygienically across the value chain. Companies should provide omni-channel options to customers who prefer online shopping by partnering with third-party delivery agents who can provide local last-mile deliveries, according to Raj (2022). In the long term, the main company would need to identify, partner, and collaborate with key customers. According to Sodhi (2021), a more robust and sustainable business model for last-mile delivery should be used as a long-term strategy by creating its own omnichannel distribution network to avoid future dependencies. This would ensure the existence of adequate channels for customers to order products, leading to stabilized demand, found Raj (2022). Through the vendor-managed inventory (VMI) model, inventory level and demand data are shared between the chain's members via electronic data interchange (EDI). Sudan (2021) found that this can help in understanding the transportation disruption for upstream and downstream partners in crisis, and can also help in analyzing demand and supply disruptions caused by transportation disruptions. Companies are planning to strengthen their demand forecasting capabilities. The role of machine learning tools, which can pick up changes in retail trends in a short time and swiftly adjust demand projections, is crucial.

3.3. Logistical Side

Regarding the logistical side, vehicle unavailability and delays are the most important issues. As a short-term solution, companies should use vehicle tracking devices and promote greater transparency to maintain a healthy mix of a dedicated and market-owned fleet of vehicles. Raj (2022) found another solution in the creation of multiple channels to distribute products to customers, making the distribution network more resilient. In the long term, for larger companies that possess their own fleet, considering that transportation is the backbone of any SC, lifeline maintenance of the fleet should be done periodically. Companies should also consider using autonomous vehicles for fixed point-to-point movements that do not require human drivers, which is crucial during times like the COVID-19 pandemic. Companies should focus on implementing cutting-edge SC transparency solutions into their transportation system operations for quick response to change using real-time data during the crisis. Sudan (2021) found Internet of Things (IoT) sensors to have been a crucial asset for tracking shipments. Blockchain ensures transparency and trust in the SC. It solves the problem of counterfeit goods since products can be traced from the first to the last point of the SC. Smart contracts allow fast payments once the agreed terms are met, said Erhie (2020). Through the use of IoT sensors, information on the arrival of raw materials to production lines or of finished goods in warehouses is updated in real-time; therefore, companies can manage stock levels more precisely. Smart IoT sensors can be used to manage planned and predictive maintenance, which leads to reduced downtime and cost savings. Localizing SCs will lead to a reduction in the lead time. This leads to higher responsiveness to disruptions, according to Kiers (2022). It was shown that e-commerce increases the average firm's value in a short period. Opening online distribution channels would be valuable for firms even without pandemic issues. Companies are moving from traditional SCs toward digital supply networks (DSNs). DSNs include the free flow of information and end-to-end transparency, dexterity, and optimization of the SC. "Digitization ensures resilient global SCs," claimed Kiers (2022).

4. RESEARCH

The Chamber of Commerce and Industry of Serbia researched COVID-19's impact on the economy and business. The research was conducted in three phases. The first phase took place between March 26 and March 31, 2020, at the beginning of the crisis in Serbia, while the third

phase was conducted between June 8 and June 15, after the quarantine. The number of business entities that participated in the first phase of the research was 806, while in the third phase, that number was 396. In this paper, the focus is on the actions and strategies that companies have taken or were planning to take to tackle the pandemic. Actions or strategies that companies took or were planning to take in the first phase of the research, i.e., at the beginning of the crisis, are shown in Figure 1. Regarding e-commerce, the results are presented in Figure 2.

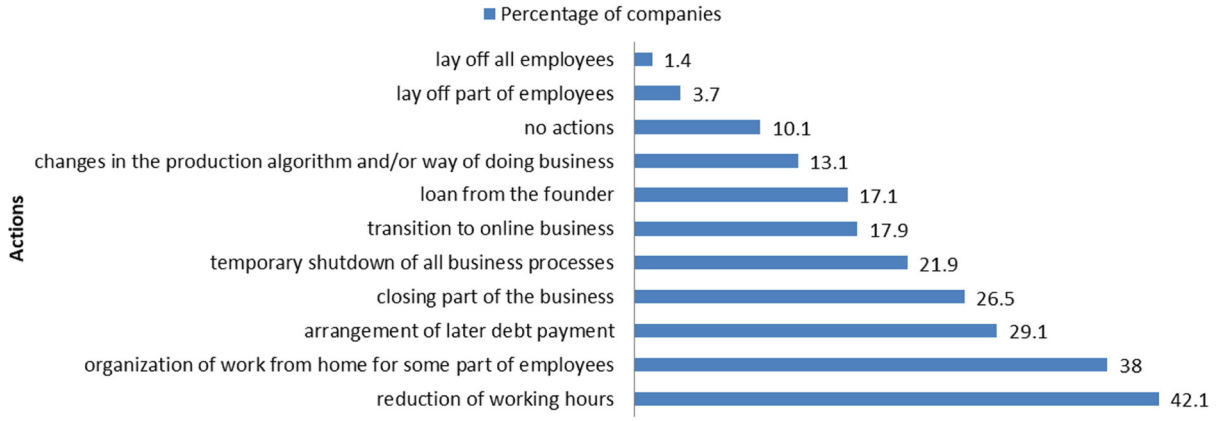

Figure 1. Share of companies that have taken certain actions (n=806) – phase 1

At the start of the pandemic, approximately 9% of companies studied had already established e-commerce. A large number of companies (around 44%) have already established electronic payment, while 29% were not planning to go digital. In Figure 3. strategies that companies have taken or were planning to take after the quarantine, in the third phase of the research, are shown.

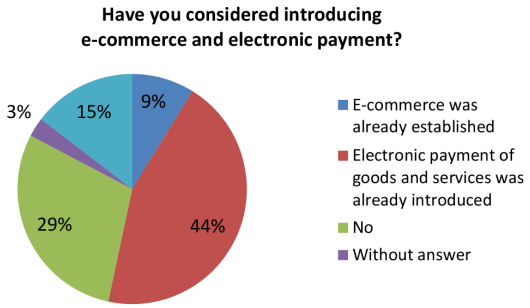

Figure 2. Results regarding e-commerce – phase 1

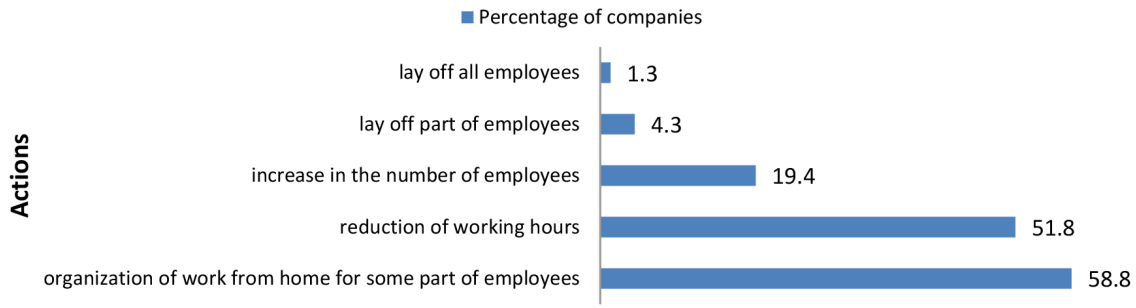

Figure 3. Share of companies that have taken certain actions (n=396) – phase 3

Even though the percentage of companies that are laying off part or all of their employees hasn't changed much, since the quarantine, some of the companies (19.4%) have hired new employees. The measures taken by the majority of the companies after the quarantine are a reduction of

working hours (51.8%), and work from home for some employees (58.8%). The same measures were also the most prominent at the beginning of the pandemic. Figure 4 depicts the measures taken or planned to be taken during the third phase.

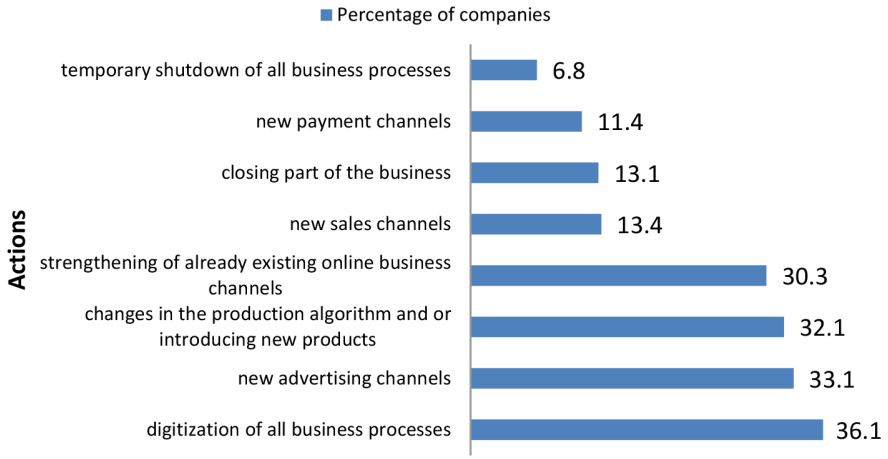

Figure 4. Actions regarding business model – phase 3

About 30% of companies that are already digitized and are planning to strengthen their online business channels endured the pandemic more easily. The majority of the remaining companies emphasize the use of digital solutions as their recovery paths. A third of companies plan to open new advertising channels, digitize business processes, and/or adapt their product portfolios to the current demand situation. Around 13% of companies have opened a webshop in response to the crisis or plan to do so.

5. CONCLUSION

The COVID-19 pandemic has exposed the vulnerabilities and deficiencies of the lean, JIT global SC model. Even though COVID-19 has had a mostly negative impact on the global economy, it has also highlighted the importance of digitalization. "Go digital to survive" is one of the major lessons learned from the COVID-19 pandemic. Companies that were already digitized endured the pandemic more easily. The most reoccurring immediate measures that were taken at the beginning of the pandemic in the Republic of Serbia were the reduction of working hours and the organization of work from home for some employees. The same actions were the most frequent after the quarantine. The most frequent measures regarding the business model that were taken or were planned to be taken in the third phase are the digitization of all business processes, new advertising channels, and changes in the production algorithm and or introduction of new products.

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Advantages and Disadvantages of Strategic Alliances in International Business

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Abstract: *The paper studies strategic alliances and their role in international business. The importance of strategic alliances in the global economy has increased. Strategic drivers for interfirm co-operation between alliance partners are market growth, cost reduction, reducing risk, and access to knowledge. The author focuses on the advantages and disadvantages of strategic alliances. The challenges of managing international strategic alliances are also discussed. Ensuring the success of strategic alliances between international firms is more difficult due to alliance partners' differences in national, organizational and professional culture. International strategic alliances are critically important to a firm success and coping with globalization, deregulation, and developments in information and transportation technology.*

1. INTRODUCTION

Alliances are a sophisticated phenomenon in organizations. Alliances are used in a wide range of situations and can entail many different partner arrangements, the pursuit of many different objectives, and varying degrees of commitment and involvement from partners. In recent years, strategic alliances have become prevalent and significant structural tools for business growth (Albers et al., 2016).

Strategic alliances can be categorized according to the number of parties engaged as either dyadic partnerships, in which only two parties are involved, or multiple relationships, in which three or more parties are involved. From the perspective of resource commitment, businesses can commit either some or no equity, but they still contribute some of their resources to the alliance and collaborate with some of their partners (Culpan, 2009). According to Contractor and Reuer (2014), there are four main sorts of motivations that influence interfirm collaboration strategically:

1. market expansion or increased revenue as a result of the collaboration;
2. efficiency or cost reduction;
3. risk sharing or reduction;
4. access to know-how or learning.

An alliance is an inter-organizational co-operation between two or more organizations that are still separate from one another but work together on a particular project - each partner's strategic objectives are to:

1. maximize the joint net value or net benefits emerging from the co-operation (Zajac & Olsen, 1993; Colombo, 2003);
2. appropriate a sizeable portion of the net benefits generated (Gulati & Singh, 1998);
3. reduce each partner's expenses and risk.

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Several methods can be used to take advantage of an alliance's advantages. It may feature monetary gains like revenue and equity growth on equity-based joint venture shares or royalties from technological licenses (Contractor et al., 2011). Earning profit markups on outsourced components or goods traded between the allies via supply chain partnerships could potentially benefit the alliance (Wathne & Heide, 2004; Kaufman et al., 2000; Jeffries & Reed, 2000). A non-financial, but no less significant, gain from an alliance could be that each party picks up useful process practices or other expertise from the alliance partner.

2. ADVANTAGES AND DISADVANTAGES OF STRATEGIC ALLIANCES

Businesses need resources that can be leveraged to produce unique and rare value for customers in order to generate and exploit a competitive edge. It is challenging for businesses to have all the resources required to compete successfully across numerous markets due to the growing complexity of markets as a result of accelerated and rapid globalization (Ariño & de la Torre, 1998). Independent businesses rarely have the resources necessary to compete on an equal footing, let alone to gain an advantage. Access to information, resources, technology, and markets is made possible by alliances. Resources include things like knowledge, access to technology, and advantages in a market. The aspirations to increase production efficiency and the resulting decrease in costs; to hasten access to technology, markets, and customers; to improve organizational learning; to expand strategic skills; and to maintain the competitiveness are the main drivers of strategic alliance formation. The positive aspects of alliances can be seen in these and other motivations.

A company's management must be aware of the following factors to improve its chances of forming a successful international strategic alliance (Brouthers et al., 1995):

1. Complementary Skills: Only companies that can strengthen the venture should be partnered with in an alliance. The knowledge, experience, and abilities must be relevant to the goods or services being supplied and must be specific to them. Alliances should only be formed by managers with companies that meet a specific purpose. There is little need for enterprises to collaborate if no new capabilities are added.
2. Co-operative Cultures: Management needs to understand how crucial collaboration is to building effective global strategic partnerships. The management of one company shouldn't assume the lead position and impart all of their knowledge to the other alliance partners while receiving no education. Management must look for opportunities to learn from alliance partners because co-operation is a two-way street. Employees that are a part of the alliance must be mindful of any existing cultural divides, and management must take care to ensure this.
3. Compatible Aims: Management must ensure that their involvement in the partnership is based on the goals of their individual company and is not merely a convenient, impromptu choice. The alliance's management must have objectives, as well as company-wide objectives. The alliance should achieve strategic goals that would not have been possible without the global strategic alliance. Conflicting objectives among the participating companies could make the alliance underperform or limit its outcomes so that only one alliance partner benefits.
4. Appropriate Levels of Risk: Management needs to take into account the hazards. Management should avoid joining alliances where they would be expected to give more money than the company can reasonably afford, both up front and down the road. Management must also exercise caution because not all knowledge, expertise, and know-how is housed within the alliance, and partner companies must prevent alliance partners from accessing

non-alliance information. In many cases, alliances are created to lower risks, yet in doing so, alliances also increase other dangers, such as political vulnerability. Two significant risk factors include giving up business expertise or discovering that financial pressures rise as a result of partner issues.

Numerous studies on alliances show significant failure rates (Kale et al., 2002), substantial transaction costs associated with drafting and overseeing alliance agreements (Argyres & Mayer, 2007), and severe uncertainty surrounding the appropriation of alliance benefits (Park & Ungson, 2001). According to studies, between 30 and 70 percent of alliances fail, failing to achieve the objectives of their parent companies or giving the operational or strategic benefits they promised (Bamford et al., 2004). Over 50% of alliances are reportedly terminated (Lunnan & Haugland, 2008).

This leads to a conundrum for businesses. On the one hand, businesses struggle to form alliances that are successful enough. On the other hand, they must now build more partnerships than ever before and rely more heavily on them in order to increase their competitiveness and growth. If this is the case, managers need to have a better awareness of what factors truly contribute to successful alliances. Failure can come at a high price. Alliance failure is caused by a variety of elements, such as partner opportunism, cultural incompatibilities, and the inherent friction brought on by aim divergence (Doz, 1996; Kale et al., 2000).

3. STRATEGIC ALLIANCES IN INTERNATIONAL BUSINESS

Due to factors such as globalization, deregulation, advancements in communication and transportation technologies, and the emergence of new market economies, strategic alliances are becoming more and more widespread. In a global context with a wide range of variable environmental elements at play, difficult strategic decision-making processes that precede partnerships become much more complex. Finding the type of value creation that is ingrained in different places is a crucial question in the formation of strategies. However, locales are infused with values, institutions, and practices that build the infrastructure in which assembly decisions are entrenched, so it's not only geography that matters (Dacin, 2011).

When companies wish to expand internationally, they may opt to have complete management control, acquire an existing company, or create a new wholly-owned subsidiary. Alternatively, they may choose to co-operate with other companies to varying degrees (Kogut and Singh, 1988). In general, businesses engage in inter-organizational connections abroad to reduce costs, establish selective alignment between host country risks and company control, and gain knowledge from their partners (Aguilera, 2011). The global market to multinational hierarchy spectrum encompasses a wide range of inter-organizational linkages, from supplier ties (Dyer & Chu, 2000) to multinational corporate groups (Colpan et al., 2010).

Global strategic alliances are described as relatively long-lasting inter-organizational co-operative agreements involving cross-border flows and linkages that make use of the resources and governance structures from autonomous organizations with headquarters in two or more countries for the joint accomplishment of individual goals connected to the corporate mission of each sponsoring firm (Parkhe, 1991). Contractual partnerships are increasingly preferred over the equity joint venture option in the changing global corporate environment. Globally speaking, the enforcement of intellectual property rules is improving yearly. Over the past 20 years,

expropriation risks have dramatically decreased, and arbitration provisions better safeguard the value of foreign assets (Contractor & Reuer, 2014). The rising codification of unregistered corporate capability is another subtle trend that tangentially supports the transferability of information in contractual alliances that are increasingly organizationally remote (Contractor & Lorange, 2002). Due to improved operations research methodology, global supply chain coalitions that previously would have been deemed too hazardous or unmanageable due to foreign exchange, political, and international logistics hazards are now feasible (Ding et al., 2007).

International partnerships give businesses the chance to access expertise and resources that aren't currently regulated or accessible in their native country (OECD, 2000). International alliances, however, can provide difficulties not present in local coalitions. According to research, alliance partners' teamwork and learning can be hampered by variations in national cultures (Lane & Beamish, 1990; Parkhe, 1991; Lyles & Salk, 1996; Hennart & Zeng, 2002).

Country distinctions still exist and have a significant impact on strategic choices and outcomes notwithstanding globalization (Tong et al., 2008). Researchers have recently been encouraged to include country-specific data and use disparities between the nations of alliance partners as explanatory factors as a result of the greater availability of country data. These could contain institutional and cultural data banks as well as assessments of each country's level of intellectual property protection (Ginarte & Park, 1997; Berry et al., 2010).

Three potential drivers of partner differences are suggested by Sirmon and Lane (2004): national, organizational, and professional. Deeply ingrained ideals shared by all citizens of a country are referred to as national culture (Hofstede, 1991; Hill, 2021). A people's "design for living" is made up of a set of common conventions, values, and priorities (Hill, 2021). National culture has a significant and enduring impact. Organizational culture is defined in terms of common group meaning (Hofstede et al., 1990; Golden, 1992; Ostroff et al., 2002). According to O'Reilly and Chatman (1996), organizational culture establishes a particular sort of social control that designates the proper attitudes and actions that organization members should exhibit. Similar organizational cultures between partners enhance learning, enjoyment, and interaction effectiveness, but cultural disparities between partners reduce these favorable consequences. The corporate procedures used to share, integrate, and exploit resources including knowledge, connections, and physical assets are projected to be hindered by decreased learning, satisfaction, and efficacy of interactions (Sirmon & Lane, 2004). Another significant culture that may have an impact on international alliances is the professional culture. When a group of people working in a functionally comparable profession has a set of norms, values, and beliefs specific to that profession, then that profession is said to have a professional culture. Through the socialization that people acquire during their occupational education and training, professional cultures are created (Jordan, 1990). The outcomes are anticipated to be disappointing when multinational alliance partners demand that individuals from various professional cultures interact during the alliance's principal value-creating activity.

4. CONCLUSION

Alliances are a sophisticated phenomenon in organizations. Alliances are used in a wide range of situations and can entail many different partner arrangements, the pursuit of many different objectives, and varying degrees of commitment and involvement from partners. The four basic kinds of motivations for interfirm collaboration's strategic drivers include: market expansion or

revenue enhancement as a result of co-operation; efficiency or cost reduction; risk sharing or reduction; and access to knowledge or learning.

In order to reduce their expenses, build a discriminating alignment between host country risks and firm control, and learn from their partners, businesses engage in interorganizational interactions abroad. Through international alliances, businesses can access information and resources that aren't currently controlled or accessible in their own nation. It is more challenging to integrate knowledge-intensive activities between foreign enterprises since partners have different national, organizational, and professional cultures. These discrepancies may prevent alliance partners from collaborating and learning from one another. However, in cross-national endeavors, cultural differences aren't always a source of conflict or unpredictability. Because conflict is likely to necessitate more engagement and communication between the partners, which will ultimately result in more effective knowledge acquisition, conflict may occasionally be a useful process mechanism for organizational learning.

In order to have the resources to be genuinely internationally competitive, multinational corporations will increasingly need to create alliances. However, making the wrong alliance partner choice could end up being much more expensive and hazardous than going it alone. Understanding the ideal methods for managing a single alliance between two or more businesses is useful. Future alliance strategies should, however, use a portfolio strategy, as most businesses participate in multiple alliances. Each unique alliance is significant, and a company should follow the proper best practices at each step of the alliance's life cycle and have a solid strategic justification for the partnership. However, by treating each of its separate alliances as a portfolio and managing it as such, a company can benefit further.

Strategic alliances are notoriously dangerous. Strategic collaborations should be avoided unless there is a genuine lack of resources, such expertise, technology, or money. If there are gaps, the business should search for complementary capabilities, collaborative cultures, compatible goals, and proportionate risk levels. Numerous research on alliances point to high rates of failure, high transaction costs associated with drafting and overseeing alliance agreements, and serious uncertainty surrounding the appropriation of alliance benefits. In response, they frequently make recommendations for the choice of partners and legal frameworks in order to lower the risks of failure, transaction costs, and misappropriation.

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Testing the Weak Form of Efficient Market Hypothesis in Period of the Global Pandemic of 2020 and the Russian Invasion in 2022: Empirical Evidence from XAU, XAG and XPT

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Abstract: *This study intends to determine if the events of 2020 and 2022 have had an impact on the efficiency of the commodities markets, in particular the spot prices of gold (XAU), silver (XAG), and platinum (XPT), between September 18th, 2017, and September 15th, 2022. The findings of the Rankings and Signals test demonstrate that, during the calm time, the gold, silver, and platinum markets do not reject the random walk hypothesis, which means that spot prices are independent and identically distributed (i.i.d.), consequently their movements are assumed to be random. Contrarily, the random walk hypothesis is rejected during the Stress period in all commodity markets, with variance ratios below unity, suggesting that returns show significant autocorrelation. To support this, the findings of the exponent Detrended Fluctuation Analysis (DFA) reveal that silver (XAG) had an antipersistent short memory (a < 0,5), during the Calm period, transitioning to a persistent movement (a > 0,5) during the time of the crisis. While the worldwide financial markets were stable, platinum (XPT) was in a state of equilibrium. This state changed to persistent with the succession of events starting in 2020 (a >0,5). In turn, gold (XAU) reduced its antipersistence (a <0,5) throughout the period of stress in international markets. In conclusion, there is evidence of some dependency in the time series, but this dependence does not appear to be easily exploitable by investors. These findings have significant implications for gold, silver, and platinum's roles as investment assets.*

1. INTRODUCTION

One of the most significant economic and financial theories tested over the last century is the efficient market hypothesis (EMH). Due to numerous contradictory evidence, also known as anomalies against HME, some researchers have questioned whether the HME hypothesis is valid so many theories have been developed to explain some of the anomalies (Fama, 1965, 1970, 1991).

The gold, silver and platinum markets are precious metal markets that have evolved into potential investment assets. From the perspective of an investor, it is critical to understand that the spot prices of these precious metals represent the relevant information set at each moment in time. This paper examines a sequence of price changes for each metal to see whether these

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markets are efficient, that is, whether the random walk and martingale hypothesis are verified in times of stress in international financial markets (Dias & Carvalho, 2020, 2021; Dias et al., 2021; Teixeira et al., 2022).

In recent decades, we learned that speculation is a necessary element of the price discovery process and that efforts to eliminate such speculation reduce informational efficiency in international financial markets dramatically. In light of these occurrences, this study will test whether the events of 2020 and 2022 have influenced the efficiency, in their weak form, of commodity markets, namely gold (XAU), silver (XAG), and platinum (XPT). The results suggest some persistence between the 2020 and 2022 events, but there is no evidence that investors can easily exploit this dependence, and these findings are crucial for investors trying to diversify their portfolios efficiently.

Because gold, silver, and platinum markets have become important components of both individual and institutional investment portfolios, this study contributes to the existing literature, particularly in the study of informational efficiency in precious metal markets. It is also important to understand the impact that the 2020 and 2022 events had on predictability in the spot prices of gold (XAU), silver (XAG), and platinum (XPT).

This study is organized as follows: part 1 is an introduction, and section 2 is a Literature Review of studies on predictability in commodities markets. Section 3 covers the data and methods. Section 4 contains the main results. Section 5 concludes.

2. LITERATURE REVIEW

Various scientific studies have examined the notion of asset return prediction through the examination of patterns that may impact commodity price information, namely precious metals. According to these studies, certain economic developments make the fast adjustment of asset values difficult, resulting in temporal gaps that investors might employ to take advantage of above-average returns without incurring additional risk (Dias & Santos, 2020; Dias et al., 2021; Vasco et al., 2021; Guedes et al., 2022).

In 2015, the authors Ntim et al. (2015) investigated the extent to which the predictability of gold spot prices can be explained by macroeconomic variable volatility in the spot prices of 28 global gold markets, with special attention on the random walk and martingale hypothesis, from January 1968 to August 2014. The authors show that gold markets in the UAE, Saudi Arabia, Indonesia, Egypt, Mexico, Nepal, Pakistan, Russia, and Vietnam are (un)efficient and persistent. For gold markets in Hong Kong, Japan, Switzerland, the United Kingdom, and the United States, the random walk and martingale hypothesis cannot be rejected, whereas the results for gold markets in Australia, Bahrain, Brazil, Canada, China, Germany, India, Malaysia, Singapore, South Africa, South Korea, Taiwan, Thailand, and Turkey are hybrid. Furthermore, Charles et al. (2015) highlight that the predictability of precious metals market returns has changed over time, i.e. the returns of gold and silver markets have been trending downwards, implying that the level of efficiency, in its weak form, of these markets has significantly improved.

Already in 2020, the authors Shahid et al. (2020) assessed whether the prices of NYSE commodities (gold, silver, and metal) fluctuate randomly. The authors show that commodities exhibit inefficient

behavior throughout the sample period, demonstrating that past prices help predict future prices. Furthermore, investors can use time-varying information to reduce the risk of NYSE investment.

Pathak et al. (2020) investigated the predictability of gold, silver, platinum, and palladium spot prices and discovered that the degree of efficiency of metal prices fluctuates with time, with the silver market exhibiting the highest levels of efficiency. In addition, Shahid, Latif, et al. (2020) investigated the predictability of four commodities indexes, namely gold, metal, oil, and silver, in different crisis periods from 1963 to 2013. The authors show, using linear and non-linear testing, that commodities index returns were predictable (dependent) in certain crises but unpredictable in others.

In more recent studies, Okoroafor and Leirvik (2022) evaluated the efficiency of the spot crude oil (WTI) market to key events in worldwide financial and commodities markets, finding that the WTI market is persistent and (in)efficient during the financial crisis. In contrast, Kara et al. (2022) tested the efficient market hypothesis, i.e. the predictability of pricing patterns, for many non-renewable commodities, including gold, platinum, and silver, copper, zinc, aluminum, lead, tin, and nickel (1980-2019). Except for silver, the authors show that none of the prices can be described by the efficient market hypothesis, which states that prices follow stationary and predictable patterns related to global economic events. In addition, Mensi et al. (2022) investigated fractal behavior and long memory in major precious and industrial metals futures markets. The authors estimated the Hurst exponent and performed an asymmetric multifractal trend fluctuation analysis for this purpose (A-MF-DFA). According to the authors, gold has the least asymmetric multifractal behavior while silver has the most asymmetric multifractal magnitude. All metals markets exhibit negative persistence and positive anti-persistence. Precious metals were most inefficient in decline before and during the 2008 global financial crisis, the European sovereign debt crisis, and the oil crisis.

In summary, this paper aims to contribute to the provision of information to market agents trading the spot prices of gold (XAU), silver (XAG), and platinum (XPT), and to attempt to demonstrate whether the 2020 and 2022 events have caused predictability in the specific metal markets.

3. METHODOLOGY AND DATA

3.1. Data

The data analyzed are the spot prices of gold (XAU), silver (XAG), and platinum (XPT), from September 18th, 2017, to September 15th, 2022. To obtain more robust results, we divided the sample into two sub-periods: the first period is referred to as Calm is defined by an apparent calmness in the financial markets and comprises the period from 18 September 18th, 2017, to December 31st, 2019. The events of 2020 and 2022 characterize the second period, a highly complex period in international financial markets marked by events such as the pandemic outbreak caused by the appearance of coronavirus in the Chinese city of Wuhan in March 2020 and, later, the Russian invasion of Ukraine in the first quarter of 2022. The time scales are daily and were obtained from the Thomson Reuters Eikon database.

3.2. Methodology

In order to answer the research question, we will go through several steps. The first step is to evaluate the evolution of gold (XAU), silver (XAG), and platinum (Pt) (XPT). The sample will

be characterized using descriptive statistics such as mean, standard deviation, asymmetry, and kurtosis, to validate whether we are dealing with normal distributions. To validate the results, we will estimate Jarque and Bera (1980). We will estimate the Dickey and Fuller (1981), Phillips and Perron (1988), Levin et al., (2002), and Im et al. (2003) tests to demonstrate that prices are stationary. The Clemente et al. (1998) test will be used to assess the most important breaks in the structure of spot prices of gold (XAU), silver (XAG), and platinum (XPT).

To answer the research question we will estimate Wright's (2000) model, through Wright (2000) Rankings and Signs Variance Ratios; to validate results we will apply Detrended Fluctuation Analysis (DFA) methodology. By assuming that the time series are non-stationary, this technique prevents false conclusions when the study focuses on the long-run relationships of the time series. Peng et al. (1994) created this methodology, which has its roots in the study of DNA behavior. This method was then used to investigate the behavior of financial series. DFA's interpretation is as follows: $0 < \alpha < 0,5$ anti persistent series; $\alpha = 0,5$ series features random walk: $0,5 < \alpha < 1$ persistent series.

4. RESULTS

Figure 1 shows the evolution of commodity markets, namely the spot prices of gold (XAU), silver (XAG) and platinum (XPT), in the period from September 18th, 2017, to December 31st, 2019, a period marked by relative stability in financial markets, as well as in the period from January 1st, 2020, to September 15th, 2022, a highly complex period in international financial markets marked by events such as the pandemic outbreak caused by the emergence of coronavirus in the Chinese city of Wuhan in March 2020 and later, in the first quarter of 2022, with the Russian invasion of Ukraine. Through graphical observation, it is noticeable that there are significant breaks in the structure of the time series, especially during the first and second quarters of 2020 and 2022. Authors Dias et al. (2022), and Zebende et al. (2022) support this evidence by highlighting large structural breaks in international capital markets.

Figures 2 and **3** show the evolution, in returns, of the financial markets under analysis and high dispersion around average (extreme volatility), and a certain synchronism in the movements of the time series can be observed. It's possible to confirm the existence of accentuated falls in structure in the markets under analysis, with special emphasis on the commodities markets, which were primarily felt in the last quarter of 2019 and first/second quarter of 2020, a period that was characterized as a bear market period due to a sharp drop in price indexes caused by the uncertainty triggered by the evolution of the global pandemic (Covid-19). In 2022, due to Russia's invasion of Ukraine, there are also structural breaks in the time series under study, however, they are less pronounced as compared to the influence of the Covid-19 pandemic.

Table 1 shows the main descriptive statistics of the returns of the time series, namely the spot prices of gold (XAU), silver (XAG), and platinum (XPT), for the two sub-periods under study, namely the Calm sub-period from September 18th, 2017, to December 31st, 2019, and the Stress sub-period from January 1st, 2020, to September 15th, 2022.

The values of average returns are shown in **Table 1**, which are consistent with classical financial theory dictates, that is, the longer the time interval, the average returns will tend toward zero. Overall, gold (XAU), had the highest average return in both subperiods under analysis, despite falling. It should also be highlighted that the commodities under research exhibited positive

average returns during the calm subperiod; nevertheless, during the financial market Stress subperiod, not only did all of them become less profitable, but even platinum (XPT) showed a negative average return.

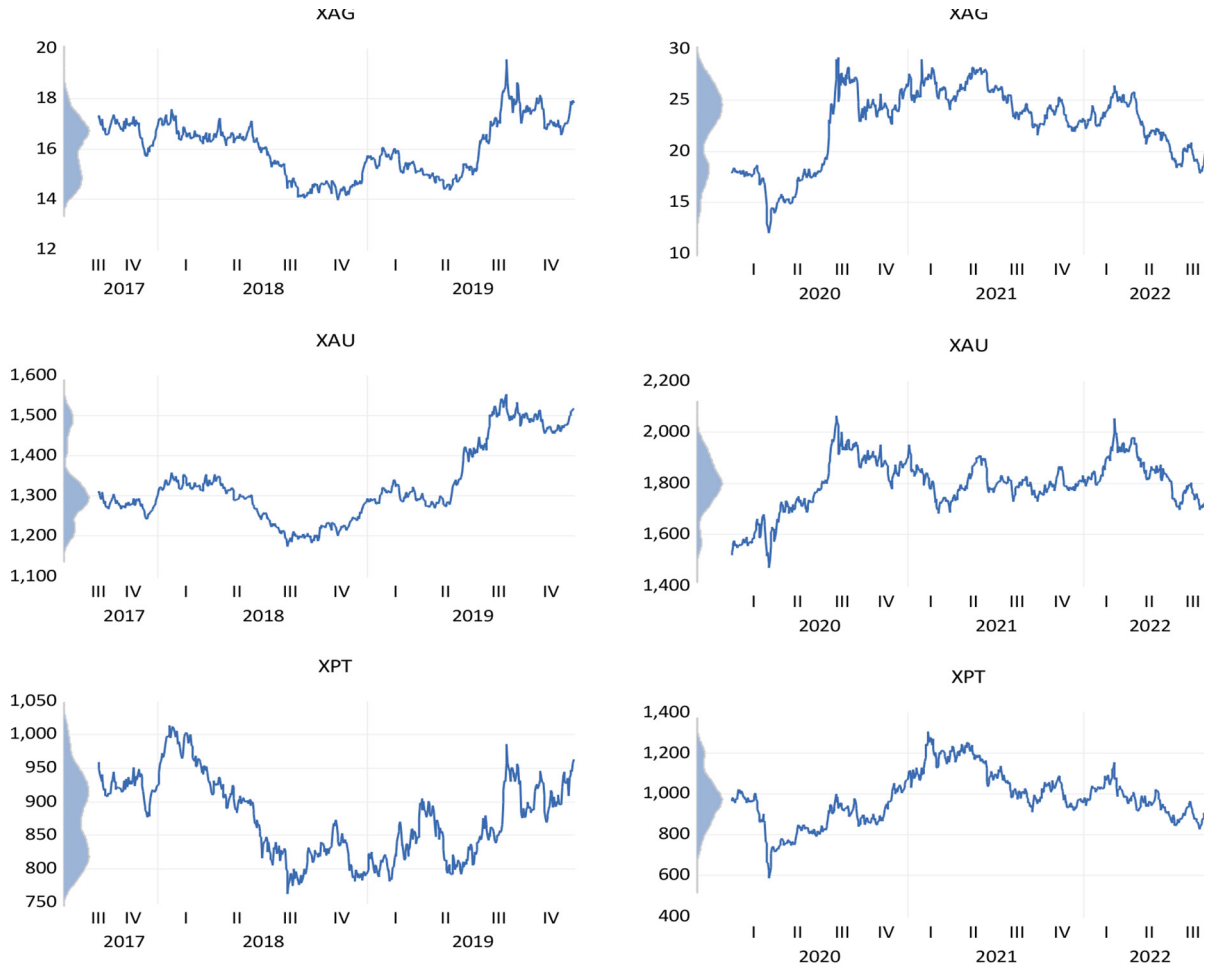

Figure 1. Evolution, in levels, of the commodity markets (XAG, XAU, XPT), for the period from September 18th, 2017, to September 15th, 2022

Source: Own elaboration

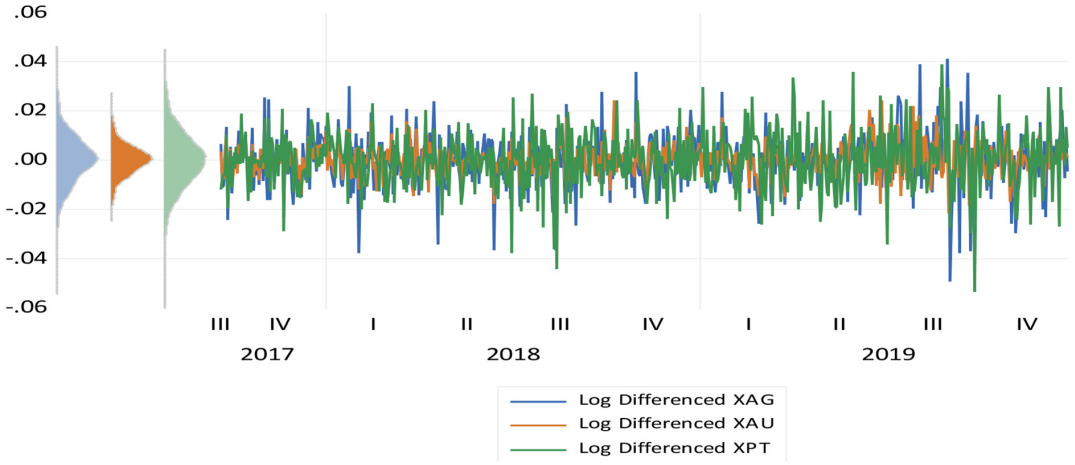

Figure 2. Evolution, in returns, of the commodity markets (XAG, XAU, XPT), in the period from September 18th, 2017, to December 31st, 2019

Source: Own elaboration

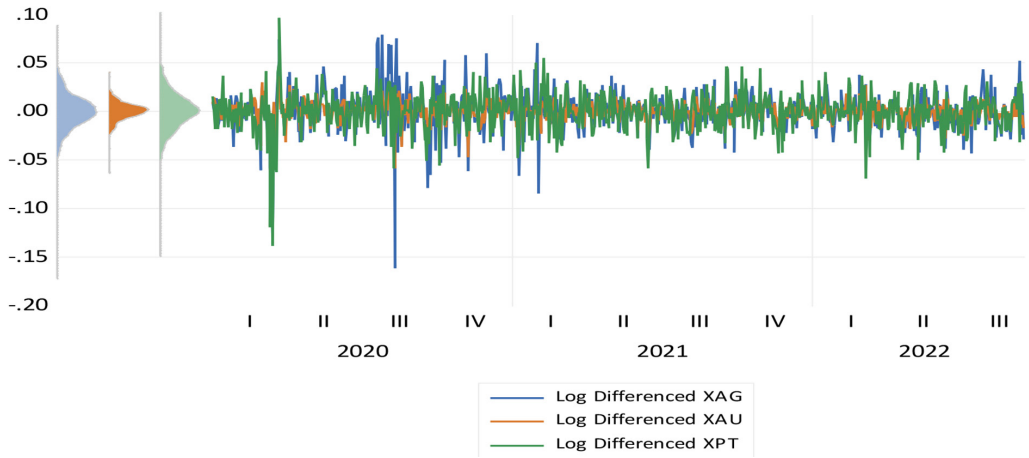

Figure 3. Evolution, in returns, of the commodity markets (XAG, XAU, XPT), in the period from January 1st, 2020, to September 15th, 2022

Source: Own elaboration

In terms of standard deviation, gold (XAU) is the riskiest asset in the calm subperiod. In comparison, all of the financial markets under consideration showed higher risk during the Stress subperiod. The results also show that the return series deviate from the normality hypothesis, which is validated by the Jarque and Bera (1980) test, as well as by analyzing the skewness and kurtosis coefficients, which are statistically different from those of a normal distribution, leading us to conclude that the return series analyzed are leptokurtic and asymmetric.

Table 1. Descriptive statistics, in returns, of the commodity markets (XAG, XAU, XPT) from September 18th, 2017, to September 15th, 2022

	Calm Period			Stress Period		
	18/09/2017 a 31/12/2019			01/01/2020 a 15/09/2022		
	XAG	XAU	XPT	XAG	XAU	XPT
Mean	5.97E-05	0.000252	5.26E-06	0.000100	0.000134	-8.66E-05
Median	0.000336	0.000270	0.000000	0.000536	0.001016	0.000649
Maximum	0.041407	0.024360	0.039076	0.079027	0.036340	0.097077
Minimum	-0.049225	-0.021652	-0.053648	-0.162015	-0.058927	-0.138772
Std.Dev.	0.010996	0.006550	0.011721	0.021290	0.009942	0.020139
Skewness	-0.244225	0.104835	-0.170491	-0.817372	-0.737945	-0.750538
Kurtosis	5.035149	4.047529	4.260143	11.07271	6.471347	8.376299
Jarque-Bera	108.2328	28.19906	42.10862	1998.483	419.1480	917.8575
Probability	0.000000	0.000001	0.000000	0.000000	0.000000	0.000000
Sum	0.035392	0.149290	0.003122	0.070898	0.094422	-0.061224
SumSq.Dev.	0.071578	0.025401	0.081333	0.320018	0.069783	0.286347
Observations	593	593	593	707	707	707

Source: Own elaboration

When we are analyzing price indexes it is crucial to analyze the (non-)stationary nature of the time series. **Tables 2** and **3** analyze the stationary nature of the spot prices of gold (XAU), silver (XAG), and platinum (XPT), throughout the Calm and Stress subperiods, respectively.

The Levin et al. (2002) and Im et al. (2003) test postulate that the null hypothesis has unit roots, showing a probability lower than a significance level of 1%, in first differences, since it causes us to reject the null hypothesis.

Table 2. Stationarity tests of Dickey and Fuller (1981), Phillips and Perron (1988), Levin, Lin, and Chu (2002) and Im et al. (2003), applied to the commodity markets (XAU, XAG, XPT) under study over the period from September 18th, 2017, to December 31st, 2019

Method	Statistic	Prob.**	Crosssections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-56.9454	0.0000	3	1773
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-47.9240	0.0000	3	1773
ADF - Fisher Chi-square	505.978	0.0000	3	1773
PP - Fisher Chi-square	505.104	0.0000	3	1773

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality

Source: Own elaboration

Table 3. Stationarity tests of Dickey and Fuller (1981), Phillips and Perron (1988), Levin, Lin, and Chu (2002) and Im et al. (2003), applied to the commodity markets (XAU, XAG, XPT), over the period from January 1st, 2020, to September 15th, 2022

Method	Statistic	Prob.**	Crosssections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-56.9413	0.0000	3	2118
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-48.1422	0.0000	3	2118
ADF - Fisher Chi-square	534.660	0.0000	3	2118
PP - Fisher Chi-square	534.821	0.0000	3	2118

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality

Source: Own elaboration

In **Figure 4** it is possible to examine the most significant structure breaks, of the spot prices of gold (XAU), silver (XAG), and platinum (XPT), over the period from September 18th, 2017, to December 31st, 2019. The results of Clemente et al. (1998) test demonstrate that more significant breaks occur mostly when rumors of the advent of an infectious disease in the Chinese city of Wuhan, dubbed Covid-19, appear. Due to the evolution of the pandemic outbreak, there are also significant breaks in the time series structure in the early months of 2020. It should also be highlighted that platinum (XPT) moves more volatilely than gold (XAU) and silver (XAG).

Even though Russia's policy choice to conduct military operations on Ukrainian territory had a large-scale negative impact, commodity markets did not show sharp falls.

In **Tables 4** and **5** are presented the results of the non-parametric version of the Wright (2000) variance test for the two sub-periods under study, namely, the "Calm" period, which runs from September 18th, 2017 to December 31st, 2019, and the "Stress" period, which corresponds to the time lapse between January 1st, 2019, and September 15th, 2022, for the commodities of gold (XAU), silver (XAG), and platinum (XPT). This approach comprises the Rankings Variance Ratio and Signals tests, and the present statistics were calculated for lags from 2 to 16 days.

The results presented in **Table 4** show that during the Calm period, the random walk hypothesis is not rejected for all markets under analysis, which means, that during this period the changes in the price indexes XAG, XAU and XPT are i.i.d., so it is assumed that past price index movements or trends cannot be used to predict future price index movements.

During the Stress period, however, the random walk hypothesis is rejected for all commodity markets, including gold (XAU), silver (XAG), and platinum (XPT). During this period, we even find that the variance ratios are less than unity, which implies that the returns exhibit significant autocorrelation. These findings lead us to conclude that, regardless of the nature of the information, markets may overreact to it during the Stress period and end up correcting themselves in the following days. Zebende et al. (2022), Dias et al. (2022), and Guedes et al. (2022) validate these findings, revealing that the high prices sensitivity to new information during this period of high complexity in international financial markets is due to the climate of pessimism and uncertainty experienced by investors during the sample period, as a result of events such as the Covid-19 pandemic in 2020 and Russian invasion of Ukraine in 2022.

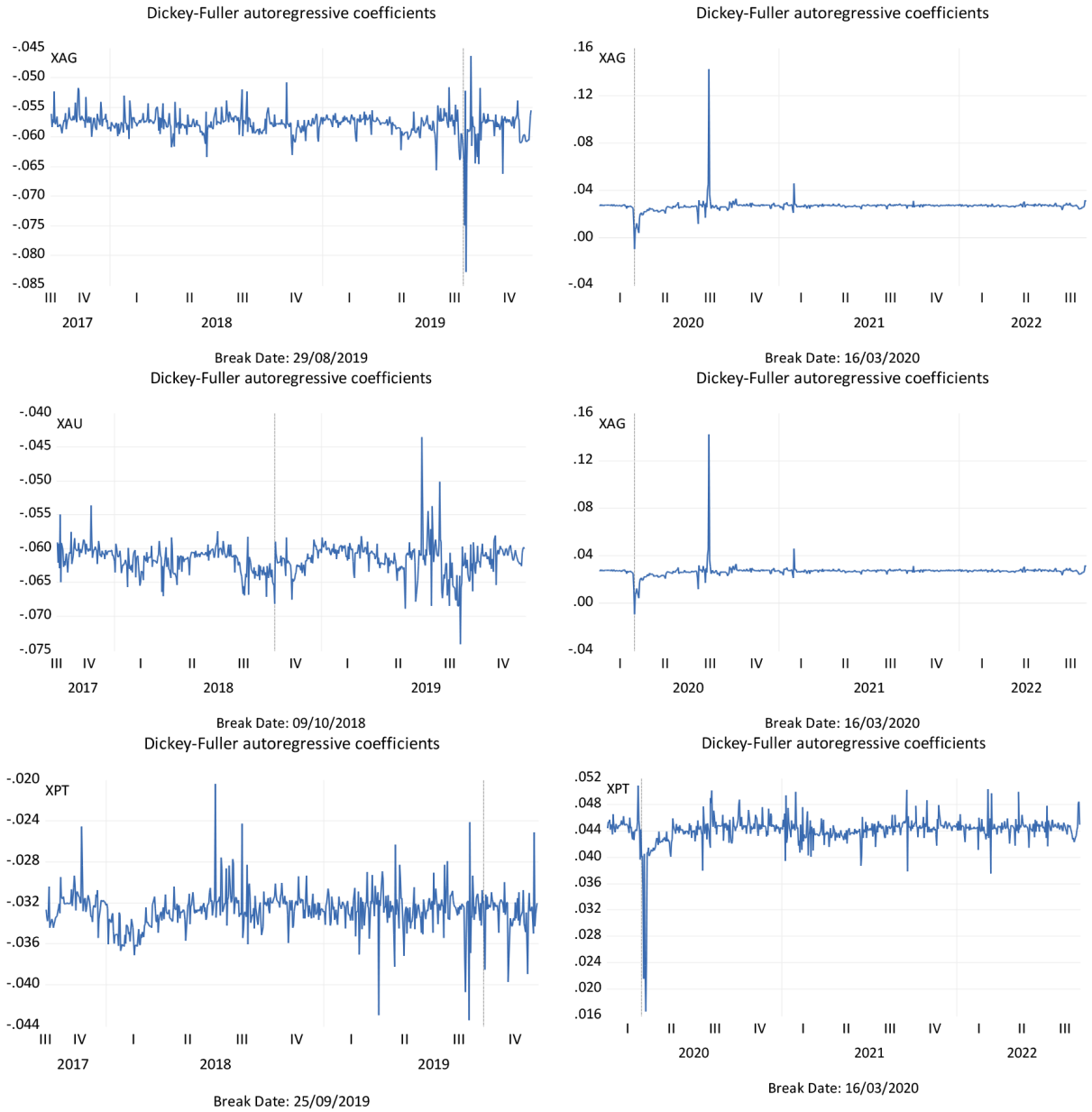

Figure 4. Evolution, in levels, of the commodity markets (XAG, XAU, XPT), for the period from 18 September 2017 to 15 September 2022

Source: Own elaboration

Table 4. Tests of Wright's (2000) Variance Ratios of Rankings and Signals, in returns, of commodity markets (XAG, XAU, XPT), over the period from September 18th, 2017, to December 31st, 2019

Null Hypothesis: XAG is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 2)		2.131658	593	0.0890
Wald (Chi-Square)		16.09920	15	0.377
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.912463	0.041065	-2.131658	0.0360
3	0.870888	0.061216	-2.109108	0.0340
4	0.887535	0.076826	-1.463903	0.1410
5	0.875196	0.089969	-1.387182	0.1550
6	0.864278	0.101516	-1.336959	0.1760
7	0.867338	0.111925	-1.185278	0.2320
8	0.860704	0.121472	-1.146733	0.2460
9	0.846881	0.130339	-1.174770	0.2440
10	0.833241	0.138652	-1.202718	0.2350
11	0.814170	0.146501	-1.268458	0.2150
12	0.795844	0.153956	-1.326068	0.1950
13	0.778120	0.161070	-1.377536	0.1730
14	0.760766	0.167887	-1.424970	0.1590
15	0.752592	0.174439	-1.418303	0.1600
16	0.748872	0.180756	-1.389321	0.1650
Null Hypothesis: XAU is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 13)		1.747963	593	0.2040
Wald (Chi-Square)		20.76580	15	0.1840
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.928226	0.041065	-1.747810	0.0790
3	0.896511	0.061216	-1.690551	0.0880
4	0.892039	0.076826	-1.405272	0.1620
5	0.870776	0.089969	-1.436313	0.1490
6	0.838329	0.101516	-1.592568	0.1070
7	0.823332	0.111925	-1.578453	0.1200
8	0.809609	0.121472	-1.567366	0.1240
9	0.794279	0.130339	-1.578350	0.1220
10	0.778460	0.138652	-1.597820	0.1150
11	0.754216	0.146501	-1.677693	0.0970
12	0.740452	0.153956	-1.685861	0.0970
13	0.718455	0.161070	-1.747963	0.0820
14	0.706922	0.167887	-1.745689	0.0810
15	0.709265	0.174439	-1.666683	0.0990
16	0.715834	0.180756	-1.572093	0.1300
Null Hypothesis: XPT is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 16)		1.144655	593	0.5420
Wald (Chi-Square)		11.26668	15	0.7320
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.969029	0.041065	-0.754191	0.4550
3	0.956153	0.061216	-0.716268	0.4750
4	0.969207	0.076826	-0.400811	0.6810

5	0.957439	0.089969	-0.473063	0.6320
6	0.955149	0.101516	-0.441809	0.6500
7	0.942110	0.111925	-0.517228	0.6000
8	0.932909	0.121472	-0.552319	0.5910
9	0.908344	0.130339	-0.703208	0.4860
10	0.885651	0.138652	-0.824718	0.4200
11	0.859158	0.146501	-0.961370	0.3400
12	0.843360	0.153956	-1.017435	0.3000
13	0.830145	0.161070	-1.054539	0.2840
14	0.812988	0.167887	-1.113918	0.2620
15	0.801978	0.174439	-1.135192	0.2480
16	0.793096	0.180756	-1.144655	0.2410

Source: Own elaboration

Table 5. Tests of Wright's (2000) Variance Ratios of Rankings and Signals, in returns, of the commodity markets (XAG, XAU, XPT) over the period January 1st, 2020, to September 15th, 2022

Null Hypothesis: XAG is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 2)		12.67728	706	0.0000
Wald (Chi-Square)		176.6346	15	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.522884	0.037635	-12.67728	0.0000
3	0.373722	0.056104	-11.16287	0.0000
4	0.300005	0.070410	-9.941766	0.0000
5	0.250896	0.082455	-9.084983	0.0000
6	0.211422	0.093037	-8.475924	0.0000
7	0.183742	0.102577	-7.957514	0.0000
8	0.165742	0.111327	-7.493744	0.0000
9	0.139225	0.119454	-7.205923	0.0000
10	0.135944	0.127072	-6.799731	0.0000
11	0.129524	0.134266	-6.483229	0.0000
12	0.114931	0.141098	-6.272711	0.0000
13	0.109201	0.147619	-6.034465	0.0000
14	0.103157	0.153866	-5.828744	0.0000
15	0.101478	0.159871	-5.620300	0.0000
16	0.091801	0.165660	-5.482294	0.0000
Null Hypothesis: XAU is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 2)		11.85102	706	0.0000
Wald (Chi-Square)		161.1216	15	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.553981	0.037635	-11.85102	0.0000
3	0.358434	0.056104	-11.43536	0.0000
4	0.293553	0.070410	-10.03339	0.0000
5	0.252260	0.082455	-9.068433	0.0000
6	0.207382	0.093037	-8.519349	0.0000
7	0.188365	0.102577	-7.912437	0.0000
8	0.161292	0.111327	-7.533715	0.0000
9	0.142062	0.119454	-7.182167	0.0000
10	0.142438	0.127072	-6.748630	0.0000
11	0.129794	0.134266	-6.481221	0.0000

12	0.120490	0.141098	-6.233316	0.0000
13	0.113554	0.147619	-6.004977	0.0000
14	0.109981	0.153866	-5.784391	0.0000
15	0.107495	0.159871	-5.582663	0.0000
16	0.101736	0.165660	-5.422325	0.0000
Null Hypothesis: XPT is a random walk				
Joint Tests		Value	df	Probability
Max |z| (at period 2)		12.79182	706	0.0000
Wald (Chi-Square)		175.2677	15	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.518574	0.037635	-12.79182	0.0000
3	0.376586	0.056104	-11.11182	0.0000
4	0.287103	0.070410	-10.12501	0.0000
5	0.236443	0.082455	-9.260258	0.0000
6	0.203024	0.093037	-8.566189	0.0000
7	0.183986	0.102577	-7.955130	0.0000
8	0.169627	0.111327	-7.458847	0.0000
9	0.142807	0.119454	-7.175936	0.0000
10	0.133193	0.127072	-6.821379	0.0000
11	0.133375	0.134266	-6.454552	0.0000
12	0.125228	0.141098	-6.199737	0.0000
13	0.116954	0.147619	-5.981943	0.0000
14	0.111292	0.153866	-5.775871	0.0000
15	0.109373	0.159871	-5.570916	0.0000
16	0.110238	0.165660	-5.371000	0.0000

Source: Own elaboration

The Detrended Fluctuation Analysis (DFS) approach was used to test the weak efficient market hypothesis in commodity markets, namely the spot prices of gold (XAU), silver (XAG), and platinum (XPT) from September 18th, 2017, to September 15th, 2022. To study two sub-periods, one marked by relative stability in international financial markets and another marked by high complexity in markets resulting from events such as the Covid-19 outbreak and the Russian invasion of Ukraine, the period under study was divided into two parts: a "Calm" period that runs from September 18th, 2017, to December 31st, 2019, and a "Stress" period that runs from January 1st, 2020, to September 15th, 2022.

Using the DFA technique the α parameter was calculated for each time series. The parameter α represents the correlation properties of time series, and means that if $\alpha = 0.5$, there are no long-range correlations present in the series, remaining in an equilibrium situation. In turn, if the parameter remains between 0.5 and 1, the series is persistent, and the process is considered to be long-term dependent with positive correlations at all lags. These markets are associated with higher risk and (positive) persistence, allowing for abnormal profits through arbitrage and providing evidence against the efficient market hypothesis. If the series has an α parameter between 0 and 0.5, the series is antipersistent, and the process is considered to be long-run dependent with negative correlations at all lags, which is related to markets that exhibit rapid mean-reversion.

Analyzing **Table 6**, we can see a significant increase in the exponents for XAG (0.48 to 0.54) and for XPT (0.50 to 0.52). During the Calm period, the commodity XAG presented an antipersistent long memory ($\alpha < 0.5$), turning to a persistent movement during the crisis ($\alpha > 0.5$).

Platinum (XPT), on the other hand, was in a situation of equilibrium during the period of so-called tranquility in international financial markets, before transitioning to a persistent state with the sequence of events beginning in 2020 ($\alpha > 0.5$). In turn, the commodity XAU experienced a decrease in the value of its exponent but remained antipersistent ($\alpha < 0.5$).

These findings show that prices do not fully reflect available information and that price changes are not i.i.d. In this view, this research has implications for investors since some returns in the markets under investigation may be predicted, offering the potential for arbitrage and abnormal profits, which implies gaining returns above the market average without incurring additional risk. These findings are consistent with those given by Dias et al. (2022), Zebende et al., (2022), and Guedes et al. (2022), all of which highlight the presence of long memories in periods of stress in international financial markets.

Table 6. Results of the DFA exponent, in returns, of the commodity markets (XAG, XAU, XPT), over the period from September 18th, 2017, to September 15th, 2022

Market	DFA (Calm)	DFA (Stress)
XAG	0.48 ≅ 0.0130	0.54 ≅ 0.0114***
XAU	0.48 ≅ 0.0245	0.46 ≅ 0.0068***
XPT	0.50 ≅ 0.0054	0.52 ≅ 0.0119***

Note: ***. **. *. represent significance at 1%. 5% and 10%. respectively.

Source: Own elaboration.

5. CONCLUSION

This article aimed to understand if the global pandemic of 2020 and the Russian invasion in 2022 caused predictability in the spot price formation of gold (XAU), silver (XAG), and platinum (XPT), in the period from September 18th, 2017, to September 15th, 2022. To answer the research question, we performed the Rankings and Signals test which allows evidencing, that in the Calm period, the random walk hypothesis is not rejected in the gold, silver, and platinum markets, meaning that spot prices are independent and identically distributed (i.i.d.), so it is assumed that their movements follow a random behavior. On the contrary, the random walk hypothesis is rejected in all commodity markets throughout the Stress period, with variance ratios below unity, meaning that returns exhibit significant autocorrelation. To validate, the results of the Detrended Fluctuation Analysis (DFA) exponent demonstrate that during the Calm period, silver (XAG) exhibited an antipersistent short memory ($\alpha < 0.5$), shifting during the crisis to a persistent movement ($\alpha > 0.5$). Platinum (XPT) was in a situation of equilibrium during the calm period in international financial markets, becoming persistent with the sequence of events beginning in 2020 ($\alpha > 0.5$). In turn, gold (XAU) decreased its antipersistence ($\alpha < 0.5$) through stress in international markets.

In conclusion, the authors provide significant evidence for regulators, supervisors, investors, and hedge managers who wish to invest in these markets by building strategies and diversifying their portfolios based on different frequencies. These results have significant implications for the role of gold, silver and platinum as investment assets.

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Risk Diversification in Asian Stock Markets: An Empirical Analysis in the Context of the 2020 and 2022 Events

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Abstract: *The World Health Organization (WHO) designated coronavirus infection a worldwide pandemic in 2020, based on the risk of contagion and the number of confirmed cases in more than 195 countries. Covid-19 had a severe impact on the global economy as a result of uncertainty and pessimism, causing adverse effects on financial markets. On February 24th, 2022, Russia launched a full-scale military invasion against Ukraine, signifying a dramatic escalation of a conflict that began in 2014. Several analysts named the invasion the largest military invasion in Europe since World War II. In the context of these events, this paper aims to estimate whether portfolio diversification is practicable in the stock markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC), for the period from September 18th, 2017 to September 15th, 2022. In the purpose of reaching such analysis it is intended to provide answers to two questions: (i) if the global pandemic of 2020 and the Russian invasion in 2022 have accentuated financial integration in these Asian markets? (ii) If yes, the existence of persistence in returns, could put portfolio diversification into question? The results indicate that those markets have low levels of integration, both in periods of normality and in periods of global uncertainty. Complementarily, the 2020 and 2022 events have significantly increased persistence in these regional markets. These results demonstrate that prices do not fully reflect available information and that changes in prices are not i.i.d. This situation has implications for investors, as some returns may be expected, creating some opportunities for arbitrage and windfalls profits. The authors consider that these results provide an opportunity for regulators in these regional markets to take efforts to ensure better information between these markets and the international markets.*

1. INTRODUCTION

Over the last 40 years, China has experienced a high rate of economic growth. The connection of capital markets between China and other countries has gradually become an important subject. The Association of Southeast Asian Nations (ASEAN) founded on August 8th, 1967, in Bangkok, includes ten member states, namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. ASEAN and China are geographically adjacent and have a long history of economic and cultural interactions. On September 5th, 2013, President Xi introduced the One Belt One Road initiative to strengthen cooperation with those nations. Under this initiative, China and ASEAN countries would continue to

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promote connectivity and strengthen economic ties. Additionally, with the ongoing regionalism of ASEAN countries and the implementation of the China-ASEAN Free Trade Area, the economical connection between China and ASEAN countries has been further reinforced (Li & Bai, 2022). The financial integration of Southeast Asian markets has been an important research topic. The performance of these developing markets has received considerable attention as a result of recent global financial market changes (Jacob et al., 2021).

China and the countries of Southeast Asia are geographically close and have had strong economic connections over a long period. In recent years, China and the Association of Southeast Asian Nations (ASEAN) countries have gradually opened their markets and strengthened their economic and trade ties, which have been reflected in their capital markets.

Considering the 2020 and 2022 events, this research paper will test whether portfolio diversification is achievable in the capital markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC) over the period from September 18th, 2017 to September 15th, 2022. The outcomes strongly suggest that the markets are partially integrated; however, we observe that during the global uncertainty of 2020 and 2022, the persistence in these regional markets has increased significantly. These outcomes may put into question the implementation of efficient portfolio diversification strategies in these regional markets.

This study contributes to the literature, particularly the study on portfolio diversification in those Asian regional markets during the pandemic breakout in 2020 and the Russian invasion in 2022. According to what we know, this is the first study to examine these Asian markets in the context of global economic instability.

The preference for these Asian financial markets is justified by the fact that they have unstable and dynamically developing economies and are connected by cultural heritage and by some similar economic conditions. In addition, following the recent financial crisis of 2008, international emerging markets, and those in Asia, have become important investment destinations. In this context, with large capital inflows, it is of high importance to understand the interdependencies and connections between these regional financial markets.

In terms of structure, this paper is organized into 5 sections. Section 1 is represented by the current introduction. Section 2 presents a literature review of articles concerning the integration of financial markets. Section 3 describes the data and methodology. Section 4 contains the results. Finally, Section 5 presents the main conclusions.

2. LITERATURE REVIEW

The comprehension of international connections between stock markets and the investigation of the occurrence of financial integration phenomena, in the context of stock market crashes, is important for investors, investment fund managers and academics, in several aspects, namely in portfolio diversification in an international context (Dias et al., 2019).

Karim and Karim (2012) examined the integration among the five emerging stock markets in ASEAN (Malaysia, Thailand, Indonesia, Philippines and Singapore), based on the Autoregressive Distributed Lag (ARDL) and the authors show that stock markets in the ASEAN region are integrated during the pre, post-1997 and post-US financial crisis. These results are in alignment

with many research studies on international stock market interdependencies, suggesting that ASEAN stock markets are drifting towards greater integration with each other, especially after the global financial crisis. This implies that the long-term diversification benefits that can be obtained by investors in ASEAN markets tend to decrease.

The authors Nittayagasetwat and Buranasiri (2018), on the other hand, examined portfolio diversification in the emerging markets of the 5 Association of Southeast Asian Nations (ASEAN) countries, namely Indonesia, Malaysia, Philippines, Singapore and Thailand. The authors evidence low correlations between the analyzed markets, but the level of integration indicates the existence of long-term relationships between the returns of the analyzed markets. Considering these findings, investors cannot fully obtain the benefit of diversification in the long term. In a complementary approach, the author Wu (2019) examined the financial integration between the stock markets of the ASEAN-5 economies, China (mainland China and Hong Kong), Japan and South Korea, through Vector Autoregressive (VAR) models along with a sliding window approach. The author suggests that the integration between markets in East and Southeast Asia is not as strong as it may appear. Although governments in this region have promoted collaboration and integration between these regional markets, however, barriers remain significant.

Hung (2019) highlights that the volatility in the Chinese market had a significant impact on other markets, suggesting that equity markets are more integrated, as a result of the financial crisis. However, Sanusi et al. (2019) demonstrate the presence of long memories in ASEAN markets, which could be beneficial for investors, as these markets show some previsibility.

In 2020, the authors Stevanius and Sukamulja (2020) analyzed the integration and co-movements between Asian stock markets and Indonesia. The authors show that in the short run, there is a relationship between Kuala Lumpur Composite Index, Thailand Stock Exchange Index and Hang Seng Index against Jakarta Composite Index. Furthermore, the authors also provide evidence of integration and co-movement between the stock markets of Malaysia, Thailand, South Korea, Japan, Singapore, and Hong Kong with the Indonesian stock market.

Additionally, the authors' Silva et al. (2020) investigated portfolio diversification in the stock markets of Indonesia, Malaysia, the Philippines, Singapore, and Thailand (ASEAN-5). The authors discovered significant levels of integration among these regional markets, which may call the portfolio diversification hypothesis into question. Furthermore, except for the Singapore (SGX) market, the authors show that ASEAN-5 markets display persistence in returns, which means, the presence of pronounced long memories.

Jacob et al. (2021) analyzed the integration of Southeast Asian capital markets, namely Indonesia, Malaysia, Philippines, Singapore, and Thailand, and suggest that the Malaysian Stock Exchange, the Thai Stock Exchange, the Singapore Stock Exchange, and the Philippine Stock Exchange were fully integrated, while the Indonesian Stock Exchange was not. These results may call into question the hypothesis of efficient portfolio diversification.

Saji (2021) analyzed financial integration in Asian capital markets to gauge whether portfolio diversification was feasible in these regional markets. The author's evidence that the cointegration results could not produce any conclusive evidence of long-run relationships between stock markets. Furthermore, there is weak price convergence between markets and financial integration is partial and incomplete.

In more recent research, Li and Bai (2022) investigated the long-run and short-run synchronizations between China's markets and ASEAN-5 markets. The authors' evidence that the co-movement between China and ASEAN-5 countries is not statistically significant in the long-run, while the average spillover effect and the volatility spillover effect are both statistically significant in the short-run, which reflects the close financial ties between China and ASEAN-5 countries. In a complementary approach, the author Prasetya (2022) studied four cases. First, to find the long-run cointegration between East and Southeast Asia. Secondly, analyze the short-run causal relationship between East and South East Asian stock market. Third, to find the most dominant East Asian stock market towards Southeast Asia and the most dominant Southeast Asian stock market towards East Asia. Finally, to search the structural analysis of forecasting for the five-day horizon period of the price of each country in both East and Southeast Asia. The author highlights that Japan is the market with the most connections in Southeast Asia, while Singapore and Philippines are the markets with the most connections in East Asia. Another point to underline in this study is that Japan is the most influential stock market in East Asia, while Singapore is the most influential stock market in Southeast Asia. This study shows that policymakers in East and Southeast Asian countries should synchronize capital market standards and regulations and reduce barriers to capital flow to stimulate the integration of regional stock markets.

In conclusion, this paper is a contribution to provide information to investors and regulators in Asian markets, where individual and institutional investors seek to efficiently diversify their portfolios, in a period of uncertainty and lack of confidence arising from the global pandemic of 2020 and the Russian invasion in 2022.

3. METHODOLOGY AND DATA

3.1. Data

The data for this study were gathered from the Thomson Reuters Eikon platform and included the daily price index of the capital markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), the Philippines (PSI), Thailand (SET), and China (SSEC).

The quotes are daily and cover the period from September 18th, 2017, to September 15th, 2022, which is marked by the global pandemic of 2020 and Russia's invasion of Ukraine in 2022. To keep the time series as reliable as possible, we have kept the prices in local currency to minimize exchange rate distortions.

Table 1. The name of countries and their indexes under analysis in this paper

Country name	Index
Indonesia	JKSE
Malaysia	KLSE
South of Korea	KOSPI
Japan	NIKKEI 400
Philippines	PSI
Thailand	SET
China	SSEC

Source: Own elaboration

3.2. Methodology

The research will be carried out in stages. To describe the sample, descriptive statistics (mean, standard deviation, asymmetry, and kurtosis) will be employed, as well as Jarque and Bera's (1980) adherence test, residual stability charts, and Q-Q Plots. To evaluate the robustness of the results, we will estimate the time series stationarity using the Hadri (2000) and Levin et al. (2002) tests.

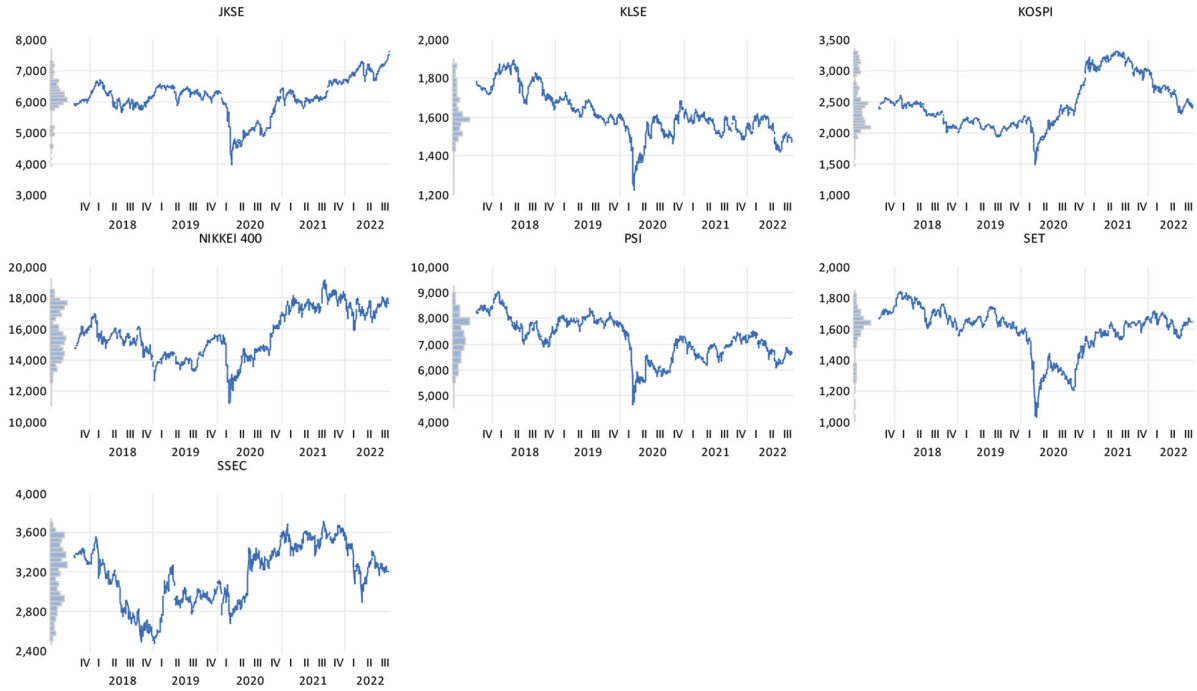
To answer the research questions, we will estimate the integration among Asian capital markets, using the Gregory and Hansen (1996) methodology that identifies structure breakdowns. In order to validate the results, we will use the Detrended Fluctuation Analysis (DFA) methodology. DFA is an analysis method that examines time dependence in non-stationary data series. This technique by assuming that time series are nonstationary avoids spurious results when the analysis focuses on the relationships of data series in the long run. DFA has the following interpretation: $0 < \alpha < 0.5$: anti persistent series; $\alpha = 0.5$ series exhibits random walk; $0.5 < \alpha < 1$ persistent series. The function of this technique is to examine the relationship between x_k and x_{k+t} values at different moments.

4. RESULTS

Figure 1 presents the evolution, in levels, of the 7 Asian stock exchanges, namely, the capital markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC), over the period from September 18th, 2017 to September 15th, 2022, a period of high complexity and economic pressure at global level triggered by the uncertainty caused by the global pandemic (Covid-19) and due to Russia's invasion of Ukraine in 2022. The markets under analysis have evidenced the existence of quite significant structural breaks during the first two quarters of 2020 triggered by the uncertainty caused by the outbreak of the Covid-19 pandemic, as well as during the year 2022, with the Russian invasion of Ukraine, although it is noted that the impact of the latter event causes less pronounced breaks in the time series.

In **Figure 2**, we can observe the evolution, in returns, of the seven capital markets under analysis. In general, the time series demonstrate a relative dispersion around the average, as well as a relative synchronization between the movements of the time series. We highlight a significant structural fall in the Japanese stock market index during the 1st and 2nd quarters of 2020, explained by the impact of the Covid-19 pandemic crisis.

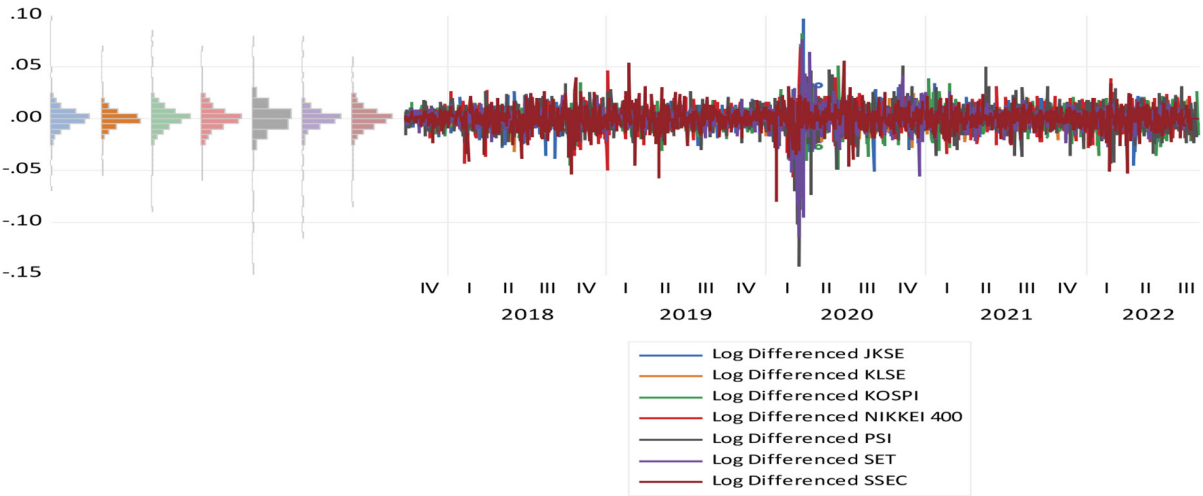
In order to understand the average returns and standard deviations of the data series of the price indexes referring to the capital markets of Indonesia (JKSE), Malaysia (KLSE), South of Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC), for the period from September 18th, 2017 to September 15th, 2022, we made graphs that can be seen in **Figures 3 and 4**. Through the analysis, we found negative average returns, namely in the KLSE (-0.000159), KOSPI (-5.54E-06), PSI (-0.000189), SET (-1.37E-05), SSEC (-4.05E-05) stock indexes, while the JKSE (0.000210) and NIKKEI 400 (0.000210) stock markets show positive average returns. As for the standard deviations of the capital markets analyzed, we found that the Philippine Stock Index (PSI) has the highest level (0.013677), while the markets of South Korea (0.011664), China (0.011291), Indonesia (0.010662), Japan (0.010985), Thailand (0.010536), Malaysia (0.007896).



Note: Data processed by the authors (software: Eviews12)

Figure 1. Evolution, in levels, of the financial market under analysis, for the period from September 18th, 2017, to September 15th, 2022.

Source: Own Elaboration



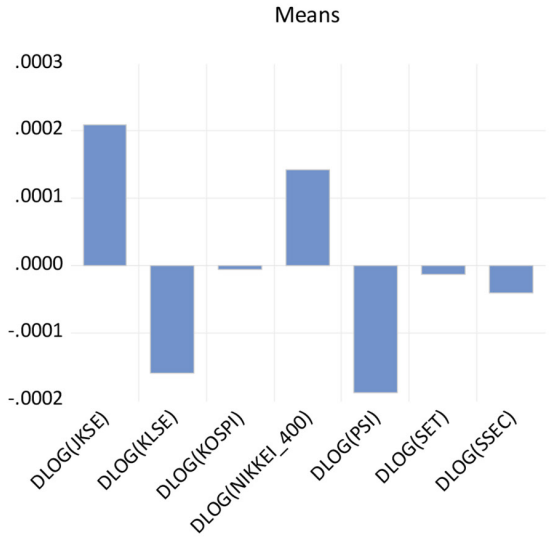
Note: Data processed by the authors (software: Eviews12)

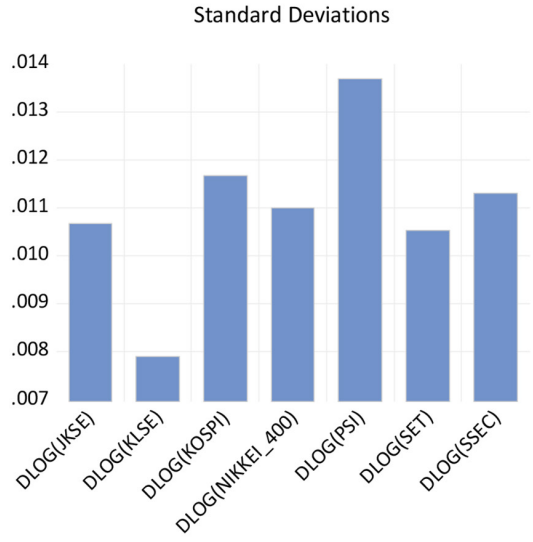
Figure 2. Evolution of the returns, of the financial market under analysis, in the period from September 18th, 2017 to September 15th, 2022.

Source: Own Elaboration

To validate whether the time series present normal distributions, we calculated the skewness and kurtosis of the capital markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC), in the period from September 18th, 2017, to September 15th, 2022. In **Figures 5 and 6** we can check these statistics, and we can ascertain that the coefficients of asymmetry and kurtosis, most prominently are centered on the capital markets of Thailand (Skewness = -2.009865; Kurtosis = 29.11360) and the Philippines (Skewness = -1.393738; Kurtosis = 17.94907). Regarding the stock indexes,

they show asymmetries and kurtosis different from a normal distribution (Skewness = 0; Kurtosis = 3), JKSE (-0.167870;12.69804), KLSE (-0.221266; 11.16387), KOSPI (-0.242733; 10.48160), SSEC (-0.669519; 8.077473), NIKKEI 400 (-0.157310; 6.352479). In summary, we can see that the time series are leptokurtic and asymmetric.



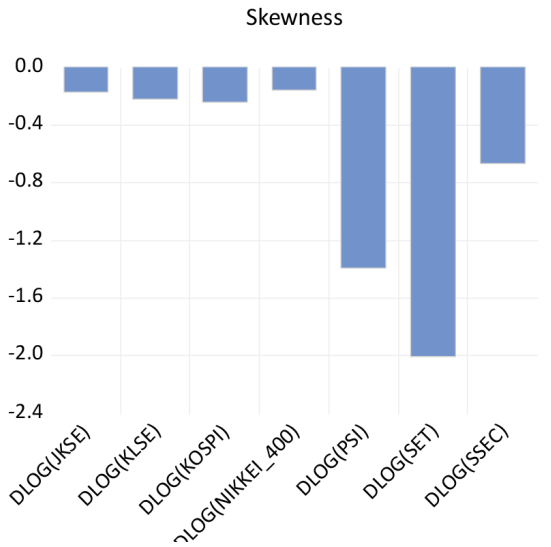


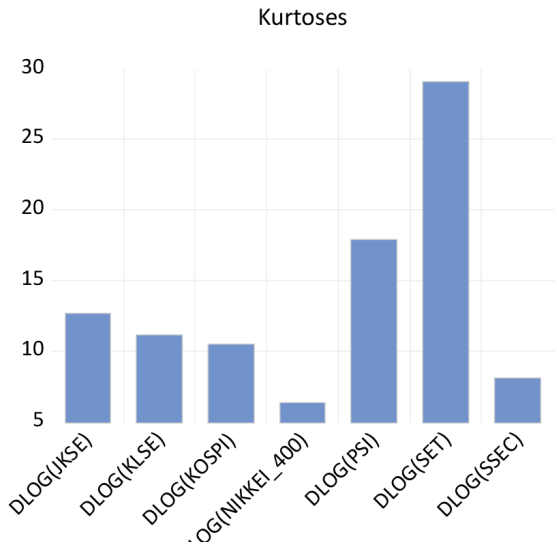
Note: Data processed by the authors (software: Eviews12)

Figure 3. Average of the 7 financial markets during the period under analysis

Figure 4. Standard Deviations of the 7 financial markets during the period under analysis

Source: Own Elaboration





Note: Data processed by the authors (software: Eviews12)

Figure 5. Skewness of the 7 financial markets during the period under analysis

Figure 6. Kurtosis of the 7 financial markets during the period under analysis

Source: Own Elaboration

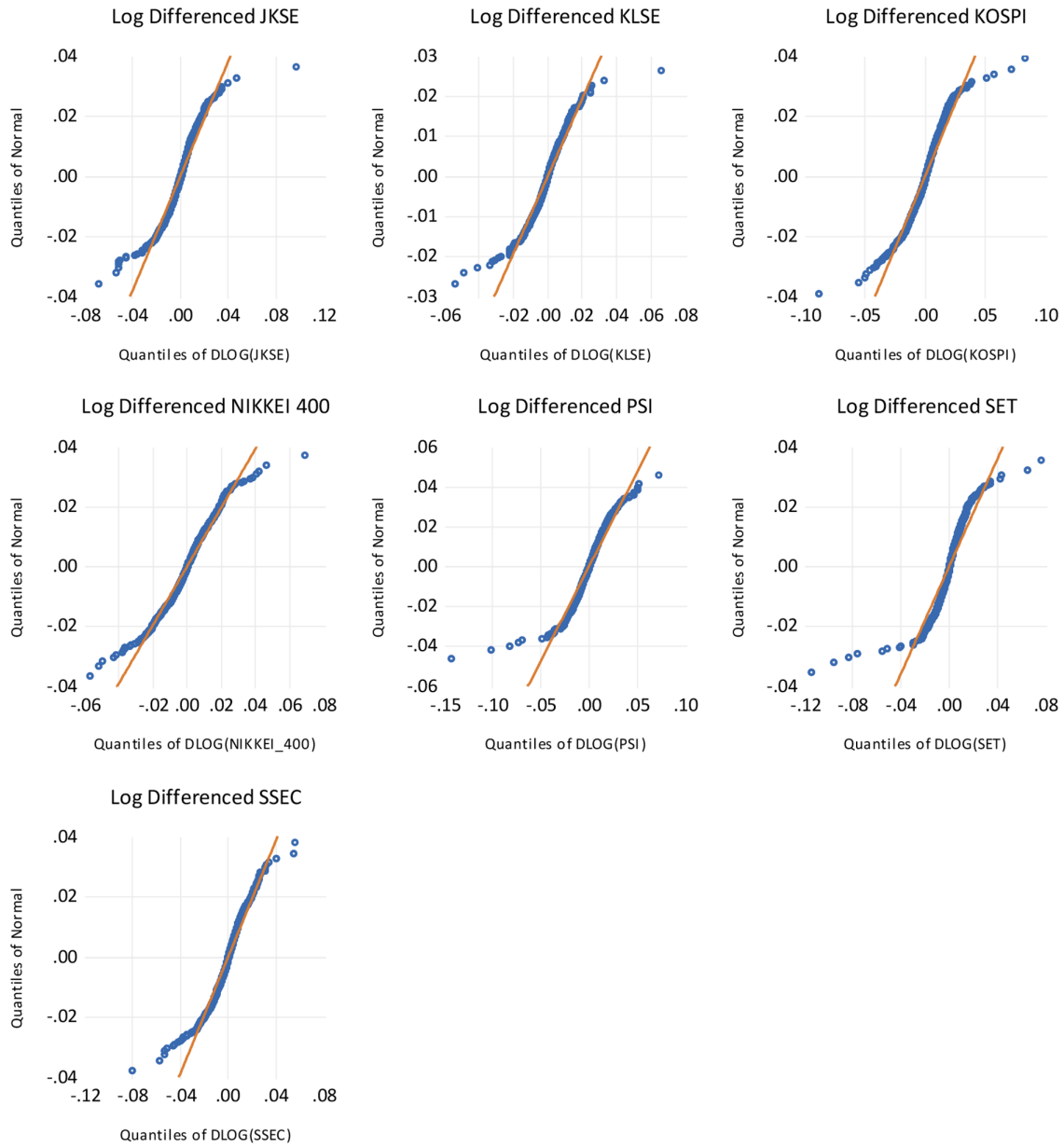
Table 2 contains the results of the test of Jarque and Bera (1980) and we verify the validation of the results of asymmetries and kurtosis that were previously estimated for the capital markets under analysis. The test of Jarque and Bera (1980) validated our results, that is, the null hypothesis of normality (H0) in favor of the alternative (H1 - non-normality), was rejected for a significance level of 1%.

Table 2. Test of Jarque and Bera (1980), in returns, of the 7 financial markets for the period from September 18th, 2017 to September 15th, 2022

	JKSE	KLSE	KOSPI	NIKKEI 400	PSI	SET	SSEC
Jarque-Bera	4810.250	3414.648	2871.395	579.1879	11812.76	35660.17	1408.559
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1226	1226	1226	1226	1226	1226	1226

Source: Own Elaboration

Note: Data processed by the authors (software: Eviews12)



Note: Data processed by the authors (software: Eviews12)

Figure 7. Q-Q Plots, in returns, of the 7 financial markets, for the period from September 18th, 2017 to September 15th, 2022

Source: Own Elaboration

Through the graphical observation of quantiles illustrated in **Figure 7**, we can also infer on the normality of time series data under analysis. The normal distribution line is graphically represented

in orange and the data distribution for each time series is represented in blue. When the time series data dispersion is compared to the normal distribution line, it is clear that none of the series overlap.

For time series estimation, the stationary nature of data series from 7 capital markets should be analyzed, namely Indonesia (JKSE), Malaysia (KLSE), South of Korea (KOSPI), Japan (NIKKEI 400), Portugal (PSI), Thailand (SET) and China (SSEC). The Levin et al. (2002) test postulates as null hypothesis the existence of a unit root in the observable components of the time series, that is, the non-stationarity of the time series. Based on the results presented in **Table 3**, the t-statistic of Levin et al. (2002) leads us to reject the null hypothesis at a significance level of 1%, indicating the stationarity of the time series under study. In addition, to validate these findings, Hadri's (2000) test was applied, and in table 4 we can see that the statistical result leads to the non-rejection of the null hypothesis at a significance level of 1%, validating the stationarity of the time series, suggesting that we are dealing with white noise (mean = 0; constant variance). This way, with stationary series, we can apply models and tests, without running the risk of getting spurious regressions.

Table 3. Levin et al. stationarity test (2002), applied to the 7 financial markets, in the period from September 18th, 2017 to September 15th, 2022

Method				Statistic		Prob.**	
Levin, Lin & Chu t*				-98.9458		0.0000	
** Probabilities are computed assuming asymptotic normality							
Intermediate results on UNTITLED							
	2nd Stage	Variance	HAC of		Max	Band-	
Series	Coefficient	of Reg	Dep.	Lag	Lag	width	Obs
JKSE	-0.91331	0.0001	2.E-06	2	22	123.0	1223
KLSE	-1.01883	6.E-05	2.E-07	0	22	779.0	1225
KOSPI	-0.88846	0.0001	3.E-06	1	22	90.0	1224
NIKKEI 400	-0.96909	0.0001	2.E-06	0	22	95.0	1225
PSI	-1.05112	0.0002	4.E-06	0	22	88.0	1225
SET	-0.77714	0.0001	3.E-06	4	22	77.0	1221
SSEC	-1.00212	0.0001	3.E-06	0	22	89.0	1225
	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-0.98191	-77.157	1.002	-0.500	0.707		8568

Note: Data processed by the authors (software: Eviews12)

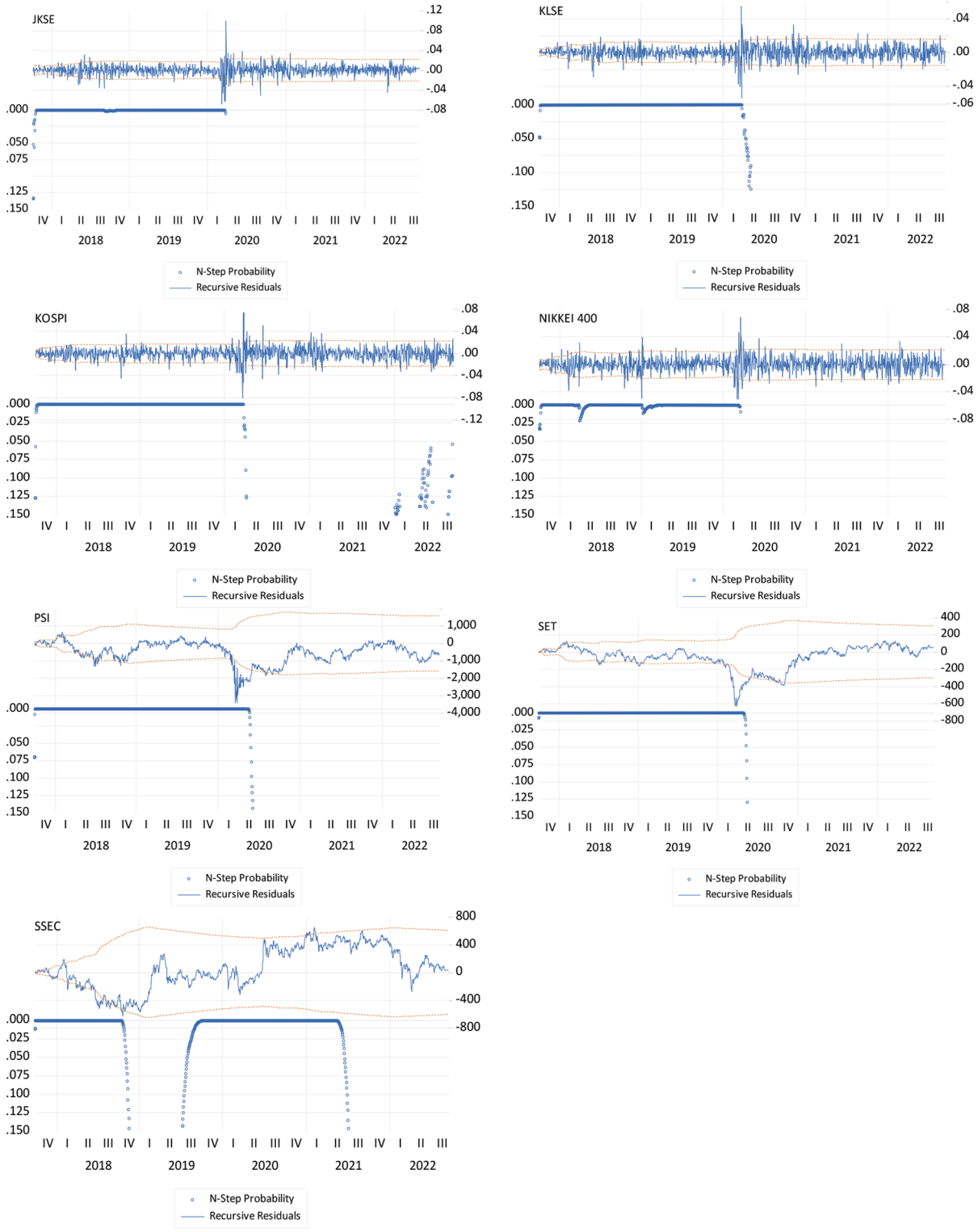
Source: Own Elaboration

Table 4. Hadri Stationarity test (2002), applied to the 7 financial markets, in the period from September 18th, 2017 to September 15th, 2022.

Method			Statistic	Prob.**
Hadri Z-stat			-0.27353	0.6078
Heteroscedastic Consistent Z-stat			-0.30346	0.6192
* Note: High autocorrelation leads to severe size distortion in Hadri test, leading to over-rejection of the null.				
** Probabilities are computed assuming asymptotic normality				
Intermediate results on UNTITLED				
Variance				
Series	LM	HAC	Bandwidth	Obs
JKSE	0.0586	0.000131	11.0	1226
KLSE	0.0271	7.21E-05	8.0	1226
KOSPI	0.1550	0.000135	1.0	1226
NIKKEI 400	0.0366	0.000130	3.0	1226
PSI	0.0329	0.000188	5.0	1226
SET	0.0479	0.000138	11.0	1226
SSEC	0.0750	0.000113	15.0	1226

Note: Data processed by the authors (software: Eviews12)

Source: Own Elaboration



Note: Data processed by the authors (software: Eviews12)

Figure 8. Stability Tests conducted on results of the 7 financial markets, for the period from September 18th, 2017 to September 15th, 2022

Source: Own Elaboration

Figure 8 graphically represents the stability tests performed on the residuals of the seven capital markets, namely the stock indices of Indonesia (JKSE), Malaysia (KLSE), South of Korea (KOSPI), Japan (NIKKEI 400), Portugal (PSI), Thailand (SET) and China (SSEC), for the

period from September 18th, 2017 to September 15th, 2022. The performances of these stability tests are related to the existence of structure breaks, which means, sharp falls in prices that cause imbalances in financial markets. The detection of structural breakdowns is important because it has the same impact as the existence of unit roots in the visible components of time series. The presence of disturbances in the variance may be observed using graphical analysis, as well as the violation of the 95 percent probability boundaries, indicating an unstable behavior in the time series investigated.

The Gregory and Hansen (1996) test was used to examine the extent of financial integration across the seven stock markets during a period of tremendous complexity defined by the economic crisis and the Russian invasion of Ukraine, during which markets broke down severely. The methodology used postulates that in the null hypothesis there is an absence of cointegration and is tested against the alternative hypothesis, that is, long term relations between markets. Thus, the behavior and degree of integration between variables will be under evaluation.

Table 5 shows the results of the Gregory and Hansen (1996) test on stock markets in Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Portugal (PSI), Thailand (SET), and China (SSEC) during the Smooth subperiod. Overall, we can conclude that the markets are partially integrated since they present 11 integrations (in 42 possible ones). When analyzing in terms of individual markets it is possible to validate that the markets that present more integrations are the KOSPI, JKSE, PSI and SSEC stock indices (2 in 7 possible), while the KLSE, NIKKEI 400 and SET stock markets present only one integration.

These results demonstrate that in this Smooth subperiod the markets are partially integrated, that is, they do not present marked synchronizations, showing that these regional markets present relevant characteristics for a successful portfolio diversification strategy. These conclusions are validated by the authors Dias et al. (2019) for Latin American markets.

Table 5. Gregory and Hansen (1996) test, relating to the 7 Asian capital markets in the Smooth period, September 18th, 2019 to December 31st, 2020

Market	Test	Test Statistic	Method	Lags	Breakpoint	Date	Results
KOSPI - NIKKEI 400	-5,31**	Zt	Trend	0	314	04/01/2019	Integration
KOSPI - SSEC	-4,7*	ADF	Regime	3	352	05/03/2019	Integration
JKSE - PSI	-5,84***	Zt	Regime	2	95	08/02/2018	Integration
JKSE - SET	-5,15**	Zt	Regime	1	289	27/11/2018	Integration
KLSE - SET	-5,15**	Zt	Regime	0	375	05/04/2019	Integration
NIKKEI400 - KOSPI	-5,58***	Zt	Trend	0	314	04/01/2019	Integration
PSI - JKSE	-5,85***	Zt	Regime	0	95	08/02/2018	Integration
PSI - SSEC	-5,11**	Zt	Regime	0	309	26/12/2018	Integration
SET - KLSE	-5,23**	ADF	Regime	0	374	04/04/2019	Integration
SSEC - KOSPI	-4,94*	ADF	Regime	3	355	08/03/2019	Integration
SSEC - NIKKEI400	-4,88*	Zt	Trend	0	344	20/02/2019	Integration

Note: Data processed by the authors (software: Stata). The critical values are found in Gregory and Hansen (1996). The critical values for the ADF and Zt parameters are: −5,45 (1%); −4,99 (5%); −4,72 (10%). For the Za parameter, the critical values are: −57,28 (1%); −47,96 (5%); −43,22 (10%). The asterisks ***, **, * indicate statistical significance at 1%, 5% and 10%, respectively

Source: Own Elaboration

Table 6 displays the results of the Gregory and Hansen (1996) test on capital markets, namely Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Portugal (PSI), Thailand (SET) and China (SSEC), in the Stress subperiod, that is, in a period of uncertainty in the global economy and financial markets. In general, the integration of markets decreased from 11 in the Smooth period to 10 in the Stress subperiod. When we look at the integration of the markets individually, we can see that the KOSPI stock index only integrates once with Japan, while the Indonesia market (JKSE) integrates with the Philippines market (PSI) and Thailand (SET), and the Malaysia stock index (KLSE) integrates with Thailand (SET) and Japan (NIKKEI 400) with South Korea (KOSPI). Regarding the capital markets, the Philippines (PSI) integrates with Indonesia (JKSE) and China (SSEC), Thailand (SET) integrates only once with the Malaysian market (KLSE), while China (SSEC) integrates with the Korean market and Japan. When we compare the two sub-periods we find that the uncertainty in the current global economy of the 2020 global pandemic and the Russian invasion in 2022, did not accentuate the integration in these regional markets; these findings allow us to evidence that the implementation of portfolio diversification strategies in these regional markets may be viable.

Table 6. Gregory and Hansen (1996) test, relating to the 7 Asian capital markets in the Stress period, January 1st, 2020 to September 15th, 2022

Market	Test	Test Statistic	Method	Lags	Breakpoint	Date	Results
KOSPI – NIKKEI 400	-5,31**	Zt	Trend	0	311	28/12/2018	Integration
JKSE - PSI	-5,84***	Zt	Regime	2	95	08/02/2018	Integration
JKSE - SET	-5,15**	Zt	Regime	1	289	27/11/2018	Integration
KLSE - SET	-5,15**	Zt	Regime	0	375	05/04/2019	Integration
NIKKEI400 - KOSPI	-5,58***	Zt	Trend	0	314	04/01/2019	Integration
PSI - JKSE	-6,06***	Zt	Trend	0	394	03/05/2019	Integration
PSI - SSEC	-5,11**	Zt	Regime	0	309	26/12/2018	Integration
SET - KLSE	-5,38**	Zt	Trend	0	372	02/04/2019	Integration
SSEC - KOSPI	-5,55**	ADF	Trend	0	343	19/02/2019	Integration
SSEC – NIKKEI 400	-4,88*	Zt	Trend	0	344	20/02/2019	Integration

Note: Data processed by the authors (software: Stata). The critical values are found in Gregory and Hansen (1996). The critical values for the ADF and Zt parameters are: −5,45 (1%); −4,99 (5%); −4,72 (10%). For the Za parameter, the critical values are: −57,28 (1%); −47,96 (5%); −43,22 (10%). The asterisks ***, **, * indicate statistical significance at 1%, 5% and 10%, respectively

Source: Own Elaboration

Table 7 illustrates the results of the α DFA exponents for the stock markets of Indonesia (JKSE), Malaysia (KLSE), South Korea (KOSPI), Japan (NIKKEI 400), Philippines (PSI), Thailand (SET) and China (SSEC), for two sub-periods: The first is from September 18th, 2019 to December 31st, 2020, which we refer to as Smooth Period, and the second is from January 1st, 2020 to September 15th, 2022, which we refer to as Stress Period.

During the Smooth period, there were long memories in select stock indexes, including the KOSPI (0.57), KLSE (0.60), NIKKEI 400 (0.53), SET (0.57), and SSEC (0.54) markets, while there was considerable persistence, that is, the existence of short-term memories, in the JKSE (0.46) and PSI (0.49) markets. In relation to the subperiod which we call Stress in stock markets, all DFA exponents increased significantly, with the exception of China's market, which went from long term memory (0.54) to anti persistence (0.48). In the individual market analysis, we find that the DFA exponents of KOSPI (0.60), JKSE (0.60), KLSE (0.61), NIKKEI 400 (0.56), PSI

(0.59), SET (0.64) stock indexes exhibit significant long memories. These results demonstrate that prices do not fully reflect available information and that changes in prices are not i.i.d. This carries implications for investors as some returns may be expected, creating opportunities for arbitrage and above average returns without incurring additional risk. These conclusions are consistent with the evidence suggested by Santos et al. (2020), Dias et al. (2020), Dias et al. (2021), Zebende et al. (2022), Dias et al. (2022), Guedes et al. (2022), that suggests the existence of long term memory in international financial markets.

Table 7. DFA exponent for return. The values of the linear adjustments for αDFA always had $R^2 > 0.99$

Index	DFA exponent (Tranquilo)	DFA exponent (Stress)
JKSE	0.46 ≅ 0.0113	0.60 ≅ 0.0029
KLSE	0.60 ≅ 0.0020	0.61 ≅ 0.0168
KOSPI	0.57 ≅ 0.0051	0.60 ≅ 0.0013
NIKKEI 400	0.53 ≅ 0.0069	0.56 ≅ 0.0149
PSI	0.49 ≅ 0.0213	0.59 ≅ 0.0250
SET	0.57 ≅ 0.0056	0.64 ≅ 0.0326
SSEC	0.54 ≅ 0.0012	0.48 ≅ 0.0243

Note: The hypotheses are H_0: $\alpha = 0.5$ and H_1: $\alpha \neq 0.5$

Source: Own elaboration

5. CONCLUSION

The general conclusion to be retained and supported by the results obtained through the tests carried out with econometric and mathematical models suggests that these Asian regional markets are partially integrated. In corroboration, through the DFA model, these regional markets reveal signs of market inefficiency, in its weak form, namely during the global uncertainty resulting from the 2020 global pandemic and the Russian invasion in 2022.

This situation has implications for investors, as some returns may be expected, creating opportunities for arbitrage and abnormal profits, contrary to the assumptions of *random walk* and informational efficiency.

In conclusion, the authors suggest that the implementation of efficient portfolio diversification strategies in these regional markets may be questionable. This study demonstrates that policymakers in East and Southeast Asian countries should synchronize stock market standards and regulations and reduce barriers to capital flows to stimulate regional stock market integration. These conclusions also provide an opportunity for the regulators of these regional markets to introduce policies to ensure better information between these regional markets and the international markets.

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Healthcare Financing Models and the Expenditure Growth

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Keywords:
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Abstract: *The present study includes the countries of the European Union, aiming to test the hypothesis that the funding models can be related to the size and growth of health expenditure, as a phenomenon from the second half of the 20th and the beginning of the 21st century. The criterion for grouping the national health systems is the dominant public source of financing from the two with the largest weight in the aggregate expenditure – health insurers' payments and payments on account of the state budget. Data from the health accounts of the countries of the EU for a period of the last 10 years are used. The observed indicator is the weight of total health expenditure of the current GDP, which allows international comparisons to be made. The methods of analysis used include descriptive statistics, verification of hypotheses for the type of empirical distributions, equality of means and variances, and graphical presentation of the detected dependencies. The results show that there is a significant variation in health expenditure between the individual countries in the EU. Within the formed two groups of countries - one with a dominant government budget and the other with a dominant health insurance financing, no statistically significant difference in the size of the health expenditure can be found. Such a dependence is found when grouping using other indicators related to geographical location and living standards.*

1. INTRODUCTION

Healthcare stands out as a specific socio-economic sphere in which the market has a limited place and role. Pure market phenomena are limited for several reasons, well known and described in the scientific literature. They can be summarized as follows (Arrow, 1963, p. 948-954; Stiglitz & Rosengard, 2015, p.368-371):

- the individual's demand for health services is not steady in origin as, for other goods, but irregular and unpredictable - it is a fact only in the time of illness;
- risky nature of the final medical treatment and its quality, which can subject the consumer properties of the produced services to a considerable degree of uncertainty;
- the individual course of the disease and influence of the applied treatment, which can predetermine the unique nature of the final result depending on the particular case;
- monopoly role of the physicians in the healthcare market which favours vertical integration prescribed demand, limits competition;
- the presence of specific monopolistic factors preventing the entry of new providers of medical care;
- the presence of stated preferences that limit the free consumer choice;
- relatively more pronounced asymmetry of information;
- an absence of profit motive since for-profit and not-for-profit organizations compete within the system at the same time;

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- availability of goods with significant positive externalities, which limits their market pricing;
- health is a basic human need with significant social importance, which implies ensuring financial affordability through the participation of the government.

As a result of these, the state makes efforts to ensure not only control by placing requirements on the activities of health care providers, but also to raise and distribute funds to ensure equity in access to the system (Culyer & Newhouse, 2000, p. 1805). Public funds are collected by two main methods – taxation and compulsory insurance payments. On this basis, two main models for the financial organization of healthcare systems are distinguished, named after their founders – the so-called Bismarck and Beveridge models.

The model of Bismarck was introduced in Germany in 1883 and first, it was based on social insurance for workers (Lisac et al., 2008, p. 184). Later, the insurance coverage was extended to other categories of employed, as well as some self-employed people (Busse, 2002, p. 17). This system allows more market elements mainly a high degree of economic and financial independence of the healthcare providers and competition among them. An advantage of the Bismarck system is the shorter waiting time to access the system. But the price of these benefits is a relatively higher current health care expenditure.

Beveridge's model differs significantly from Bismarck's because health fundraising is done through taxation. In this sense, all members of society participate in this process, and the government bears the total or a large part of all health expenditures. Within the revenue system, there are no special instruments intended to finance the current health costs. Similar systems, financed as a priority or entirely at the expense of the state budget, are to a greater extent centralized and integrated. In turn, they are relatively "more economical". However, the main disadvantage is the presence of larger queues of patients, i.e. ceteris paribus, slower time access to health goods. This model was introduced after the Second World War and was influenced by the British economist William Beveridge in 1948. Such kind an organization of the system was argued through the sentence that health is a basic human right and the whole society should be contributed to the system, which is realized by taxation. This system has free universal access to health care (Koen, 2000, p. 4; Rodrigues, E., et al., 1999, p. 164).

Both models allow for a certain level of private spending. As the latter finds expression mainly through private insurance products and through the so-called direct patient payments. In both models, private sources have significantly less weight than public ones.

2. AIM OF THE STUDY

The present study includes the countries of the European region, aiming to test the hypothesis that the funding models can be related to the size and growth of health expenditure, as a phenomenon from the second half of the 20th and the beginning of the 21st century. This study tries to solve the following scientific tasks:

- to select a measure of health expenditure that allows providing a comparison among economies with different wealth, income, and living standards.
- to define sets of national health systems from the EU region with their health expenditure according to the type of financial model.

- to provide evidence for the distribution, central tendencies, dispersion, and homogeneity of collected data.
- to confirm or reject the hypothesis for the relationship between the models of healthcare financing with the size of expenditure.

3. DATA AND METHODOLOGY

International data about health indicators, including economical ones, can be found in several publicly accessed sources. In this regard can be mentioned the regional Eurostat Database, global World Bank and International Monetary Fund Data Bases, and some specialized sources like the European Health for All database of the World Health Organization. According to the aim and the tasks of the study, it was chosen Eurostat Database which provides opportunities for the extraction of different measures of expenditure, and for international comparisons to be made.

It was chosen the per cent share from the current GDP of total current health care expenditure (TCHE) or its specific element by a source of financing as a reliable unit of measure which allows international comparisons to be made.

The following quantitative methods were used – descriptive statistics, tests for normality, homogeneity of variances and non-parametric tests for equality of group medians. All graphs and tests were performed with the SPSS 23 software product at a significance level of 0.05.

4. RESULTS AND DISCUSSION

After reviewing queries in the database "Health care expenditure by financing scheme"[3] from a total of 33 observed countries (27 - members of the EU and 6 outside it), two subgroups were formed. In the first subgroup, we included 13 countries with the lowest share of Social health insurance schemes below 1.5 % of the current GDP. This is the group of countries that come as close as possible to the Beveridge model. The other 20 countries, whose financing is based mainly on social health insurance and compulsory contributory health insurance, were included in the second group, presenting the Bismarck model group.

In addition, publications available on popular scientific Internet platforms[4] representing health systems from the last ten years were studied to be assigned to the appropriate group, according to a funding model (Lo Scalzo et al., 2009, p. 49; Theodorou, 2012, p. 42; Economou, 2010, p. 49; Barros et al., 2011, p. 58; Dimova et al., 2018, p. 63).

Total health expenditure as the sum of all funding sources for the total population of 33 countries and both samples follow a frequency distribution close to normal (Sharpio-Wilk test Sig. > 0.05). The same is confirmed for both groups of countries whose distribution of health expenditure as a per cent of current GDP is close to normal. According to the significance levels of the tests, it can be concluded that the distribution in the Bismarck model group is closer to rejecting the hypothesis of a normal distribution of the data. This is due to the fact that there is a definite number of countries with relatively small weights of TCHE from the national income. The histograms of the two samples can be seen in Fig. 1.

[3] The queries were performed on 06.02.2022 for the last available data for 2019.

[4] www.academia.edu, www.researchgate.com, https://scholar.google.com/

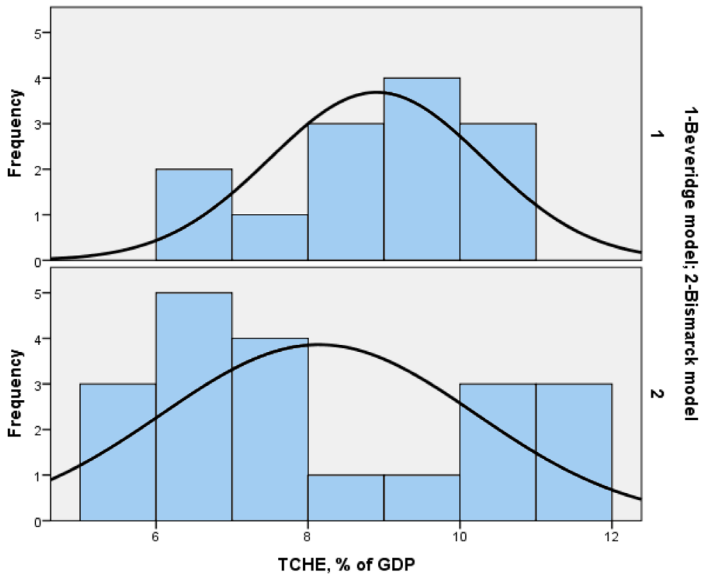

Figure 1. Frequency distribution of TCHE with normal curves in two samples.

There are 12 (60 %) countries in the group with insurance financing with a weight of health expenditure in GDP below 8 %. In the countries that adopted the Beveridge model with costs below the specified threshold, this number is only 3, with a cumulative share of 23.1 %. There is a well-marked difference in the means, medians, and dispersion of the data in the two samples (Fig. 2).

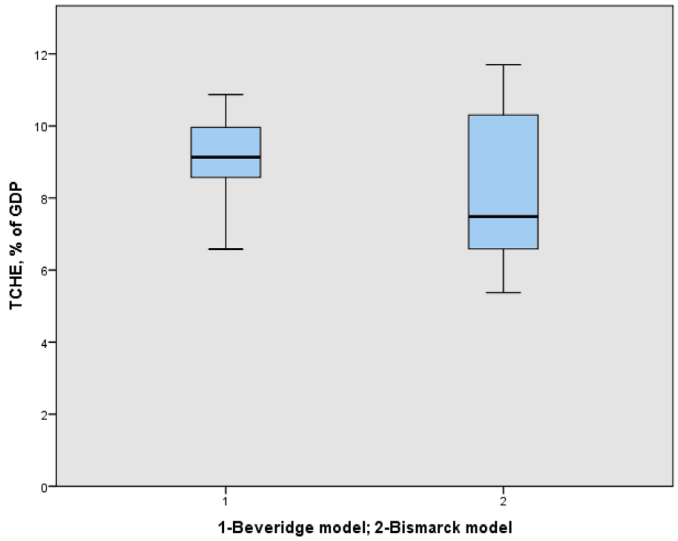

Figure 2. Group medians, maximum, minimum value, 1st and 3rd quartile of TCHE.

In the sample of countries that base their health systems on the Bismarck model, we encounter quite a pronounced dispersion (Range = 6.33 %; IQR = 3.84 %). This sample contains countries whose data are relatively heterogeneous in terms of spending as a share of GDP. The hypothesis of homogeneity of variances in the two groups is rejected (Levene's test Sig. < 0.05).

The difference in group medians is visible in Fig. 2 ($Median_1$ = 9.13 %; $Median_2$ = 7.48 %), but whether it is large enough to be considered statistically significant as well? The non-parametric test for independent samples shows that the hypothesis of equality of group medians cannot be accepted (Mann-Whitney U test Sig. > 0.05). Average measures of health care expenditure, presented as a percentage of current GDP, do not differ statistically significantly in the two groups of financing models.

This result may be due to the large variance in the Bismarck group. If we pay more attention to this group, we will find that the majority of countries with low expenditure weights are not those that have long and traditionally used the social insurance model of financing. These are the countries that have returned to this practice after years of centralized command-administrative management of the system. To understand more about the financing models and the health expenditure they generate, a new third group of countries can be created, including those from Central and Eastern Europe (CEE). From the group of countries with the Beveridge model, there is only one country from the specified region, which was also assigned to the third group (Latvia). Thus, the third group contains 13 countries (Median = 6.98 %; IQR = 1.32 %). The median values and the variation of the data in the three groups can be presented in Fig. 3.

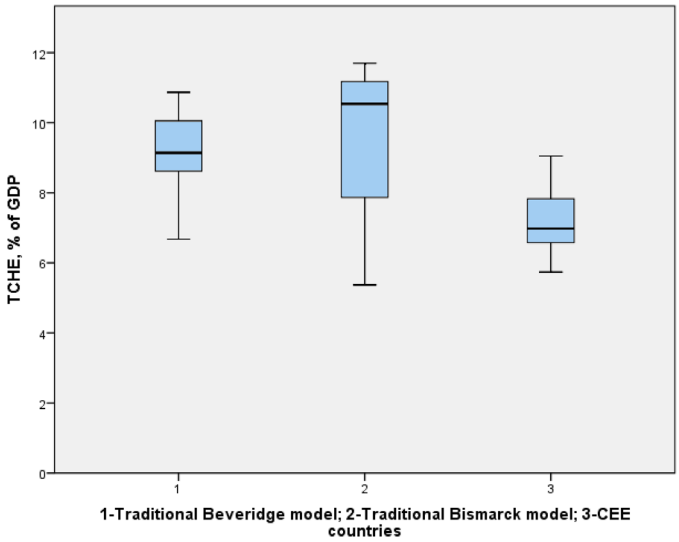

Figure 3. Medians, maximum, minimum value, 1st and 3rd quartile of TCHE in the three groups of countries.

The results of the non-parametric test in this case confirm the hypothesis of a significant difference in the group medians (Kruskal-Wallis Test Sig. < 0.05). There is at least one pair of group medians that are significantly different from each other. This fact is due to the significantly lower levels of health expenditure in the CEE countries, not so much to the visible difference between the two groups of countries with traditions in the analyzed financing models.

5. FUTURE RESEARCH DIRECTIONS

The search for more convincing predictors of health expenditure in the European region, other than financing models, could be directed towards the use of living standards indicators, the parity purchasing power of income, or similar ones.

6. CONCLUSION

Although visually there is not a small difference in the mean values and the medians of the two groups of countries with Beveridge (n=13) and with Bismarck (n=20) models, the hypothesis that the paradigm of the financing model can be related to the significant changes in the size of the total expenditure of health care cannot be confirmed. This study also supports the hypothesis that belonging to a given geographic region may also be associated with significant differences in healthcare expenditure.

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A Holistic CSR Maturity Assessment Model

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Abstract: *Recently, there has been an increasing interest in defining Corporate Social Responsibility (CSR) and the factors that have the potential to influence it. CSR has become an essential strategic tool and its initiatives have increased in variety and scope, impacting communities and businesses in economic, environmental, and social terms as a means of raising the social profile and maximizing the corporation's long-term economic and social value. This paper aims to introduce the concept of Corporate Social Responsibility and to investigate the key enabling factors and constraints that play a crucial role in the adoption and implementation of CSR initiatives. For this, a holistic framework, namely a Corporate Social Responsibility Maturity Model (CSRMM) for CSR assessment will be analyzed and presented.*

1. INTRODUCTION

It has been many years since Bowen published his work about the responsibilities of businesses for society, defining Corporate Social Responsibility (CSR) as the social obligations companies should fulfill through their policies, their corporate decisions, and their actions (Bowen, 1953). The concept of CSR is extended beyond legislation, as organizations voluntarily incorporate social and environmental concerns in their strategies, adopting a more responsible role. Implementation of CSR initiatives triggers organizations to undertake responsibility related to the impact their activities have on customers, employees, shareholders, the community, and the environment. CSR embraces three organizational aspects: economic, environmental, and social. Elkington (1999) identified a more common expression of these three aspects and named it with 3Ps**: people-planet-profit**.

The environmental pillar is the most well-known of the three. The main topic stressed here is the effect of organizational actions in the direction of the environment. Thus, this pillar refers to activities companies undertake to protect the environment and reduce their environmental impact and carbon footprint.

The second pillar is the Social one. It takes into account the interest of all stakeholders and the community in the progression of providing an impartial and ethical organization. It deals with companies' interaction and interrelations with their shareholders, customers, employees, and the local society and discusses the practices companies implement to engage their assets to enhance social sustainability. This pillar enhances operational performance through 'efficiency', quality products, and reliability, which increases productivity, corporate social performance, and customer commitment.

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The Economic pillar is considered one of the main drivers for sustainability and CSR. It is related to the implementation of sustainable business practices to promote long-term profitability and is assessed with indicators related to quality, speed, dependability, flexibility, and cost. This pillar supports the environmental and social pillars, embracing aspects that an organization must fulfill.

Figure 1. Illustration of CSR Pillars

For the successful development and implementation of environmental, social, and economic goals these three pillars must have complementary relationships and be equal without overshadowing each other. Thus, companies need a coherent framework to identify, develop, implement, control, and improve their strategy with social flair, able to ensure effectiveness and profitability.

CSR is considered one of the most important objectives for companies (Luo & Bhattacharya, 2006). However, despite its significance, it lacks a generalized and unique definition. To explain this concept, different definitions and theoretical perspectives have been framed – with a considerable common ground between them. It is associated with corporations and their evident societal obligations expecting that companies are not only responsible to their shareholders but to society in general, in addition, to pursuing profits (Hsu, 2012). Due to this, there is a growing interest in the topic from the academic world and CSR practitioners, aiming to investigate the CSR key enablers, the benefits generated by fulfilling social responsibilities, the impact on the company's reputation and the customer's perception, and finally the stakeholders' view.

The concept of CSR can be approached from different angles, which can vary in context, processes, and added value. For the purpose of this paper, we will consider CSR as a part of corporate strategy that is driven by ethical implications, social awareness, and environmental concerns, interacting with stakeholders, on a frequent and structured basis.

The contribution of our research is the proposition of a novel methodology and a holistic CSR Maturity Model (CSRMM) that assesses the CSR maturity level of corporations and can be implemented from small and medium enterprises to multinational organizations with the same efficiency. The resulting model provides all the necessary information for identification and mapping the drawbacks and the assets that strategy professionals and academics have to consider when designing CSR initiatives. It also provides practical guidance to corporations for succeeding at a higher level of maturity.

In Section 2, a literature review of the CSR concept is presented. It was based on the most prominent literature review articles related to the adoption and implementation of CSR policies and activities during the last years. The research has formulated the research objective that this paper addresses, namely: the proposal of a novel holistic and integrated framework for CSR Maturity Assessment since this literature survey revealed a gap in this field. Section 3 presents ISO 26000:2010, the standard that provides guidelines for CSR initiatives implementation, intending

to assist organizations to upgrade to a higher level of maturity. The overview of ISO 26000:2010 is crucial for the formulation of our research objective. In applying this standard, corporations should consider diversities related to society, environment, culture, law and organizational aspects, while being consistent with European and international norms.

Section 4 presents a short overview of the current maturity models, while Section 5 is the core of our research. A Holistic CSR Maturity assessment model is proposed. The Critical Success Factors and Enablers related to Corporate Social Responsibility in a Maturity Assessment Framework are depicted and their interrelations are analyzed. Finally, Section 6 concludes.

2. LITERATURE REVIEW OF THE CONCEPT

Socially responsible activities of any company, represent their awareness about the environment they operate (Tuan, 2012) since these activities have a significant impact on society, the environment, employees, and, at the end of the day, the company itself. Corporate Social Responsibility is established as one of the most popular and emerging organizational issues for both the academic community and the business world. However, there is great variety as far as CSR understanding and implementation are concerned, and many definitions of the term exist.

CSR is traditionally perceived as philanthropic actions organized and implemented by corporations. The earliest definition of CSR is the one given by Howard Bowen who, according to Carroll (1999), is the father of corporate social responsibility. He defines CSR as the obligation of businessmen to implement actions, decisions, and policies that are desirable in terms of the objectives and values of society (Bowen, 1953). Davis described CSR as a firm's consideration of issues beyond the narrow economic, technical, and legal requirements (Davis 1973 cited in Carroll, 1999) while Carroll (1979) gave a broader definition defining CSR as the social responsibility of business addressing the economic, legal, ethical, and discretionary expectations each society has. Another scholar suggests that companies should be considered as the source of the social and environmental problems they are trying to solve (Granum et al., 2015) and not as part of the solution. Therefore, the debate about their role and their obligations is loud. Friedman (1970) argued that, the only social responsibility of a business is to increase its profits within a legal and ethical framework and that a firm cannot be held responsible, only people can. Similarly to Friedman, French (1979) states that companies can have responsibility and ethics, not as autonomous entities but via their people, since they are organizations with a specific structure that apply decision-making procedures. The result of this decision-making depicts the mindset and the ethics of their people.

On the opposite side, Zadek (2001) considers that companies have extended responsibility against society. Therefore, he categorizes them into three distinct generations regarding their social activities for sustainable development: philanthropy, corporate strategy to be used as a competitive advantage, and finally companies that implement activities that can make a difference. Following Zadek's view, Matten (Matten et al., 2003) describes the way companies implement those activities.

Looking behind the scene of this implementation, European Commission (2002) while addressing the CSR concept, has acknowledged the motivation that companies have as well as their role. So, it defined CSR as a corporate contribution to sustainable development, recognizing CSR as an undivided part of corporate business, and depicting the social and environmental concerns of stakeholders. However, nowadays the term has evolved and climbed up the

management ladder (Skarmeas & Leonidou, 2013). Today, CSR has many forms, ranging from corporate-centered to business-centered to multi-stakeholder initiatives involving civil society and government. CSR has been transformed from philanthropy and voluntary actions to regulated practices and strategic corporate activities. Corporations are receiving pressure from society that demands compliance with regulations on aspects such as human rights, environmental protection, and transparency, necessitating the existence of CSR in the corporate strategy. Respecting legislation is considered a prerequisite for meeting the CSR concept but if companies want to be fully aligned they should have in place processes that integrate social, environmental, ethical, human rights, and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders. Additionally, companies aim to maximize the creation of shared value for their owners/shareholders and society as well while, at the same time, they try to identify, prevent and mitigate possible adverse impacts.

Corporate Social Responsibility refers to both people and organizations behaving and conducting business ethically and respecting social, cultural, economic, and environmental issues. It is considered of high priority, climbing on the top of the agenda of corporations, while its scope spans from responsible business to strategic decision-making. CSR is often valued as a strategic competitive tool, embracing three distinct organizational, aspects: economical, environmental, and societal, which force companies to integrate systems that focus on the common good for society in general and stakeholders in particular. Businesses acknowledge their obligations towards society, extending beyond law mandatory aspects and the narrow goal of profit-making.

When CSR moved from theory to practice, it was considered a breakthrough dimension of business operations. Literature contributed to the definition and characterization of the CSR phenomenon (De Bakker et al., 2005). To this end, Garriga and Mele (2004) map the present territory by classifying the main CSR theories and related approaches into four groups. More specifically, according to instrumental theories, the corporation is an instrument for wealth creation and its social activities are only a means to achieve economic results. Political theories deal with the power of corporations in society and the responsible use of this power in the political arena; integrative theories consider which corporations are focused on the satisfaction of social demands; and finally ethical theories, based on the ethical responsibilities of corporations to society. In practice, each CSR theory presents four dimensions related to profits, political performance, social demands, and ethical values. The findings suggest the necessity to develop a new theory on the business and society relationship, which should integrate these four dimensions.

When looked at strategically, corporate social responsibility can become a source of tremendous social progress, as the business applies its considerable resources, expertise, and insights to activities that benefit society (Porter & Kramer, 2006). Strategic management research has studied the positive interconnection between social success and economic and financial profitability (strategic CSR approach). Porter and Kramer (2006) stressed the high importance of integrating corporate strategy and society's needs while Lantos (2001) introduces the concept of strategic responsibility, linked to the fulfillment of philanthropic responsibilities that will simultaneously benefit the financial performance. Zadek (2004) states that organizations pass through five stages of corporate responsibility, from defensive, to compliance, to managerial and strategic, and, finally, to civil. According to Goyal and Kumar (2017), the top management's involvement and commitment play a crucial role in the successful implementation of CSR. However, the value system and the processes affect the formulation and implementation of CSR initiatives (Chin et al., 2013).

In 2011, the Commission adopted its renewed strategy for CSR, which combines horizontal approaches to promote CSR with more specific approaches for individual sectors and policy areas. Considering that a public authority has to support and ensure CSR conduct by using a smart mix of voluntary and mandatory measures, including regulation, puts CSR at the center of Commission policies and proposals. The actions that Commission is targeting are analytically described in a staff working document (SWD, 2019) which was published in March 2019. Extra emphasis is now given to the drivers of corporate social performance, the actions that managers can take to affect that performance, and the consequences of those actions on both corporate social and financial performance (Epstein & Roy, 2001) as well as the stakeholders. Stakeholder theory (Freeman, 1984) identifies strategic motivations for relationships with the different categories of stakeholders. The differential roles that transformational and transactional leadership styles play in corporate social responsibility practices, as well as the interplay between leadership styles and institutional CSR practices, are also under continuous consideration (Du et al., 2013).

While exploring the need for systematic evaluation to identify the level of acceptance of CSR in strategic planning, several studies have been conducted. Maon et al. (2010) refer to stages of different levels of CSR dedication and implementation. These different stages are subdivided into different dimensions describing a consolidative model; different characteristics from academic literature are formulated into cultures and stages in which an organization can exist. In addition, Kouroula and Halme (Kourula, A., Halme, M., 2008), focus on the societal and business outcomes of engagement, classify different corporate responsibility (CR) actions into three types – philanthropy, integration, and innovation which influence corporate engagement and commitment.

To this end, different phases of maturity enable the evaluation of the distinctive levels of CSR integration into the company strategy and the stage at which the company currently stands on its determined path (Marques-Mendes & Santos, 2016) bringing into the spotlight maturity models as a key factor of successful CSR adoption.

3. ISO 26000:2010 STANDARD: GUIDELINES FOR CSR MATURITY

ISO26000:2010 was initially developed in 2005 and published in 2010, by the International Organization for Standardization (ISO). The aim was to effectively assess and address social responsibilities that are relevant and significant to their mission and vision. Its target purpose was to give an overview of the Corporate Social Responsibility concept and under this frame; it identified opportunities arising from its implementation such as increased competitiveness and reputation resulting in profit increase. It does not dictate an obligatory procedure for companies that wish to behave socially aware. On the contrary, it provides valuable recommendations acting as a method pointer for creating social policy as an efficient tool through which organizations can contribute and perhaps influence social issues in the context of the wider communities they operate. The guidelines proposed by ISO 26000:2010 concentrate on their potential to contribute to the strengthening of the social establishments of the above-mentioned communities, to empower, generate autonomy, and develop skills in their final beneficiaries.

ISO26000:2010 standard refers to corporations that develop and implement - or wish to do so- CSR activities in their strategic agenda. Its purpose is to provide guidelines that allow these corporations to perform their respective activities in compliance with social and environmental requirements in the framework of their corporate priorities. The standard highlights seven

key subjects underpinning the development and operation of any organization: More specifically, it guides recognizing social responsibility and engaging stakeholders and ways to integrate socially responsible behavior into the organization. In addition, identifies seven core subjects and issues pertaining to social responsibility namely Organizational governance, Human rights, alignment with the UN Guiding Principles, Labor practices, The environment, Fair operating practices, Consumer issues and last but not least Community involvement and development.

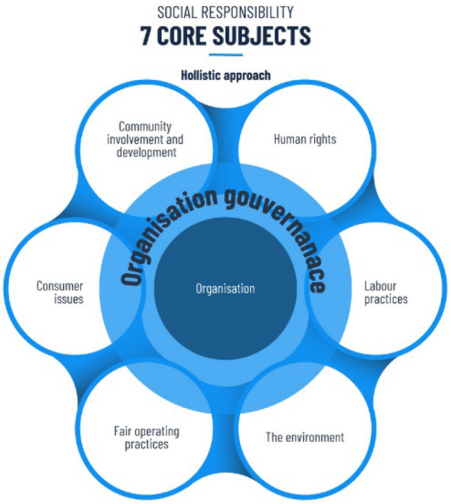

Figure 2. CSR Core Subjects Overview
Source: https://www.boreal-is.com/blog/iso-26000-social-responsibility

Moreover, ISO26000:2010 acknowledges seven key underlying principles namely Accountability, Transparency, Ethical behavior, Respect for stakeholder interests, Respect for the rule of law, Respect for international norms of behavior, and Respect for human rights, targeting in assisting organizations to address their social responsibilities, while at the same time, respect cultural, societal, environmental, and legal differences and economic development conditions. It provides practical guidance related to making social responsibility operational and places emphasis on performance results and continuous improvement. ISO 26000:2010 supports stakeholders' engagement and additionally enhances the credibility of reports and claims made about social responsibility. It aims at increasing confidence and satisfaction in organizations among both their customers and other stakeholders and ensures consistency with existing documents, international treaties and conventions, and existing ISO standards. Finally, ISO 26000:2010 promotes common terminology in the social responsibility field and targets to broaden awareness of social responsibility.

4. CSR MATURITY MODELS

CSR Literature regarding CSRMM focuses on the development of specific models, without verifying their practical application in companies (Marques-Mendes & Santos, 2016). When a company is Socially Responsible (SR), means that the company incorporates actions to ensure that its employees act responsibly. Becoming Socially Responsible implies that a company is in the transition of becoming SR, by undertaking actions and policies that enable responsible behavior. ISO 26000:2010 guides companies on how to create insight into these actions and policies.

A method to create distinction in the maturity level of companies when implementing ISO 26000: 2010 actions is to develop a maturity grid consisting of distinct maturity levels. These

levels contain actions and processes that a company should accomplish in order to qualify for that specific level. They can serve as a "roadmap" that enables managers to diagnose what capabilities a company currently possesses and which are lacking and need to be built in order to progress in a particular area. A CSR maturity model should be enabled from ISO: 26000 actions and act as a tool/method that assesses organizations regarding their CSR performance and the same time suggests actions for performance improvement.

Crosby (1979) introduced the first maturity model, which referred to the Quality Management Maturity Grid and contained five levels of organizational skills, dealing with methods and tools of quality management on a scale from one to five, such as uncertainty, awakening, enlightenment, wisdom, the certainty of sales, improvement actions and company quality posture. The grid revealed a development path defining all necessary actions that should be in place for the company to reach the next maturity level.

Maturity levels describe the next levels of CSR implementation. They are hierarchically structured, and the levels follow a logical sequence, starting from total immaturity, (level 1), through informality or implementation (level 2), standardization and monitoring (level 3), aware measurement and management (level 4), until continuous improvement, as a display of the highest maturity (level 5). Each maturity level is described by the strategies, structures, systems, processes, and used methods and tools, describing at the same time the path of CSR implementation development as far as CSR and indicating the successive stages of maturity and the current position of the company.

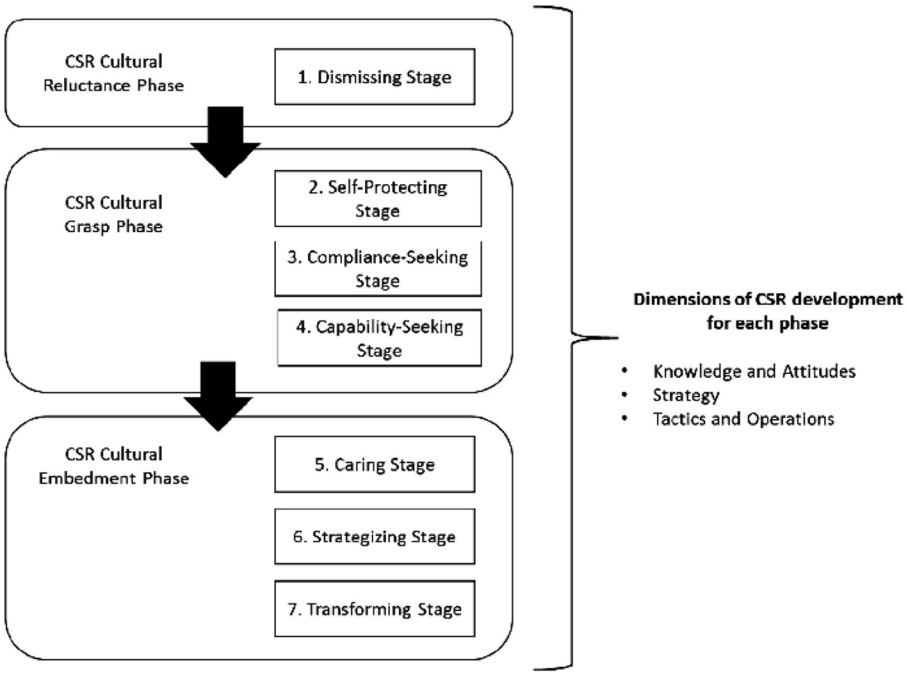

Figure 3. CSR implementation process
Source: Maon et al., 2010.

The two most comprehensive models describing the stages of CSR development are the Mirvis and Googins Model from 2006 and the Maon, Lindgreen, and Swaen model from 2010. The first assumes a finite sequence of stages in the development of corporate citizenship. The successive stages of maturity are enforced by the so-called triggers which are internal and external challenges that demand action. According to this model, these triggers focus primarily on the

credibility of the company as an entity, and then on its ability to meet the stakeholders' expectations. Coherence of efforts and, finally, involvement in the institutionalization of citizenship in its business strategies and culture are in the later stages (Mirvis & Googins, 2006).

Maon, based on the previous model, additionally introduces the stakeholder culture dimension and social responsiveness dimension and builds the consolidated, 7-staged CSR development model that integrates organizational values and culture with managerial processes and operations (Maon et al., 2010).

In their view, organizational culture plays a crucial role in CSR development, since the transition to the higher stages of maturity requires a good understanding of the concept and internalization of its respected values. Our methodology for a CSRMM development is a 6-staged procedure (Figure 4), strongly related to corporate strategy and organization:

Figure 4. Proposed CSR implementation process

5. PROPOSED INTEGRATED–HOLISTIC CSR MATURITY ASSESSMENT FRAMEWORK

CSR, as a part of management systems, has evolved from a systemic approach to pure strategic management. Organizations that have integrated and implemented CSR activities, compliant with ISO26000:2010 guidelines standard, must continuously improve it. Furthermore, measuring CSR activities is of key importance from a sustainable organization perspective. The concept of CSR is directly related to long-term focus and benefits. Maturity assessment in corporate social responsibility (CSRM) evaluates corporate evolvement in general and in specific areas and creates strategic improvements related to economic, social, and environmental dimensions.

The literature did not provide us with studies regarding the relationship of CSRM and the CFS with main management principles. Glykas Quality Compass (GQC) considers ten quality concepts subdivided into three categories: five core concepts, three intra-core concepts, and two auxiliary concepts as described below:

1. **Five core concepts:**
   a. **Strategic Focus:** Strategy is directly related to the vision of the corporation, the implemented CSR activities and the quality management system of the organization.

An organization that has a clear strategic direction, provides senior management the roadmap for alignment of functional activities towards achieving the corporate goals and objectives and consequently increasing operational efficiency. Clear strategy achieves greater employee involvement and contribution, improved human efficiency, enhanced performance, greater commitment, higher levels of internal and external customer satisfaction, and competitive advantage and thus increase profitability and market share.

b. **Customer Focus:** Refers to the required actions and procedures that must be addressed so as a corporation to meet customers' needs and expectations. It concerns actions related to the general direction of the quality management system, the policy, the objectives, their design, the awareness, the production, the support, the monitoring of customer satisfaction and the continuous improvement. Customer focus can affect brand reputation and increase loyalty.

c. **Human Resources Focus**: Human Recourses of all organizational levels is fundamental. Employees must be engaged and contribute by creating and delivering value for the achievement of the organization's target goals and vision. Effectively managed employees comprise a high performing workforce providing the organization a competitive advantage. This can be achieved through proper coordination and communication within the organization. Through active participation, employees gain knowledge and experiences, understand the importance of quality, and create and enhance strategic partnerships while at the same time increasing their commitment to the organization. Essential considered the incentives, the education and employees' training as well as their integrity and the way they conduct business promoting respect, trust and fairness.

d. **Process Focus:** It deals with processes and interdependent activities that convert inputs into outputs adding value, increasing quality levels and productivity leading to continuous improvement. Extra emphasis is given to achieving efficiency and effectiveness during organizational processes.

e. **Leadership Focus:** One of the most important factors for the continuous improvement of the quality of an organization is that of the appropriate senior management. Leadership sets clear organizational goals, establishes unity and decides and defines quality policy that must be aligned with quality objectives as part of the corporate culture. Leadership communicates the vision and strategy of the organization motivating employees to participate toward achieving the goals of the organization.

2. **Three intra-core concepts:**

f. **Change Management Focus:** It is a framework or a systematic approach, related to organizational changes affecting employees, customers, core values processes and profitability through evaluation methods and corrective actions provided by data analysis. Change management metrics should be considered holistically, providing the organization with the required information for implementing strategies and methods that will ensure effective change and tactics adjustment to achieve its goal.

g. **Performance Measurement Focus:** It is the process of evaluating, measuring and determining the efficiency and effectiveness of actions of an employee. Performance measurement brings scientific metrics into the decision-making process, underlining the change derived from information accuracy and knowledge, instead of practical experience. The primary goal of performance measurement is the identification of opportunities that can contribute to employees' evolution inside a corporation as

well as to act as a motive for succeeding in their maximum performance through appropriate and continuous support. Evaluates productivity and ensure the personal development of individual employees, increasing at the same time job satisfaction, motivation and commitment to the organization and its vision.

h. **Continuous Improvement:** Also known as a continual or continuous improvement process. It's a continuous effort for products, services or processes of an organization improvement, focusing on value-added activities enhancement. Organizations with a culture of continuous improvement can benefit from inherent flexibility and techniques improving knowledge sharing, process improvement and workflow management.

3. **Two auxiliary concepts:**

i. **Information-Knowledge management:** Knowledge management is the process of creating, maintaining, using and sharing exchanging knowledge and experience of employees in an organization. Although knowledge management is usually about know-how, information management is about know-what referring to the management of data both facts and figures obtained from vertical sources. It is a cycle of knowledge, a multidisciplinary approach to improving performance by avoiding previous unsuccessful approaches and strategies and by making the best use of knowledge. In organizations with continuous learning and development culture, knowledge management is focused on improved performance, competitive advantage, innovation and exploitation aspects, and knowledge sharing to ensure the continuous improvement of the organization.

j. **Corporate responsibility**: It concerns the impact that an organization has on society, the environment, the economy and all stakeholders. Organizations that have effective corporate responsibility programs add value to the organization itself, ensure its viability and operate in ways that enhance society and the environment. In addition, CSR activities can help forge a strong bond between employees and the organization, boost morale and increase commitment.

Figure 5. Glykas Quality Compass Concept

The above concepts are used in all four-quality perspectives (CSRM, standards, methodologies and Quality excellence awards) and follow the PDCA cycle for continuous improvement. The PDCA cycle, or Deming cycle, is a methodology that consists of four stages: Plan, Do, Check and Act.

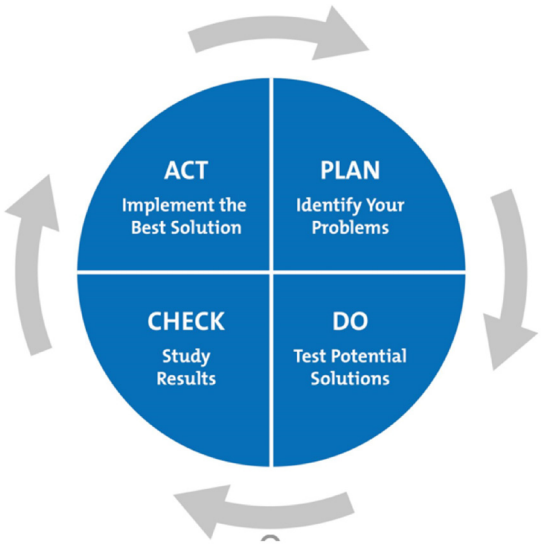

Figure 6. Deming Cycle Graphical Representation
Source: https://deming.org

The Glykas Quality Compass (GQC) framework provides a matrix, a ten-to-ten table, founded on the ten, most crucial, critical-success factors, which are identified in current, maturity-assessment frameworks and the ten, best-known enablers, which are identified in the literature. The matrix can be used regarding the CSFs during the design of the framework and regarding the enablers during the implementation of the CSRM framework, for the three-fold managerial perspective **Processes – Human Resources – Information Technology.**

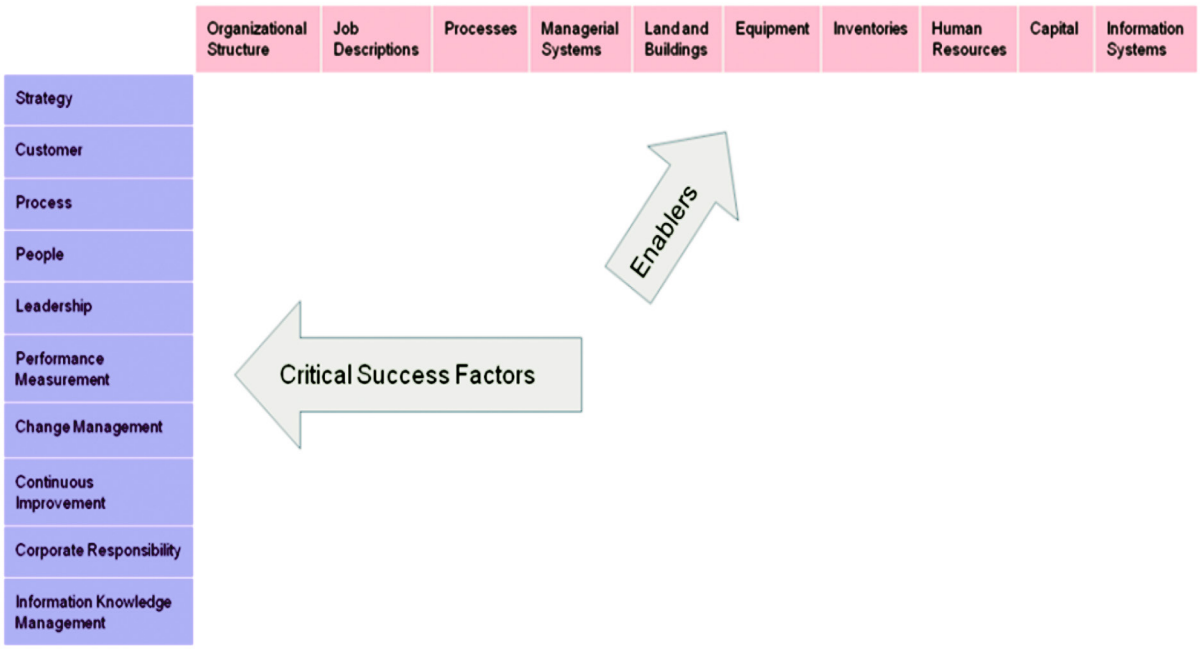

Figure 7. Framework of Glykas Quality Compass
Source: Glykas, 2019.

In order to examine whether the GQC can be expanded to apply to the ISO26000:2010 requirements, given that the standard's scope is to "provide guidance to those who recognize that respect for society and environment is a critical success factor". The holistic approach of the GQC maturity assessment model combined with CSFs corporate social responsibility management principles and organizational resources could be implemented for the assessment of the ISO26000:2010 Corporate Social Responsibility Standard, providing a useful guide for the continuous improvement of organizations. At the same time, it depicts the level of maturity when it comes to CSR implementation in corporate environments. The GQC approach could also assist CSR management implementation team to clarify the CSR concept and link it properly with corporate strategy (Glykas, 2019).

This research could be used as a recommendation and implementation guide according to ISO 26000:2010 for an organization in order to test the GQC method. Such a case study would provide findings, tools and categories to expand the GQC model, producing thus a generic GQC CSRM maturity framework to be used as a reference by future researchers in the field of CSR maturity assessment.

6. CONCLUSION

Contemporary companies measure their success beyond profit. The positive impact they provide to both society and the local community is critical. Thus, corporate social responsibility should be seen as an appropriate process, for advanced mitigation actions that minimize the negative effects and not only as a strategic competitive tool. CSR can assist companies to self-regulate their activities and be socially accountable to their customers, stakeholders, and society, at the same time. So, in a nutshell, corporations engage in CSR aiming to enhance financial performance, achieve a competitive advantage, and broaden their reputation and image.

In this paper, we provided a literature survey in the field of our study focusing on the investigation of the relationship between ISO2600:2010 and CSR dimensions, aiming to develop a maturity model that verifies the influence of the standard guidelines in CSRM. Our research verified that ISO 2600:2010 does not influence CSR dimensions in the same way. It acts more proactively in ethical and environmental dimensions and is less present in social and strategic CSR. We found evidence of a positive association between the standard guidelines and CSR principles, which indicates the importance of its implementation as well as in the dissemination of values and behaviors aligned with its scope.

The Critical Success Factors (CSF) related to Corporate Social Responsibility in a Maturity Assessment Framework have been identified and thoroughly analyzed. Moreover, the relationship between CSR activities that influence corporate performance, reputation, brand name, and finally profitability was presented.

Research contributions are important for both professionals and academics since the study's research objective resulted in the proposal of a holistic and integrated Corporate Social Responsibility Management Maturity Assessment framework encompassing the core guidelines of ISO26000:2010 in order to be used by both researchers and practitioners. In order to answer these questions, the GQC model was presented and a framework combining this model with the requirements of the ISO 26000 was designed in order to be tested in a future case study.

During the study, we had to overcome several limitations. The relevance of this study relies on the association of ISO 26000:2010 with the advancement of corporate social responsibility, especially in the context of implementing its guidelines. Although there are studies that investigate the relationship between these constructs, there is a gap in the literature regarding standard implementation and its influence on the different dimensions of CSR.

Our ongoing research on the Corporate Social Responsibility Maturity Assessment Framework application includes the implementation of the proposed framework in a corporate environment. This will prove its feasibility and furthermore will define the extent of influence each of the critical success factors has on the evolution of Corporate Social Responsibility.

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Information and Communication Technologies in the Function of the Development of Digital Competences of Persons with Disabilities

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Disability;
Digital competence;
Skills

Abstract: *The subject and problem of the work refer to information and communication technologies, which are one of the most important prerequisites for life and work for people with disabilities. From education itself, social life, professional rehabilitation and employment, information and communication technologies are a factor without which participation is impossible for people with disabilities, regardless of the form. This paper singles out one particular aspect of the use of information and communication technology, which depends on the level of development of the country and the existential status of a specific person and what type of disability it is. Investing in information technology and digital competences of people with disabilities has a pronounced positive impact on the development of social entrepreneurship in the context of companies for the employment of people with disabilities. When talking about information and communication technologies, we are talking about different equipment, software and the like, with the help of which people with disabilities can communicate more easily; they have a great impact on all people in the world, especially on people with disabilities.*

1. INTRODUCTION

Information technology is a discipline that arose as a result of the practical requirements of companies, social enterprises, commercial banks, the public sector, the education system, the health system, and practically all areas of society. Information technologies represent the application of computers, aids, and software for, the analysis, download, transmission and processing of data in all the mentioned areas, especially in the context of business and development of companies.

2. INFORMATION-COMMUNICATION TECHNOLOGIES

The definition of information and communication technologies goes in the direction that it is a set of tools, processes, methodologies and equipment necessary for the collection, processing and presentation of data and information in all spheres of society (Sotirović, 2004). The term information and communication technology is often used in a much broader sense and includes all activities that IT professionals deal with, from the installation of application programs to the design of complex computer networks and information systems. The ability to use information and communication technologies implies (Sotirović, 2004): good knowledge of all tools used in computing; having the necessary skills to effectively use these tools; recognition of situations in which information and communication technologies can be used to solve a problem. The development of computers has influenced the rapid development of communications, and

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information and communication technologies imply the integration (joining) of telecommunications, computers, software, and memory, intending to enable users to access, store, transfer and manipulate information (Sotirović, 2004).

3. USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES BY PERSONS WITH DISABILITIES

Information and communication technologies have been used in practice for a long time, and particular progress has been experienced in the last decade, especially when it comes to information and communication technology in the context of the development of digital competences for people with disabilities. When talking about information and communication technologies, we are talking about different equipment, software and the like, with the help of which people with disabilities communicate more easily. Information and communication technologies have a great influence on all people in the world, especially on people with disabilities. In that case, people with disabilities are one of the more vulnerable groups because they practically depend on the development of information and communication technology in their education and work. The good thing is that the use of information and communication technology in everyday life enables easier access to information, but the negative thing is that not all people with disabilities in every part of the world have equal access to them, because unfortunately one of the decisive factors is money, and the largest number of people with disabilities cannot afford to purchase information and communication technology for their needs. In order for information and communication technologies to be used by persons with disabilities as planned, certain prerequisites must be met following the particular form of technology used and the specific type of disability of a person. Before the very application of information and communication technology to persons with disabilities, it is necessary to determine the level of ability, that is, the education of the person to use the necessary technology, practically the same case as with the system of professional rehabilitation and determining the remaining and work ability. This is causal and related because the remaining work ability depends on the level of knowledge of using digital technologies. If a specific person with a disability is capable of using technology, support is achieved in the habilitation and rehabilitation of the user's abilities, improving access to information, overcoming geographic and social barriers through support in communication and networking, and creating a positive self-image, increasing motivation and self-confidence, and can be employed and maintained at work (Association of therapists, 2022). The daily use of information and communication technologies also helps people with disabilities to have normal social interaction with other people and lead a life like other people. This is primarily about the inability to communicate, dyslexia, blind and partially sighted people and people with learning problems (Muhammad, 2022).

4. ANALYSIS OF THE USE OF INFORMATION COMMUNICATION TECHNOLOGIES FOR PERSONS WITH DISABILITIES

When using information and communication technologies by people with disabilities, certain problems can be crystallized (Muhammad, 2022):

- insufficient information about the development of information and communication technologies by persons with disabilities;
- lack of interest on the part of disabled people themselves in the use of information and communication technologies, because they think that they are not so important for the availability and analysis of information in different spheres of life;

- availability of information and communication technologies, too little investment by the state and non-existence of subsidies by the state, because ICTs are financially unavailable to ordinary individuals in a large number of cases.

People with disabilities must not completely surrender to information and communication technologies, but use them only as a tool for the daily activities they have to carry out (Muhammad, 2022).

5. RAISING THE DIGITAL COMPETENCES OF PEOPLE WITH DISABILITIES TO ACHIEVE A BETTER POSITION IN THE LABOR MARKET

Information and communication technology greatly improves the quality of life of people with disabilities, whereby different information and communication technology tools are used for different forms of disability (Čop & Topolovec, 2009:312). Starting from education as the basis for finding an adequate job for students with partial and complete visual impairments, these are primarily (Čop & Topolovec, 2009:312): adapted textbooks written in braille with adequate relief illustrations; textbooks printed in enlarged black print with illustrations of moderate size and without much detail; complete Braille stationery; paper, blocks, folders for storing texts written in braille; standard audiovisual means and adequate lighting. For these needs, many information and communication technologies have been applied in practice more and more recently (Čop & Topolovec, 2009:312). Informal education seeks to provide the opportunity to acquire knowledge about the necessary technologies, which increases a person's self-confidence, communication, and integration in society, as well as some other competencies of a concrete person with disabilities, acquisition of digital competences and finally improving their position on the labor market or, in the case of an employed person, maintaining their job in their working environment (Batelo Kokić & Kisovar-Ivanda, 2015). Information and communication technologies for persons with disabilities are regulated in Article 9 of the Convention on the Rights of Persons with Disabilities, which talks about accessibility. In order to enable persons with disabilities to live independently and participate fully in all areas of life, the signatory states of this Convention take appropriate measures to ensure their access, on an equal basis with other persons, to the built environment, transportation, information and communications, including information and communication technologies and systems, as well as other equipment, spaces and services intended for the public, both in urban and rural areas (Convention on the Rights of Persons with Disabilities, 2022). Access to information and better accessibility to services is possible in situations where action plans or accessibility standards are adopted for certain types of people with disabilities (Digital Empowerment, 2016). UNESCO recognized that information and communication technology could lead to better access to information, which was eventually confirmed in the Convention on the Rights of Persons with Disabilities. Unfortunately, this requires significant financial investments, which is why the involvement of the state is necessary because without these incentives people with disabilities can't play a significant role in social spheres (The ICT opportunity for a disability-inclusive development framework, 2013).

6. EQUIPMENT AND SOFTWARE APPLICATIONS

Portable devices and applications are basic elements for facilitating the daily life of people with disabilities and represent the basis of information and communication technologies for people with disabilities. For people who cannot see at all, or see very poorly, the device itself and the text on the screen: Applications within portable devices provide the possibility of converting an image or text in a document into speech, or a Braille document, via a connected Braille device. In practice, speech or speech programs are used much more (Okić & Kragić, 2015).

People with cognitive impairments may have various problems related to memory, analytical skills, attention, reading skills, comprehension or communication. To reduce these problems as much as possible, it is possible to use portable devices and associated applications for speech recognition and converting text to speech, using the so-called reminders that remind a person of tasks he has to do, converting text into images for people with reading problems, predicting words when writing text, and the like (Miljković, 2005).

Braille technology – Blind and partially sighted people – Braille digital monitor, recorder and printer (Okić & Kragić, 2015): In addition to Braille monitors and voice recorders, Braille printers can also be used in practice, which allows printing text from a computer in Braille form. As printers need a bit more time to display the engraving on paper, Braille printers are often very slow and very noisy. When printing, it is possible to use one of two versions (American Foundation for the Blind, 2022). In Bosnia and Herzegovina, only the Center for Blind and Visually Impaired Children and Youth and the Library for the Blind have this printer.

Daisy player – is a device that allows people with severe or partial vision impairment to read books, record conversations, listen to radio programs, etc. The player also allows you to search books, when book Sense reads each title so that a person can know roughly what part of the book they are in (Daisy Player User Guide, 2022).

Windows eyes and JAWS speech program – windows eye is one of the best and most used tools for reading text from the computer screen. It enables the conversion of components of the Windows operating system into synthesized speech, which provides full access to the computer system for 32 blind and partially sighted people at the same time.

Tobi – disabled people with physical impairments, especially those who cannot move their hands, there is the possibility of using some version of the TOBII tool. TOBII is the world's leading tool for tracking eye movements based on which it is possible to use portable and other devices (TOBII, 2022).

Head mouse extreme – an excellent device that is especially intended for people without the ability to move or with limited use of their hands. This device tracks the movement of the entire head and thus moves the cursor on the monitor (Origin Instruments Corporation, 2022).

Keystroke – an advanced keyboard that helps a person with physical disabilities have full access to a computer. KeyStrokes allows you to use a mouse, trackball, head, or another emulator to type characters in any standard Mac OS X application (Origin Instruments Corporation, 2022).

There is also Icommunicator, Signvideo, Proloquo, etc. (Icommunicator; Origin Instruments Corporation, 2022).

7. LAW ON PROFESSIONAL REHABILITATION, TRAINING AND EMPLOYMENT OF PERSONS WITH DISABILITIES OF THE FBIH AND THE REPUBLIC OF SERBIA

Although these are laws that specifically and exclusively regulate issues in the field of professional rehabilitation, training and employment of persons with disabilities, this law still has shortcomings that should be harmonized. Given that the provisions of the Convention (Convention on the Rights of Persons with Disabilities, 2022) are general, i.e. that they contain only

appropriate principles and legal standards for the realization and protection of certain rights of persons with disabilities, the Law on Professional Rehabilitation, Training and Employment of Persons with Disabilities needs to be harmonized with the Convention, i.e. to achieve a specification that corresponds to that principles and standards, but also the social circumstances of application in Bosnia and Herzegovina, more specifically in the Federation of BiH. However, without this Law, the majority of employment of persons with disabilities would practically not have been achieved because this Law was the basis for the establishment of Funds for professional rehabilitation and employment of persons with disabilities in both FBiH and the Serbian republic, through which financial incentives for the employment of persons with disabilities are provided.

8. METHODOLOGICAL FRAMEWORK OF WORK

8.1. Subject and Problem of Work

The subject and problem of the work refer to information and communication technologies, which are one of the most important prerequisites for life and work for people with disabilities. The subject of research refers to the importance of entrepreneurship in the sphere of employment of persons with disabilities as one of the most vulnerable, marginalized groups of people in society concerning information technologies. Investigate how and to what extent digital aids can help a person with a disability in work and make work easier. The research problem refers to the legal assumptions that are of great importance when employing people with disabilities. How are they employed, what is the importance of investing in information technology and whether there is state support in that process. How to deal with the problem of employment of marginalized groups, in this case, people with disabilities.

Objectives of work:
- investigate the role of digital aids that can facilitate the work of people with disabilities;
- determine the extent to which the place of employment of a person with a disability is digitized, which facilitates work;
- investigate how much is invested in additional education to improve digital skills;
- investigate how technically equipped the company where people with disabilities work is;
- analyze whether the state provides incentives for the development of information technologies that are crucial for the work of persons with disabilities; point out the importance of incentives from the state in the field of employment of persons with disabilities and the importance of investing in digital technologies, which are one of the most important factors in everything.

Research hypotheses:
- **H0:** Investment in information and communication technologies and the development of digital competences of persons with disabilities have a pronounced positive impact on the development of social entrepreneurship and employment of persons with disabilities.
- **HP1:** The problem of employment of socially vulnerable categories of people, specifically people with disabilities, is a problem for the whole society.
- **HP2:** Digital aids greatly contribute to better quality work of people with disabilities.
- **HP3:** Additional education and training of employees in the field of digital competences will lead to the improvement of the company's operations.
- **HP4:** The state provides sufficient support, allocates funds and invests in the development of digital technologies, which are one of the essential factors in the work of persons with disabilities.

8.2. Work Tasks

The task of this research is to demonstrate the importance of social entrepreneurship in the employment of marginalized groups. Point out the support that the state should provide, which will contribute to increasing the employment of people with disabilities and care for people with disabilities through work engagement.

8.3. Research Methods

The research will collect data using the following methods: survey method, interview method, analysis and synthesis method, inductive method, deductive method, description method, and statistical method.

9. RESEARCH

103 respondents participated in the research, 62 female and 41 male respondents.

Table 1. Digital aids

Do you think that digital aids can greatly help in performing daily tasks in the company you work for? (mark an X in front of the correct answer)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	99	96.0	96.0	96.0
	No	4	4.0	4.0	100.0
	Total	103	100.0	100.0	

Source: Authors

Table 2. Types of disability

Please circle the type of disability you have					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Physical	39	37.6	37.6	37.6
	Sensory	28	26.7	26.7	64.4
	Learning difficulties	8	7.9	7.9	72.3
	Combined	28	27.7	27.7	100.0
	Total	103	100.0	100.0	

Source: Authors

According to the results of the analysis, the largest number of respondents in the sample have physical disabilities, 37.6%, followed by combined and sensory disabilities, while the smallest number of respondents have learning difficulties. According to the opinions of the surveyed groups, respondents who have a disability between 3 and 6 years of age most agree with the statement that social entrepreneurship has been developed in Bosnia and Herzegovina, while respondents who have been disabled for more than 15 years do not agree with this statement, and consider that it is not sufficiently represented. According to the results of the analysis, it can be concluded that investment in social entrepreneurship is quite modest. Therefore, additional investments in social entrepreneurship are necessary so that people with disabilities have the opportunity to participate in the creation of new values. The research also examined attitudes about the equipment and use of IT aids in the work they do. Respondents answered on a scale from 1 to 5, and the answers are as follows:

– To a small extent, the respondents agree with the statement that their workplace is digitized enough for the tasks they perform. The average value of the answers is 3.5, with a

medium level of deviation. According to this answer, it can be concluded that additional investments are necessary in the digitization of the equipment of employed persons with disabilities, in order to increase productivity.

- To an even lesser extent, respondents agree with the statement that they regularly attend courses that improve their competencies for digital skills. The average rating of the respondents is 3.3, so it can be concluded that this parameter is also quite neglected by the levels of government dealing with the promotion of social entrepreneurship.
- The respondents have a similar attitude when it comes to communication via e-mail, where the average response of the respondents is also 3.3, with a small degree of deviation.
- The respondents somewhat agree with the statement that their company is equipped with digital aids for all types of disabilities. It can be concluded that companies are working on digital equipment, but that there is significant room for improvement.
- The respondents agree to some extent that the work organization is such that they complement each other when performing tasks. As with the previous cases, it can be concluded that there is room to bring this type of organization of work of persons with disabilities to a higher level.
- According to the results of the analysis, it can be concluded that the respondents agree with the statement that the growth of information technologies is accompanied by the growth of the competencies of persons with disabilities. The average rating for the stated statement is 3.7 with a small degree of deviation around the average value of the answer.
- Respondents generally do not agree with the statement that the state constantly invests in raising the digital competences of people with disabilities. The average score for the above statement is 2.8, which is the lowest score compared to all assumptions from the above set of questions. It is common knowledge that digital competences, in addition to increasing work productivity, make the work of people with disabilities easier and more accessible, so additional education becomes more important. Respondents agree with the statement that planned educations are present for people with disabilities, who are trying to be productive. The average score for this statement is 4.17 with a small degree of deviation around the average value of the answers. The respondents fully agree with the statement that there is absolutely a need for planned education. Also, the respondents agreed with a high rating that the education of persons with disabilities is also important, as well as the knowledge of information and communication technologies.

10. FUTURE DIRECTIONS OF RESEARCH

The topic in question is not yet sufficiently researched and there are not many studies that deal with the same, and in that, it is a contribution and a challenge for research. Future directions of research are reflected in the realization of the importance of digital entrepreneurship as part of sustainable development regarding human resources, where the clear focus is the solution to the existential problem through social entrepreneurship of the most vulnerable groups of people. Digitization in entrepreneurship is used in the context of organizations that have managed to solve the existential problem of those people who could not find employment in the open labor market.

11. CONCLUSION

Information and communication technologies in the context of acquiring digital competences and the importance of information and communication technology for the education and work of people with disabilities were investigated. H0 - Investment in information and communication

technologies and the development of digital competences of persons with disabilities has a pronounced positive impact on the development of social entrepreneurship and employment of persons with disabilities. The respondents gave particular importance to the statements related to digital competences, so the ratings were mostly above 4, which is quite high on a scale of 1 to 5. The conclusion is that the main hypothesis was fully tested and proven, through the mentioned set of questions, but also other questions that analyzed the digital competencies of people with disabilities. HP1 - The problem of employment of socially vulnerable categories of people, specifically persons with disabilities, is a problem of the whole society". The respondents agree with the statement that the problem of employment of persons with disabilities is a macroeconomic problem, while to a lesser extent, they agree that it is also a microeconomic problem, however, the score of 4.16 and 3.68 is sufficient to confirm the hypothesis. HP2 - Digital aids greatly contribute to better quality work of people with disabilities. The hypothesis was confirmed because the respondents agree that digital aids contribute to the development of people with disabilities, but they point out that social entrepreneurship is underdeveloped and that investment in it is insufficient. HP3 - Additional education and training of employees in the field of digital competences will lead to the improvement of the company's operations. The hypothesis was confirmed, respondents are aware that investment in digital competences will contribute to personal development, but the problem is reflected in insufficient investment according to the concept of lifelong learning. HP4 - The state provides sufficient support, allocates funds and invests in the development of digital technologies, which are one of the essential factors of the work of persons with disabilities. The hypothesis was partially confirmed because the respondents mostly disagree with the statement that the state constantly invests in raising the digital competences of people with disabilities. The average score for the above statement is 2.8, which is the lowest score compared to all assumptions from the above set of questions. It is common knowledge that digital competences, in addition to increasing work productivity, make the work of people with disabilities easier and more accessible, so additional education becomes more important. Respondents agree with the statement that planned educations are present for people with disabilities, who are trying to be productive. The average score for this statement is 4.17 with a small degree of deviation around the average value of the answers. The respondents fully agree with the statement that there is absolutely a need for planned education. Also, the respondents agreed with a high rating that the education of persons with disabilities is also important, as well as the knowledge of information and communication technologies. Social entrepreneurship is not only the employment of people with disabilities, but it is specifically the most represented in Bosnia and Herzegovina, it is also the employment of other marginalized groups of people, but the employment of people with disabilities can be a good example of how to solve the employment of these other groups of socially vulnerable people.

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Changing the Process of the Employee Recruitment in the Labour Market

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Abstract: *Human resource management is an important managerial function. Finding quality and motivated people represents a challenge for any business. The ways to reach the best future employees have changed with the development of social networks and digitalization in general. To be competitive, every company needs a well-designed approach to human resource management. The company's set goals can only be achieved based on the abilities of employees with certain skills. The reason for choosing this topic stemmed from the many problems faced by the human resources departments due to the transformation that is happening in the labour market. The purpose of this paper is to show a concrete example, of the recruitment of employees when using a modern method using the social network. All the stages that are used to acquire the best candidate who would complete the set tasks will be explained. The data were obtained using the telephone interview research method. This work will be able to serve the other companies or departments that manage human resources as one of the examples of the new concept of recruiting employees and accordingly, contribute to future research. The findings that are stemming from this research will certainly support further studies of human resource management using new technologies and tools that collect analytical data and skills of employees and consequently help companies to select the best candidates.*

1. INTRODUCTION

Skilled management, quality human resources and good organization are the key factors for the implementation of any plan. Modern management implies a high degree of proactivity, always balancing between focus and flexibility, i.e., openness towards new perspectives, by means of thoughtful and quick responses to new opportunities, seeking opportunities in diversity and continuous and systematic learning (Rupčić, 2018).

Managerial work is extremely diverse: it requires productivity, efficiency and effectiveness, and depends on many internal and external factors, including a large number of tasks that are taking place in parallel with cooperation with employees and interaction with them. Today, a manager must possess a large amount of formal and informal knowledge, a plentiful of information, and the ability to communicate, negotiate, plan, organize work, manage human resources, and manage and control all processes.

In the long term, choosing human capital is one of the most important elements of any business in these challenging times. Planning and raising capital require knowledge of the purpose, vision and mission of the company, all in order to timely provide the staff by means of the necessary knowledge, competencies and skills.

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An employee can be a source of income for the organization if he provides the necessary opportunities for that individual (Voicu, 2014). Competence and work performance are extremely important factors when it comes to human resource management. In an organized business system, the employment activity by itself (possible dilemmas on how to obtain quality staff), the method of selection, advertising, or invitation to interested candidates, evaluation of their work and professional motivation can significantly vary from one company to another. The modern company is adapting to new ways of work and listens to the changes that are happening in the environment so there is an increasing orientation towards online recruitment.

As the face of technology changes and becomes more social, it is problematic to compare technologies used today and the ones used in the past (Ruleman, 2012). The modernization of human resource management is undergoing a major evolution as digitalisation infiltrates within work operations (Votto et al., 2021). In this context, this article discusses some of the new ways of attracting and recruiting future employees and provides a basis for a better understanding of new business processes.

2. PLANNING AND RECRUITMENT OF HUMAN RESOURCES

The process of planning human resources is a complex one. It starts with the set goals and with defining needs. Based on the defined goals and strategy, it is necessary to conduct a job analysis: what, who, when, how, where and why it should be done.

Job analysis begins with an analysis of the value creation process by applying a systematic approach, when observing, surveying, and interviewing the existing employees. The collected data are systematized into jobs and job descriptions are made. The job description includes a list of tasks and responsibilities of a particular workplace. Based on the job description, job specifications are made, which include a list of required qualifications, knowledge, skills, and experience, but also the characteristics that are expected from the candidate (Rupčić, 2018).

In order to obtain the desired specter of human resources in the company, during the planning, recruitment and selection of the candidates, the management must have an idea of what type of people they want to hire, what motives and interests drive employees, and what behaviour they want from their employees.

The goal of management of human resources is to create a working environment and professional guidance of employees, in order to enable the achievement of all of the goals of the company, both current, developmental and strategic. Recruitment and selection of staff is a key activity for the present and future successful business of any company. The core indicators of business performance are productivity, efficiency and effectiveness – they all depend on the quality of human potential. The quality of human potential refers to knowledge and skills which human resources dispose of, but also to character properties that create a desirable working environment.

It's possible to achieve business success by developing human potential, but only if staff have the potential for development. The candidate recruitment process begins with defining the need for employees and job specifications. Candidates can be found inside or outside the company, therefore we have internal and external sources of recruitment.

Internal sources of recruitment include filling the workplace using regrouping of existing employees because there may be people in the company who have the conditions for promotion and

it is possible to offer them and reassign them to a suitable vacant position. In this way, it is possible to connect the wishes and capabilities of candidates with the needs of the company, which can also strengthen the motivation of the candidate and guarantee his commitment to work.

In addition to increased motivation and commitment to the company and work, some of the advantages of internal recruitment are better knowledge of the advantages and disadvantages of the candidate - if the candidate knows the company, its goals and organization, the company does not need to invest in its socialization process; stronger perception of the company's concern for the good employees has been created, and also the use of already invested funds in human resources have been used: all of that is much faster and cheaper than external employment.

Potential limitations that can be created by internal employment are the redistribution of good employees to places for which they are not competent, the creation of internal conflicts and decline in motivation and dissatisfaction of other candidates and employees, and the lack of change by which the established way of working is maintained.

The internal competition can be published through the company's internal communication network or newsletter, but also by the recommendation of employees, managers or other key persons.

When the staff are seeking for from external sources, i.e., from the labour market, it is necessary to ensure that information reaches a group of potential workers. We manage this by advertising vacancies in employment agencies, educational institutions or in the appropriate media (such as newspapers, magazines, professional publications and websites that are specialized in employment mediation).

The agencies that offer their mediation services for temporary employment in the Republic of Croatia are Adecco Croatia, Dekra Employment, Demano Temporary Employment Ltd., Trenkwalder, Naton HR, Easy Consult Ltd., and others.

Also, one of the ways to secure staff is the engagement of Headhunting agencies that contact a person with a certain profile when looking for staff for a client. The following Headhunting agencies are present in Croatia: Dekra hr., Hill-croatia.hr, Antal.com, consulteam.hr, Isg.eu, Neumannpartners.com and others (posao.hr, 2020).

Companies can make databases in which inquiries about possible employment are entered, but are also included persons who have done work practice or they have participated in a vocational training program in the company, and this way opportunities for employment are created.

Search for employees can be based on recommendations, prior knowledge, or based on information from online social networks (LinkedIn). Such candidates are probably already working somewhere else, so the company will decide which methods to use to arouse their interest. The advantages of the external method of candidate selection are such that there is a much greater choice of talents who, with new knowledge and skills, can bring new energy, perspective and ideas to the company. Internal tensions, rivalries and conflicts are reduced, and it is possible to change the way of thinking and doing business.

The external method of selection implies attracting, contacting and evaluating the potential candidates, which is much more difficult and expensive and bears the risk that the choice will

ultimately turn out to be wrong. In addition, it is necessary to invest in the process of adaptation and orientation of the new candidate and acquaint him with the goals, organization and characteristics of organizational culture, while in the end causing dissatisfaction and moral problems among existing employees who feel qualified for that particular job.

2.1. Online Recruitment of the Future Employees

Recruitment of future employees has been increasingly done through the use of online platforms that represent the external source of finding the necessary staff. The development of information technology, and unpredictable circumstances in the environment such as the COVID-19 pandemic, have brought some new ways of finding future employees remotely, which are gaining momentum, and have become indispensable in today's circumstances.

One of the more recent ways of finding potential employee are the video conferencing applications that have become an integral part of today's world for attending interviews, classes, meetings, and assorted gatherings, as well in the COVID-19 era (Kathiravan et al., 2021).

Traditional methods of recruiting employees still exist, but they are increasingly being overshadowed by modern, new ways of recruiting staff. Online employment (via the Internet) could complement or replace traditional employment methods. Studies have shown that most adults, for example in the USA (over 80% of them) use the Internet (Perrin & Duggan, 2015), while in the Republic of Croatia, all households use broadband Internet access, while the share of households that use mobile broadband Internet access has increased from 66% to 70%, mostly due to the increased availability of mobile devices such as tablets, mobile phones and USB modems that exploit the 3G / 4G technology (Central Bureau of Statistics, 2019).

Also, there has been recorded an increase in Internet users when compared to the previous years. The largest increase was recorded in the age group from 55 to 64 years of age, i.e., 8% when compared to the previous year. As expected, the youngest population is at the forefront of Internet use, and the number of users is declining in proportion to their age. A similar trend was observed in the structure according to employment status in which pupils and students, as the youngest group, most often use the Internet (Central Bureau of Statistics, 2019).

As the Internet has been increasingly used as a means of finding a job, accordingly, today's advertising for new jobs is done through Internet platforms, where data is submitted electronically and the interview of a future employee is done online, and all communication takes place via computer. This way of candidacy through certain platforms, allows us to apply for a job anywhere in the world, which allows job seekers unimaginable opportunity to present themselves, their knowledge and their skills. On the other hand, the availability and presence on social networks allow the future employer more information about the potential candidate, as well as obtaining information that can be obtained indirectly. It is possible to gather a lot of information about a potential candidate by watching the candidate's posts on social networks and getting to know the profile of the person applying for the job in more detail. Very often this can be an advantage when choosing a candidate.

Thus, according to the portal MojPosao (2021), 49% of employers check the profiles of candidates through social networks, because posts on social networks can help them to create an overall image of the candidate. While a profile found on LinkedIn has a professional orientation

and purpose, profiles set on Facebook, Instagram and Twitter serve personal purposes and have been used for a person to express his views, preferences and the way he sees the world around him. The employer has the right to choose the person he or she believes will best contribute to the company, so the candidate's activities on social media can leave a significant impact on employment. Inappropriate content on the candidate's profile left a negative impression and influenced the decision on (non)employment in 40% of employers, while 51% of them stated that the candidate's profile can positively influence the selection decision.

A large part of the population uses social networks daily, most often *Facebook*, *Instagram*, *LinkedIn*, *YouTube*, *TikTok*, or some others. It is estimated that at the beginning of 2021, that number was 53% or 4.2 billion users (Murgić Novak, 2021). It is quite certain that today social networks should be part of every employer's business plan, with a focus on how to use them best for individual needs to hire new talents.

Today, the model of searching for human capital with the use of the Internet is becoming more frequent and widely used. This method saves a lot of money while saving a lot of time, and a larger number of candidates from anywhere in the world is "at hand". Also, it is possible to contact candidates who are "passive", i.e., do not look for a new job, but if they are offered something interesting enough, it is possible to get them to apply.

LinkedIn is the largest business social network with nearly 800 million members in more than 200 countries. The goal of this network is to establish contacts and business relationships with people around the world, connect professionals and make them more productive and successful. It was founded by Reid Hoffman in 2003 (About LinkedIn, 2021).

Creating a profile on *LinkedIn* pages is free, simple and fast, and strives for the truth of data. Today, some employers even make it mandatory for their employees to be online for greater visibility.

While in a candidate's CV, only basic and scanty information can be found, the space on *LinkedIn* is less limited and a person can detail the job description, skills and knowledge they possess. The keywords on the candidate's profile help speed up the search for the necessary features and staff, as well as a network of contacts that creates additional opportunities for "first contact" with employers or employees.

LinkedIn Learning is an opportunity where you can learn a lot and also develop a range of new skills and add previously completed courses directly to your profile, while *LinkedIn* groups offer a way to find more like-minded people in your business, industry, or area of interest.

Furthermore, both social networks and the Web are places where users connect and communicate with each other by exchanging information, views and opinions, and as such communication has crossed the boundaries of an e-mail and has become a means of communicating, linkage of people, regardless of distance and time, thus enabling socialization and the creation of a new culture that has not been previously seen in the development of human communities (Grbavac & Grbavac, 2014).

Social networks are virtual communities of interconnected individuals who share content, information, files, images, audio and video recordings and cover all types of connections from

work, academic and professional to family connections. Social media has revolutionized the way people communicate and relate to each other and the way they interact with the new tools that information technology offers. In that aspect, they were the turning point in the field of human communication, information flow and immediacy, to the point that the most important issue can be considered as another means of communication (Enciklopedia - titanica, 2022).

To access the social network, it is enough to open a profile that allows you access to the desired platform. Today, social networks are the crucial channel of communication, regardless of the age you belong, and they are ideal for building a relationship of trust and loyalty with existing members, as well as attracting new ones. With the click of a mouse, we'll get news from any of the segments such as sports, politics, culture, weather, or information pertaining to the local, regional, or global level - a lot of data that are accompanied by images or video media. In recent years, professional social networks and similar concepts have been developed to connect candidates with organizations, so in this way, organizations could realise employment faster and more efficiently, establish professional contacts, find jobs and also check their candidates.

3. SELECTION OF CANDIDATES

The selection of candidates is a long and complex process. Using pre-selection, i.e., by a selection of a smaller number of candidates from the group of applicants who meet the formal criteria of the competition announced for a particular job, candidates who have submitted incomplete documentation or who do not meet the required criteria are eliminated.

The candidate selection process varies from company to company and depends on the required candidate profile. The average validity of various predictors of job success puts mental ability tests in the first place that is followed by a probationary period, followed by personal biography, recommendations, and experience, while the success at the university, a sum of education, candidate's interests and age are placed at the bottom of the scale (Adamović Topolčić, 1999). After selecting a shortlist of candidates from the pre-selection method, the candidates are interviewed. To avoid costs, the interview may be preceded by a telephone or video interview. The candidate can then be invited in person for an interview at the company.

Analyses of many companies have shown that the most important characteristics of employees are: personal initiative, creativity, communication skills, analytical skills, intrinsic motivation, flexibility, ability to work in a team and the like (Adamović Topolčić, 1999).

Candidates are selected through interviews and various tests. Interviews are the most commonly used tool when selecting candidates, while the method of conducting interviews varies from company to company; but, their purpose is the same: to check interpersonal, communication and teamwork skills.

According to Rupčić (2018) the interview can be structured, unstructured and semi-structured. The structured interview is conducted in accordance with previously defined questions that were put to all candidates, and the answers are recorded and compared with the answers of other candidates. An unstructured or undirected interview is quite the opposite in approach. The candidate is asked general questions which, according to their content, determine the further course of the interview. This type of interview allows the candidate to present himself independently and without interruption, and can further reveal the candidate's character, behaviour and experience, therefore

obtaining a more complete picture of the candidate. The semi-structured interview is a combination of the first two models. The candidate is asked pre-determined questions, but he is allowed to ask questions or sub-questions that are imposed during the interview.

In addition to interviews, candidate characteristics are tested by various tests, depending on the job for which they are required: abilities and skill tests, personality tests, knowledge tests, physical ability tests, verbal, numerical and abstract reasoning tests, intelligence tests, honesty and integrity tests, and many others.

Employing the abilities and skill tests are put for the assessment of the candidate's existing skills and ability to perform the whole job or certain aspects of the job, as well as the possibility of developing and acquiring new techniques. They are shaped following the skills that are sought and assessed, such as dexterity, strength, or endurance where each test is shaped differently. The personality test measures the basic characteristics of the candidate's personality required for the job, and the degree of compliance of the person with a particular job is determined.

Respondents rate their agreement with the above statements, which identify personal traits such as extroverted ness, conscientiousness, creativity, openness to new experiences, optimism, comfort, stress tolerance, emotional stability and proactivity. Understanding the personality of the employee is especially important if the job on the line requires certain characteristics, but the personality does not ensure the final effect of the job. Knowledge tests are designed to examine technical and professional knowledge and also the specific knowledge of the job for which the candidate applies.

Physical fitness tests use exercises that require a certain level of fitness needed for the job. Strength, speed, endurance and balance can be measured. The test of honesty and integrity is a subtype of the personality test by which are measured honesty, reliability, credibility, and prosocial behaviour. They consist of direct questions about previous experiences to eliminate inappropriate, dishonest and antisocial candidates.

Intelligence tests or cognitive ability tests provide information about the candidate's mental abilities, such as the ability to learn and think quickly, pursue logic and logical reasoning, show analytical skills, reading comprehension and the like. The advantage of these tests is in predicting performance in the workplace and candidates cannot influence the accuracy of the results.

4. ENCOURAGING TO BUSINESS SUCCESS AND MOTIVATION

Successful managers possess ingrained qualities such as organization and perseverance that during further, education, training and work on themselves, do develop and improve. Their job is to direct others to do the job, and they must have the ability to work with different people and also the need to achieve results, success, and experience when working in a variety of positions.

Research has shown that managers have in common: achievement and ambition, the ability to learn from hardships situations, high commitment to work and work energy, inventiveness, skills when working with people, a high level of intelligence, a high level of self-confidence, and also a high level of tolerance for others and interest in economic profits, and from the position of the working values they are: emphasis on the possibility of advancement, strong identification with the organization, interest in salary and status and recognition (Adamović Topolčić, 1999).

Optimal employee performance depends on the company policy and is called compensation. Compensation implies the fee that employees receive for their work: the basic salary as a basis and the incentive part of the salary as a motivation for optimal work performance (bonuses and incentives, innovation fees, knowledge dissemination fees, and flexibility).

Additional employee benefits may include paid sick leave, vacation, Christmas bonuses, gifts for children, holiday regressions, excursions, insurance policies, health check-ups, wellness programs, sharing profit, and others. Material incentives are not the only way to encourage employees and to pursue the achievement of business success. Motivational factors can be intangible, of which we can list the following: job security, good interpersonal relationships, education and training opportunities, creative work, awards, recognitions, reputation, scholarships and tuition fees, study trips, specializations, using of a company car, managerial benefits, etc.

The quality of human resources can be maintained and developed by introducing special benefits that employees value. This can be flexible or part-time work, the possibility of working from home and other locations, the possibility of unpaid leave, or unlimited vacation.

The essence and importance of motivation stem from the following:
- improving productivity, efficiency and creativity of work,
- improving the quality of working life in organizations,
- strengthening the competitiveness and success of the company (Bahtijarević-Šiber, 1999).

Motivation is manifested as any influence that provokes, directs, and sustains the target human behaviour. It is achieved by involving the whole chain of reactions - from the feeling of needs that cause desires to be fulfilled, and otherwise, some tensions cause (re)actions that lead to satisfaction as a final result of this process (Buble, 2006).

Motivation has an extremely large effect on employee work performance. Such a motivated employee can easily become demotivated (in case the superior does not notice and does not react to the achievement of the performance that is above the standard) and vice versa.

5. FINDINGS – TOWARD CONSIDERATION OF RECRUITING EMPLOYEES

The respondent , who was interviewed by telephone gives a clear description of the stages of getting the desired job and then lists all the stages that need to be passed when recruiting, by the desired employer. This is an example of an employer from the IT sector.

1. Representing a person by creating a good profile on a social network. This includes the use of keywords and terms that are relevant to the business. The profile should be representative and politely arranged. The candidate profile is actually a CV that should contain all of the previous business experiences.
2. Employers contact a person's profile if the person suits them. In case the candidate's profile is interesting to the employer, the interview process begins as in any other company when the interview takes place in person ("live"). Recruiting employees goes through several stages.
    a. First phase - Interview with a person from the Human Resources Department.
    b. Second phase - The level of communicativeness of the person who is important for the job is checked.
    c. Third phase - The next phase is an interview with an expert from the department looking for an employee (e.g., IT department, an interview with a person working in

the IT sector). Often this person is a future colleague, head of the department, etc. Here the level of professional knowledge is checked in detail and it can be immediately seen whether the person has the necessary knowledge or not.

d. Fourth phase - Another interview is conducted, chiefly with the general manager of the department. The conversation is similar to the one held in the previous phase.
e. Fifth phase - Another round of interviews is held, mainly with the human resources manager who was the initiator of the selection at the beginning of the employee recruiting. Salary and working conditions are discussed here. In case the candidate did not satisfy in one of the previous stages, here can also be explained why the person did not get the desired job and why they did not decide to assign him or her a job.
f. Sixth phase - In case the candidate has passed all of the previous stages of recruitment, an agreement is concluded between the human resources manager and the candidate when he can start with the work.
g. Seventh phase - The candidate becomes an employee of the company and the employment relationship begins, so as the process of socialization in a new work environment.

The previously cited phases may vary from company to company, but in most cases, the recruitment is carried out as it was shown above. The number of phases depends on the size of the company, the pyramid structure itself, and the level of management. An important factor is the matter of urgency of the search for the employees (when some phases are skipped).

In the case where a person applies for a job individually, the stages of recruitment are almost identical, except that in this case, the person contacts the first potential employers through social networks.

6. CONCLUSION

Today, most companies adapt their business to the changes that have occurred in their environment, and also when it comes to finding new employees. Companies recruit employees through social media or websites, after studying the profile of a particular person they think (he or she) might have all the qualifications and skills that are required for a particular job. The described process of recruiting employees by contacting through social networks/websites indicates the importance of a good presentation of the job seeker (good Web profile) that will further rise the interest of the future employer for a particular candidate, and thus allow him to introduce himself. The traditional way of acquiring employees has not disappeared, but it is quite certain that today the influence of social networks has become extremely large because it is easier to find the desired employees. This article can offer a good guide for both employers and employees, and a good foundation for future research on the pros and cons of social media recruitment.

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Effect of the 4th Industrial Revolution on Employability – Case of Albania

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Employability;
Skills gap

Abstract: *The labor markets are undergoing significant changes as a result of the fourth industrial revolution's implementation in every sphere of the economy. One easy image may come to mind when you hear the term "digital economy": a robot employee, designed to perform specified tasks automatically. In any case, digitalizing employability entails more than just applying AI codes; it also entails raising performance standards, emphasizing soft skills among workers, eliminating low - and middle-level roles, and increasing demand for highly qualified workers.*

Albania has made significant strides toward economic digitalization. Numerous businesses, especially large ones, are spending money to advance the technologies they work with. Technological developments at the macroeconomic and sectoral levels are fundamentally changing the work market and employability in our country, having a significant impact on both employers and employability

1. INTRODUCTION

Our manner of living and working has undergone a major change as a result of the technological revolution. The reaction to transformation is integrated and comprehensive, including all participants in the global policy, from the public and corporate sectors to academia and civil society, and is unlike anything humankind has ever encountered before. Since the middle of the 20th century, the Fourth Industrial Revolution has been occurring, and it is defined by a fusion of technologies that is obfuscating the distinctions between the physical and digital environments (Schwab, 2016). The Fourth Industrial Revolution is developing exponentially rather than linearly when compared to earlier ones. Additionally, technology is upending virtually every sector of the global labor market. With enormous processing, storage, and knowledge access capabilities brought forth by billions of people being connected via mobile devices, the possibilities are virtually limitless. Emerging technological advances in areas like artificial intelligence, robots, the Internet of Things, automated vehicles, quantum computing, etc. will extend these possibilities. Artificial intelligence has recently made impressive advancements. Artificial intelligence is already all around us in self-driving cars, drones, virtual assistants, and the matching of criteria that form the basis of investment or translation software. The labor markets in both developed and developing countries are undergoing profound change as a result of the fourth industrial revolution, which has caused an increase in the number of employees required in some economic sectors and/or a decrease in the number of employees in many traditional economic sectors. Digital technologies have made it possible to create more products and services with fewer employees, exposing employers to the risk of chronic unemployment. Digital technology' labor-saving effects quickly affect employment, but new job opportunities develop slowly. New labor markets are developed, assets are transferred between industries, business know-how is

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accumulated, and businesses are obliged to employ employees with new skills, particularly after COVID-19. While all of this takes time, companies were compelled to make quick adjustments during the Covid-19 pandemic.

Are all of these transformations brought about by the fourth industrial revolution beneficial to the labor market? To accelerate the creation of new job roles in the digital economy, investments in data and digital infrastructure are crucial. The adoption of cutting-edge digital technologies by businesses may also increase. For instance, the increased use of digital information in companies demands employees with high levels of planning, time management, critical thinking, leadership, and teamwork skills. However, the majority of job seekers do not seem to have these digital world abilities. Furthermore, it has been seen that people with the skills advance more quickly, which could lead to greater inequalities among a country's population. Additionally, experts argue that the rise of digital technology has increased the demand for hard and soft skills at all levels and decreased the necessity for conventional talents. Innovation, productivity, and employment development can all be sustained through encouraging investment in ICTs and related reforms. New markets will continue to expand with the help of policies that encourage market competition, foster entrepreneurship, assist the development of new products and services made possible by ICT, and advance professional and soft skills and competences. Helping people adjust to new occupations will minimize social costs and facilitate the adjustment. In the digital economy, it's more important than ever to have active labor market policies, income support, lifelong learning, and responsive educational systems (World Economic Forum Annual Report, 2021-2022).

2. EFFECTS OF THE 4TH INDUSTRIAL REVOLUTION ON ALBANIA'S EMPLOYABILITY

Employers in Albania were somehow compelled to experience the effects of the fourth industrial revolution during the epidemic. ICT is currently one of Albania's primary economic drivers (Science, technology, R&D and innovation in Albania, 2020). In Albania, businesses using computers for work purposes made up 99.0% of businesses with 10 or more employees in 2022, up from 98.5% in 2021 (INSTAT, 2022).

It has been noted that ICT and digitization processes aid in the modernization of the following processes:

Economic processes, through the establishment of start-ups, the growth of creative job activities, and an increase in productivity in the majority of Albania's economic sectors;

Social processes that support and facilitate social innovation by enhancing the services offered to the community and generating the common good;

Administrative and institutional operations are greatly simplified by e-government services, digital identity, enabling interagency interoperability, offering additional services online, and participation in decision-making by both citizens and companies (AKSHI, 2022).

New job vacancies brought on by digitization may reduce the unemployment rate, but they also seek highly skilled employers, including both professional backgrounds and soft skills. Even though growth in other economic sectors in Albania remained essentially stagnant, jobs were mostly produced in the ICT sector. Rising activity and employment rates, which are the highest

in the region at over 70% and 60%, respectively, also reflect these improvements (Western Balkan Labor Market Trends, 2020). Large skill gaps brought about by the fourth industrial revolution have negatively impacted company growth and job creation in Albanian companies, particularly for positions needing "new economy" and "non-routine" skills. Employers in companies that are innovative and connected to international markets use more "new economy" soft skills than employers in the local Small and Medium Enterprises operating in Albania. It is believed that these kinds of employers are more likely to use advanced computer skills and are more likely to be skilled in personal and organizing, and planning competences. On the other side, these companies face greater challenges in finding and recruiting workers with the necessary skills, whether for "routine" or "non-routine" jobs.

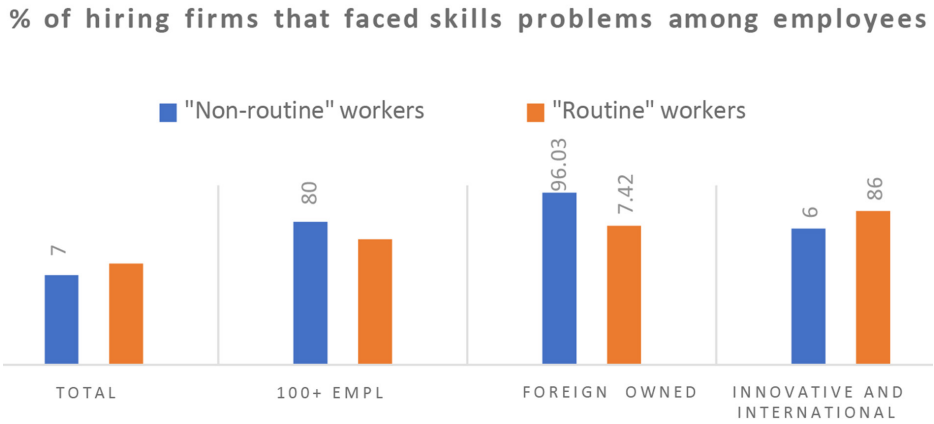

Figure 1. Skill gaps problems among the companies in Albania

Source: Authors, 2022.

Finally, the Fourth Industrial Revolution will alter both what we as job seekers do and who we are. Our feeling of privacy, ideas of ownership, how much time we spend working, how we establish relationships, and how we develop careers all of these things will be impacted. The possibilities are unlimited because they are only limited by our imagination.

Albanian children and young people must have the professional and soft skills they need to succeed in life and at work. While necessary but not sufficient for success in life, foundational skills, also known as deep learning skills, are those that lay the groundwork for future skill enhancements. These skills include communication (speaking, reading, and writing), numeracy, problem-solving, collaboration, interpersonal skills, and information access and processing.

Soft skills development is a lifelong process that starts in prenatal and is supported by appropriate stimulation, instruction, and training. Early skill-development interventions offer significant benefits because they help shape the brain in ways that will make learning and adapting in the future more successful. Professional skills are required to carry out particular tasks. As a result, they must be taught in upper secondary and postsecondary programs, and training should have to take place in close cooperation with companies. It is more likely that students will find a job and be able to adapt to the fourth and forthcoming industrial revolutions if they are better equipped in terms of both soft and professional skills.

Higher-order cognitive and socioemotional skills that will ensure employers' adaptability and upskilling/reskilling of skills throughout their employability are also developed through VET and higher education.

3. CONCLUSION

Technology is not an exogenous force that humans do not influence, and neither is the disruption it brings. In our daily choices as citizens, customers, and investors, we are all accountable for directing its progress. To shape the Fourth Industrial Revolution and steer it toward a future that represents our shared goals and values, we should use the chance and leverage we have.

It all comes down to people and values in the end. We need to prioritize and empower people in order to create a future that benefits us all. The Fourth Industrial Revolution may indeed have the ability to "robotize" humans and rob us of our hearts and soul in its gloomiest, dehumanized form. Nevertheless, it can also elevate humanity into a new collective and moral awareness based on a shared sense of destiny, as a complement to the best aspects of human nature— creativity, and empathy.

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Human Resources Management in Quality 4.0 Maturity Assessment

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Abstract: *The paper analyzes critical success factors and enablers for the maturity assessment of Quality 4.0 implementations. The emphasis is on how digital transformation technologies have impacted human resource processes and how technology and quality are related. This study presents a literature review on Quality 4.0 and provides an overview of the key issues and future perspectives for quality management in the digital era. The research results contribute to the digitalization and quality literature and a holistic approach that should be composed of CSFs and Enablers. No previous studies have been identified that provide a holistic analysis.*

1. INTRODUCTION

Technology has been used to create significant changes in society. The term digital era refers to the period when the changes were most significant. The recent discourses have focused on digital transformation which is defined as the changes associated with the use of technology in various aspects of human society (Veldhoven & Vanthienen, 2021). Due to the increasing use of digital tools, the human resource management (HRM) function is affected by its effects on the organization's core values. One of the advantages of digitalization is the ability to gather and analyze vast amounts of data. This process enhances the knowledge acquired in the organization and increases the analytical capabilities of the collected data, by using algorithms and an increase in information flows.

Due to the rapid emergence of DT in the workplace, HRM has become more diverse, and people-oriented. The various changes that are happening in the industry are some of the challenges that the profession faces. The rise of digital employees has required HR professionals to make operational and strategic changes in order to influence their behavior and attitudes (Fregnan et al., 2020).

The need for a relationship between technology and quality has become clear as we recognize the importance of quality in today's environment. Quality Management is a process utilized for optimizing the operations of organizations. This discipline can help improve the productivity

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and competitiveness of businesses in times of societal change. The goal is to help companies develop their capabilities in order to capitalize on the opportunities presented by Industry 4.0 (I4.0). This includes developing their innovation management capabilities and improving their skills in this field. Models for the Quality Management System (QMS) could play a role in supporting the development of skills and competencies in I4.0. As a result, there is a term of Quality 4.0 (Q4.0) signifying an integral part and extended concept of I4.0. The core culture and managerial approaches of quality managers are considered as factors that drive the success of the Q4.0 concept. This argues that adopting a quality management system could help improve the profitability of the organization. Quality 4.0 is a shift that addresses the challenges of working with production systems that are constantly monitored and assessed in real-time.

While Quality 4.0 is mainly focused on the technical aspects of improving efficiency and effectiveness, it has a social side. This concept tackles issues such as the need for people to develop new skills and attitudes, as well as the establishment of a supportive culture. One of the key factors that the Q4.0 transition needs to be considered is the development of skills in leadership. The new era of quality management requires a leader who combines the principles of quality with the demands of I4.0. This leader should have the necessary resources and the mindset to implement Q4.0 effectively.

The transition to Q4.0 requires continuous learning and innovation. A quality-based knowledge is also necessary to support the development of effective and efficient processes and procedures, setting benchmarks for sharing digitalization-related practices. The goal of an agile approach is to enable cross-functional collaboration and the sharing of knowledge. This method facilitates the continuous improvement of processes and the dissemination of ideas and experiences, which leads to positive results.

2. HUMAN RESOURCES PRACTICES

Human Resources Management (HRM) refers to a set of practices that organizations use to ensure that their workforce is well-equipped to meet their operational needs. HRM Practices are focused on the combination of administrative personnel functions with performance, employee relations and resource planning. They help organizations maximize their return on investment and minimize financial risk. HRM practices can affect various aspects of an organization's performance such as turnover, stress, and burnout, etc., which in turn influences organization performance indicators like reputation, sales per employee, sales growth, return on investments, etc. (Alam & Mukherjee, 2014).

A particular definition of HRM is the one defined HRM as those decisions and actions which concern the management of employees at all levels in the business and which are related to the implementation of strategies directed towards creating and sustaining competitive advantage (Syed & Bayeroju, 2019). HRM practices can improve and sustain an organization's performance. These practices are based on employee selection that fits with the company's culture, behavior, attitude, and necessary technical skills required by the job, compensation contingent on performance, and employee empowerment to foster teamwork. Seven HRM practices that improve organizational performance are employment security, selective hiring of new personnel, self-managed teams and decentralization of decision-making as the basic principles of organizational design, comparatively high compensation contingent on organizational performance, extensive training, reduced status distinctions and barriers, including dress, language,

office arrangements, and wage differences across levels, extensive sharing of financial and performance information throughout the organization (Pratibha et al., 2021).

Due to digitalization, the competition between workers has changed into competition between people and machines. Employees' careers depend on their skills in digital technologies, regardless of their qualifications. People take responsibility for their qualifications and skills and may be more or less willing to learn new technologies in any environment they want and to be open to change.

Technological, cognitive, social, and emotional are skills that are in great demand. Companies need to offer continuous learning and training to their employees to acquire these skills. Education and continuous training must be based on the learning culture and HRM practices of organizations to be effective. Among the human resources practices that favor the success of training is the reward and promotion system of organizations that values continuous learning at the individual level and compensates employees accordingly for recently acquired skills. Creating a climate of continuous learning requires organizations to adopt characteristics such as openness, innovation, discipline, interactive collaboration and constructive confrontation (Zaitouni et al., 2020).

3. SOCIAL NETWORKS, HRM PRACTICES AND E-HRM IN THE TECHNOLOGY ERA

The rise of social media has completely changed the way people connect. Social networks are tools that allow people to connect and share interests and activities, by developing online communities. Social networking tools allow organizations to create and maintain their own social networks without the need for extensive training or expertise. From an organizational point of view, by adopting social networking technologies companies could communicate with stakeholders inside and outside the organizational boundaries: they could be effective in creating and directing their culture, in managing change, in stimulating collaboration, in increasing motivation, in empowering expertise and in sharing and building knowledge (Manuti & de Palma, 2018). The term collaboration is an evolving process whereby two or more social entities actively and reciprocally engage in joint activities aimed at achieving at least one shared goal (Bedwell et al., 2012). The explosion of social media has highlighted the importance of collaboration in organizations. It has also called for a redefinition of what constitutes collaboration. The emergence and evolution of technologies within an organization's context have contributed to the creation of the so-called Enterprise 2.0, featured by an extended use of technology mainly addressed to four main working processes: communication, collaboration, cooperation, and connection (Manuti & de Palma, 2018). People use various platforms to communicate with each other. These platforms allow people to interact with each other in various ways. They help people at work with their needs related to operation and sociality. These platforms allow people to communicate with others in various ways, such as text, image, voice, video, or a combination of these.

E-HRM (Electronic Human Resource Management) is the use of online technologies for HRM services and practices within an organization. It is the first field of HRM to make use of web-based technology and it embraces e-recruitment and e-learning.

From this base e-HRM has expanded to embrace the virtual delivery of all HR policies and strategies. E-HRM is a tool that allows HR professionals to perform various HR activities such as planning and conducting appraisals, training, and analyzing employee development programs, training, and evaluation labor costs. Employees can use e-HRM to plan their own development, apply for promotion, transfer, and career development plans and access a range of information

on HR policy and strategy. This system is essentially the devolution of HR functions to management and employees. They access these functions typically through web technology channels. E-HRM involves the configuration of human resources, and it is a way of implementing human resource management in an organization. This implementation can be done through the application of strategies, policies, and practices. Improvement in the HR strategic orientation, improvement in client focusses and satisfaction and decrease in costs or increase in efficiency can be achieved by following a specific e-HRM direction. Companies are aware of the fact that human resources have changed from a cost factor to a success factor. E-HRM is an automated and web-based tool that supports various HR processes. The three main tiers of e-HRM are *operational, relational, and transformational*. Operational e-HRM is concerned with administrative functions payroll and employee personal data. Relational e-HRM is concerned with supporting business processes by means of training, recruitment, performance management and so forth. Transformational e-HRM is concerned with strategic HR activities such as knowledge management, strategic re-orientation. An organization may choose to pursue e-HRM policies from any number of these tiers to achieve their HR goals (Prakash & Mores, 2019).

Hiring is the process by which employers look for candidates to fill jobs in their business. The beginning of the process is the search for recruits, and the end is the submission of applications. Through an online application, managers have more efficient and effective ways of recruiting. Electronic recruitment is the implementation of this process through network technology. The websites used to fill the posts are resume databases, marketing, search engines, or social networking platforms.

Companies hire employees through many websites. E-recruitment channels are corporate websites, online recruiting platforms such as CV online, professional social media platforms such as linkedin.com and xing.com and social media platforms such as facebook.com and twitter.com. The services allow users to communicate with peers by voice using a microphone, video by using a webcam, video conferencing and instant messaging over the Internet. Skype is a computer program that can be used to make free voice calls over the Internet to anyone who is also using Skype. It is more useful for selecting the right candidate. E-recruitment offers wider access and geographical spread, a larger audience, better chances of finding the right candidate, time and cost savings, better matching of staff with vacancies, efficiency, easy access to job seekers, reduction of unqualified candidates and more opportunities for smaller companies. Apart from these advantages, it also has several disadvantages such as checking the validity of CV skills, low Internet penetration and lack of knowledge in many locations worldwide and the non-exclusive dependence of organizations on e-recruitment methods (Ltd, 2019).

Through online recruitment job, search costs are much lower, there are more opportunities for candidates to show their skills, there is no factor of geographical location, vacancies can be filled in less time, because through social media networking answers are faster, young people have more job opportunities and positions can be viewed by more candidates.

E-learning technology is the utilization of web technology to deliver learning. E-learning as an idea covers a scope of uses, learning techniques and procedures. E-learning allows the learners to watch different activities and listen to lessons repeatedly as required (Ghosh et al., 2021).

E-learning technology is in great demand worldwide. Organizations prefer e-learning because it reduces employee stress and increases collaboration and satisfaction. The growing preference

for e-learning is attributed to the motivation of the individual to interact with others, to exchange views, to receive feedback, to share knowledge, to improve communication and to facilitate the relationship that maintains learning agility.

E-learning technology can help employees maximize their performance by giving them the knowledge they need at the right time. E-learning (distance mode) technologies enable organizations to support the complete Human Value Cycle (HVC): recruit, assess, train, test, certify, and retain (Prakash & Mores, 2019). E-learning is successful when the focus on everyone working is ensured. By combining the right tools and methods of collaboration, knowledge and e-learning, employees can easily achieve higher performance. E-learning tools help identify and address a skills gap in one part of the solution while helping collaborate on one outcome that can improve the performance of the workforce.

4. THE NEED FOR NEW COMPETENCIES AND SKILLS

Companies, employees, and managers are not only confronted with completely new issues in their work and organizational processes as a result of digital transformation. To keep up with and adapt to these rapid changes, new skills and abilities are required, such as capturing and filtering information. Whereas it used to be easy to cover one's entire working life with information gained through apprenticeships or studies, this is no longer the case. The half-life of expert knowledge has drastically diminished, and the task of lifelong learning has taken on a whole new meaning. No longer is it simply needed to learn to move ahead, but it is also needed to learn to stay up with the constant changes.

Expert knowledge must be continuously expanded and partially aligned in the workplace multiple times, to the point where there will be completely distinct job profiles every 10 years in the future. Recognizing, evaluating, and using relevant data is becoming increasingly critical. As a result, Markgraf's research has identified a number of new skills that will become increasingly important in the context of the fourth industrial revolution (Brauweiler et al., 2020). The respondents were asked to rate how essential things will be short, from their perspective. The significance was graded on a scale of 1 to 7, with 7 indicating the highest level of significance. In total, more than 500 people took part in the assessment of future competency requirements.

Participants were able to make their own additions to the given competencies in addition to rating them. This option was frequently used, but there was no clear idea of what additional skills would be necessary. The data included a wide range of themes related to teamwork and communication in many cases. Only self-organization and ethical action or ethical moral responsibility can be identified as extra points.

Overall, it is clear that abilities connected to new problems, new situations, and communication and interaction are becoming increasingly important. The participants anticipate a constant metamorphosis and the opportunity to continuously train themselves.

Organizations in practically all industry categories are implementing different programs to study and utilize the benefits of emerging digital technologies, such as social networks, mobile, big data, and so on. Companies must adopt management strategies to oversee these complex transitions, which usually entail transformations of critical company operations and impacts products and processes, as well as organizational structures. As a result of the maturing

of digital technologies and their widespread penetration across all marketplaces, society as a whole is undergoing rapid and drastic transformation.

Digital technologies help companies reduce costs, improve work efficiency and productivity, improve customer satisfaction, and optimize the company's supply chain. These digital technologies have been defined as Artificial Intelligence (AI), Big Data, Cloud Computing, the Internet of Things (IoT), Virtual and Augmented Reality (VR/AR), and cyber-physical systems, social media, analytics, mobile devices, or built-in devices. Features of digital technology are reprogramming, homogenization of data and self-referential character of digital technology.

A digital artefact is a digital component, multimedia content, or application that composes a portion of a new product or service and provides value or specific functionality to the end user. Examples may be different applications running smartwatches (Sukreep et al., 2019), Amazon Dash Button (Sharma, 2021), Google Pay (Poongodi et al., 2021), and Face ID. Digital objects work either as standalone software or as a hardware component in a physical gadget or as part of a wider ecosystem running on a digital platform. A digital artefact makes natural products or services support innovation. For example, companies use social networking sites to create and grow social capital and find new business opportunities (Stepantseva & Breitenecker, 2020).

Digital platform corresponds to the common sets of services and architectures used to promote product and service offerings. Examples are the Google Chrome browser which allows you to work with the Google search engine and Apple's iOS platform which allows you to run different applications on your smartphone. Digital platforms have facilitated the transformation of the industry while creating new bases of innovation and positions.

Digital infrastructure or tools are the set of digital technology systems and tools that contribute to collaboration and communication. These tools support business and innovation. Examples of digital infrastructure include Microsoft Azure, the Google Cloud Platform, or Stanford FabLearn and MIT Fab Central Labs used for digital prototypes and mock-ups.

Successful Digital Transformation necessitates the development of a diverse set of talents, the relevance of which will vary based on the business context and the specific demands of the organization. In order to be competitive, digital technology must become integral to how businesses run, and businesses must rethink and possibly re-invent their business models.

Because of their pervasiveness and economic effect, digital technologies spread quickly. They're referred to as general-purpose technology (GPTs) (Casalet & Stezano, 2020). The phrase GPTs has been thrown around a lot in recent discussions of the role of technology in economic growth, and it usually refers to changes that affect both domestic life and corporate practices. For this reason, steam, electricity, internal combustion, and information technology (IT) are frequently characterized as GPTs. This transformation comes in the shape of a once-in-a-lifetime opportunity to increase welfare and solve major social challenges ranging from health care to education, or environmental protection. GPTs have four main characteristics: pervasiveness, which means they can be used in a wide range of industries; improvement, which means they should improve over time and thus improve quality; cost-cutting, which means they should continue to reduce costs for their users; and innovation spawning, which means they should make it easier to invent and produce new products or processes.

Interinstitutional and collaborative ties were increasingly important as Industry 4.0 took shape, helping to solve the digital ecosystem's execution and implementation issues. As social networks grew in size, decision-making became more important, opening up new avenues for thinking about highly specialized environments in collaborative settings.

5. DIGITAL TECHNOLOGY TRENDS

Value networks are reshaped by developing the digitalization of products and services. Organizations must monitor technological changes to make improvements to the transformation and business. These improvements can give organizations a competitive advantage. Digitalization of products and services requires the application of new digital solutions.

Many companies monitor the trends in digitalization and its influence in the services and production sectors. The term digitalization is sometimes associated with industry 4.0. Industry 4.0 is defined as the integrated digitalization and connection of production processes, starting from the customer's order, through the creation of production processes, up to the next stage of products (Wilkesmann & Wilkesmann, 2018). In course of the digitalization concept, it is important to apply to common technology trends in Industry 4.0. As shown in figure 1, PricewaterhouseCoopers has identified the following core digital technologies for the production: Mobile devices, IoT platforms, Location detection technologies, Advanced human-machine interfaces, Authentication & fraud detection, 3D printing, Smart sensors, Big data analytics and advanced algorithms, Multilevel customer interaction and customer profiling, Augmented reality/wearables, and Cloud computing (Stepantseva & Breitenecker, 2020).

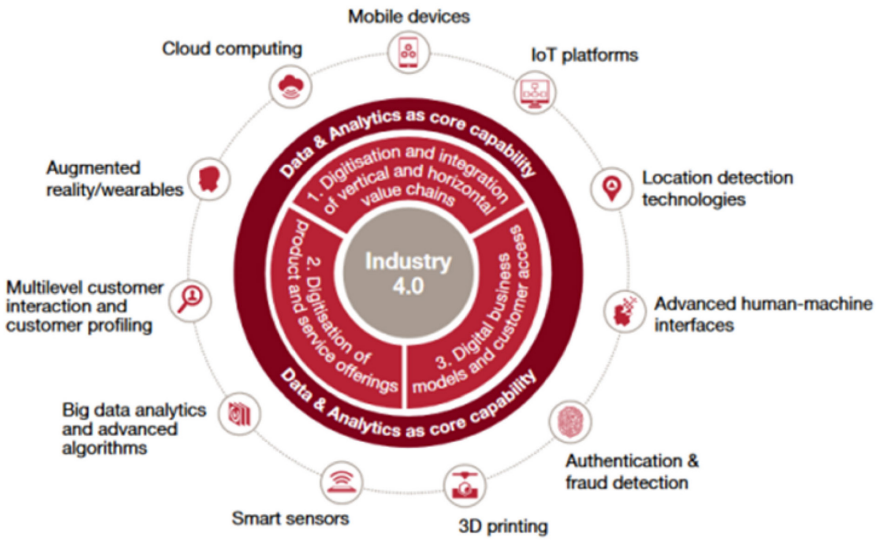

Figure 1. Key contributing digital technologies
Source: Stepantseva and Breitenecker, 2020.

Several trends in digital technology are important changes for society and business. With *analytics* organizations extract information about markets, customers, operations, and anything else related to their operations through big data. Since the amount of data is constantly increasing, companies use supporting infrastructures such as algorithms and analytics engines. The *cloud* is a tool that can differentiate a business from its competitors. It is used to expand the data center and shift the workload, while allowing access to artificial technology, digital reality, blockchain, quantum computing and for other more. The term *digital reality* refers to the way

people interact with technologies and data. These are virtual reality (VR), augmented reality (AR), mixed reality (MR), the Internet of Things (IoT) and spatial technologies. Large companies implement *blockchain* solutions to manage different databases. It is expected that business process reengineering will enable companies to realize massive transformation across various functions and locations. C*ognitive technologies* make decisions and activate business opportunities, for people. Some examples are Robotic process automation (RPA), neural networks, bots, machine learning (ML), natural language processing (NLP), and the broader domain of artificial intelligence (AI) (Stepantseva & Breitenecker, 2020).

Companies need to deal with strategic digital trends. *Automation* tools such as robots, autonomous vehicles, and drones, use artificial intelligence and perform automated functions that used to be done by humans. *Augmented Analytics* are a key feature of modern analytics, data preparation and management, data process mining, data science platforms and business process management. To create more artificial location solutions, developers can work independently using *AI-Driven Development*, and advanced models delivered as a service. A *digital twin* is a digital representation of a system. Companies carry out digital representations in order to improve their ability to collect and display data and to apply the right analytics. *Empowered Edge and IoT* are endpoint devices. Edge computing outlines a computing topology where information processing, content collection and delivery, are located closer to these endpoints. *Digital reality* includes virtual (VR), augmented (AR) and mixed (MR) reality. It helps employees to understand digital world and be able to interact with it. Respectively offers a digital experience to customers. *Blockchain* ensures trust and reduces excessive interaction between business ecosystems. It reduces costs and time and increases cash flow (Stepantseva & Breitenecker, 2020).

Artificial Intelligence (AI) is a tool that improves human well-being, increasing individual and social well-being and facilitating progress and innovation. It also contributes to achieving the goals of sustainable development by monitoring climate change, the proper utilization of natural resources, the improvement of human health and the business processes of companies.

Trust in artificial energy systems concerns the internal characteristics of technology and quality assurance of socio-technical systems that provide the use of artificial energy. Similarly, in systems related to food safety, aviation, and nuclear energy. The reliability of the system and the systemic approach must be applied to all parts and processes of the system, during its all-life cycle.

Reliability of AI applied throughout the life cycle of system should be legal, in line with human ethical values and principles, and technically and socially strong, in order not to damage the systems. These elements are necessary all together, but they are not enough alone to achieve reliability.

A reliable approach is a driver for providing responsible competitiveness by enabling the base for all players they can trust that their development, expansion, and application of AI systems are lawful, ethical, and robust. The requirements for reliable artificial intelligence are human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, societal and environmental well-being and accountability (Stepantseva & Breitenecker, 2020).

6. DIGITAL TECHNOLOGY IN PRACTICE

Connectivity and mobility are the key features of digital technology. These features are found in modern products and services and operate regardless of geographical location. The structure of the industry and the view of the company on its customers is changing due to technology. This means that to maintain their market position, organizations must interact with change.

Business transformation of companies is necessary to be part of their strategy. Organizations are now developing new digital divisions, shaping existing ones and hiring experts in digital transformation and technology. Companies that rely on digital technology, even if they are new to the market, are gaining a competitive edge. The reason is that they have not introduced changes at all or not changed promptly enough, or because these companies have not succeeded to adapt own business models to the competitive market conditions they meet from digital giants and major digital service providers, for example, as Amazon, Google, Facebook, Apple, Alibaba, Microsoft, Snap and eBay, Airbnb, Uber, Booking.com or Spotify. The music industry is one illustrative example of how rapidly change can occur. Ten years ago, Apple radically changed the industry by launching iTunes. But up to date, new streaming services (e.g., Spotify, the new Apple Music, and Deezer) are turning the successful iTunes model inefficient. Thus, Apple has moved from a pioneer in its industry to an imitator (Stepantseva & Breitenecker, 2020).

Artificial life and machine learning are new digital technologies that have been developed. For example, voice-user interfaces such as Google Assistant, Amazon Alexa, Apple Siri, Microsoft Cortana and Yandex Alice (Golenkov et al., 2020). These virtual assistants are based on voice recognition software and intelligent interfaces that enable collaboration between humans and computers. They can help you find information and follow some instructions. Recently, Amazon patented a new Alexa feature that it could understand based on speech and emotion when a user is sick and offer medication. All this enhances the customer experience and creates added value for the company's customers.

Digital technology became an important tool for organizations and new forms of work have emerged. Nevertheless, companies continue to use and enforce the old procedures and laws. An example is Uber, a company that provides digital taxi services. The government was against the company because it applied technology to open up and enhance access to taxi services for both providers and customers (Stepantseva & Breitenecker, 2020).

New digital technologies require constant updating of employees' skills. Digital skills, the use of innovation and the ability to organize and make decisions are important for employees to be able to confront new technologies. Organizations that implement digital transformation are looking for candidates with critical thinking, entrepreneurship and problem-solving while providing opportunities for learning and adaptation to new transformational work environments. The necessary skill of an employee in a business is cooperation. Cooperation includes an ability to read and react to emotions, intentions and needs.

Digital technology has affected job search in the labor market. Platforms have been created that allow finding employees, while also finding a job. Such platforms are LinkedIn and Facebook. LinkedIn and Facebook have become important tools for companies, for facilitating the recruitment processes and attracting candidates. Young people have the opportunity to connect with

potential employers or start their own businesses. For recruiters, social networking platforms have become one of the key tools in finding potential employees (Marin & Nila, 2021).

Digital technology has also become an integral part of the banking system. Digital technologies have contributed too many changes in banking processes, in terms of management, production and delivery. Digital transformation has affected banks in *new business models*, *operational efficiency, higher quality and faster service, personalization, transparency of operations and cybersecurity and largest investments.* Digital technologies were incorporated in the business processes of the banks and new business banking models were created, resulting in the development of digital banking. Banks improve their efficiency by transforming business models and automating business processes. In this way they save their workforce in simple functions that are not necessary and direct it to tasks related to strategic tasks. Financial technology allows improving the accessibility and speed of operational services and reduces errors and deviations in the work process. Banks offer targeted content thanks to a better understanding of lifestyle, interests, stage needs and social affiliation preferences. Financial technology helps prevent the risks associated with financial technologies. Artificial selection allows the problem to be solved. The application of digital technologies in the business processes of banks requires time and investments in research and development. The digitalization process improves the customer experience by delivering better, faster, and more personalized banking services and products. Factors that create added value to customers for banking products and services are higher personalization, increased service speed, access to the service or product anytime and anywhere, better functionality and forecasting, a better understanding of customers' needs in advance, and offering relevant products and services early.

7. INDUSTRY 4.0 AND HRM 4.0: NEW SOCIAL SUSTAINABILITY

Human Resources Management (HRM) activities are impacted by The Fourth Industrial Revolution (i.e., Industry 4.0) from three perspectives.

Firstly, Industry 4.0 puts Human Resources Management to the test by asking it to add value to the emerging smart organization, where work transcends organizational borders and successful human-machine collaboration can potentially deliver new benefits. Human Resources Management may play a new critical role as a change agent, assisting smart organizations in developing new workforce digital mindsets and competencies to communicate with machines, as well as colleagues and supervisors, in an open community setting (Imperatori & Bissola, 2018).

Second, workplace digital transformation necessitates a reform of existing HR policies, which must accommodate the evolving employee-organization relationship, in which employees can work from anywhere, have no set working hours, and collaborate with people both inside and outside the company. Hierarchical control loses its effectiveness in such circumstances, performance evaluation becomes more important, and all employees are expected to actively contribute ideas and decisions. In the same vein, smart technology allows e-HRM to expand and deliver new HRM solutions that usually provide more direct contact between workers, HR, and the organization. They also better correspond with people's routines and behaviors when it comes to connectivity, and they offer a more flexible work environment (Imperatori & Bissola, 2018).

In this context, HR systems must be compatible with the new manner of working and the new types of workers, and supervisory and worker behaviors must be aligned with the new digital

culture. Performance must be clearly defined and measured in terms of work results. Career paths must be organized consistently. Ways of interaction, as well as the time and space for collaborations, must be openly set, and organizational spaces (i.e., offices and plants) must be specifically redesigned for the new work processes, allowing workers to better manage their time and space.

Human Resources practices should also enable firms to manage a segmented and composite workforce. Diverse people practices are needed, among other things, for a diverse workforce that can balance the organization's and people's expectations sustainably and fairly. To effectively recruit, select, and engage external as well as internal stakeholders, as well as to best match the demand and supply of talents and competences across the product lifecycle, new and aligned management methods are required. Real-time employee data is becoming more common, which can provide useful insights and enable data-driven decision-making. The data necessitates firms' and HRM experts' digital and analytical capacities to be enhanced (Bissola & Imperatori, 2019).

Third and most importantly, the Human Resources department should be the organizational unit that is most committed to Industry 4.0's human-centered approach and supports its implementation in a socially sustainable manner (Schneider, 2018).

People are becoming more conscious of how their actions and lives affect others. The current economic crisis revealed some of the capitalism socio-economic system's contradictions, resulting in undesirable phenomena including unemployment, austerity, and social insecurity. Customers, communities, employees, governments, and shareholders are among the stakeholder groups putting pressure on businesses to be socially sustainable (Bissola & Imperatori, 2019). Organizations have reacted in a variety of ways to this pressure. *Society and business*, *social issues management*, *public policy and business*, *stakeholder management*, and *corporate accountability* are just a few of the phrases that have been used to characterize the phenomenon of corporate responsibility in society.

Sustainability, according to Wheeler, Colbert, and Freeman, is *an ideal toward which society and business can continually strive; the way we strive is by creating value, by creating outcomes consistent with the ideal of sustainability along social, environmental, and economic dimensions* (Bissola & Imperatori, 2019).

Human Resources Management 4.0 has the potential to play a pivotal role in the development and implementation of socially sustainable solutions. It can provide a stimulus for positive social change and the long-term adoption of new digital technologies and innovative organizational solutions, supporting the positive outcomes of Industry 4.0 while avoiding potential downsides.

Human Resources Management experts and academics must assist corporate executives and employees in adopting a 4.0 attitude, which entails using digital tools to manage, organize, lead, and work for positive social change. Human Resources Management 4.0 can help with work innovation, employee empowerment, competency development, and enabling them to actively address current labor concerns. Employees have been considered as passive performers of their assigned job activities for a long time. Several academics have recently emphasized that work design theory must take into account the effect of employees on their job design. Human Resources Management 4.0 could be the key to allowing employees to have more control over their job characteristics, resulting in increased work motivation and more sustainable social growth.

In this new world, the concept of an unnecessary trade-off between *doing well* and *doing good* must become a crucial issue, and HRM experts and practitioners share a significant social duty (Bissola & Imperatori, 2019).

This is a new world for the HRM area, which may provide HR professionals with new employment options. Furthermore, it has the potential to change the impact that scholars have on people, businesses, and society at large by promoting the positive and, more importantly, long-term aspects of ongoing work transformation and allowing for a human-centered organization (figure 2).

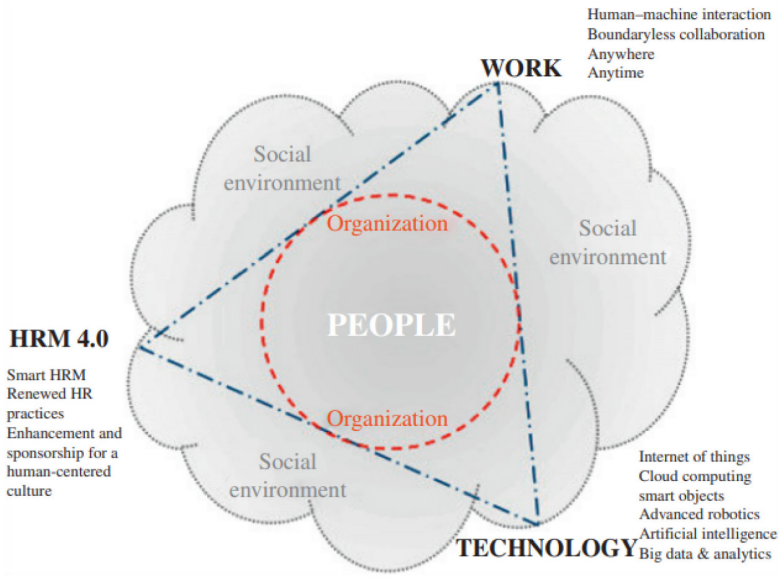

Figure 2. Ecosystems for Human-centered Approach in Industry 4.0
Source: Bissola and Imperatori, 2019.

8. CONCLUSION

Quality 4.0 framework can be developed and defined in a variety of ways. It can be based on a variety of factors, including a move from products to services, value creation in markets, and the quality of business models, among others. Zairi (2017) proposes such a response to the quality profession's crisis. He proposes that the quality profession requires a new quality DNA by changing how quality is understood as a concept and the notion of customer satisfaction, by employing disruptive thinking to keep up with business evolutions, particularly the digital revolution, for the proactive pursuit of excellence and quality leadership, and by changing the meaning of strategy in the role of quality to reflect the need for agility and flexibility and to focus on a customer-centric approach (Zonnenshain & Kenett, 2020).

For the new quality revolution, which Zairi refers to as Quality Mark II, he proposes the following framework: The discovery as the propelling force; the value creation generator which includes: personalization, perfection, partnership, prediction and delivery; the business renewal rocket which includes: experience, engagement, experimentation, enlightenment, disruption and distinction (Zonnenshain & Kenett, 2020).

The Quality 4.0 system's goal is to help companies attain maturity in their Industry 4.0 capabilities. Real-time data management, interoperability, virtualization, decentralization, agility, service orientation, and integrated business processes are all Industry 4.0 design principles

(Ranjith et al., 2021). These design concepts are relevant for developing the framework since they are organizational capabilities for both Industry 4.0 and Quality 4.0. In addition, achieving Sustainability is a vital competence for enterprises in the Industry 4.0 age. The core goal of Quality 4.0 strategy and implementation is to achieve maturity in these eight skills.

Aldag and Eker defined Quality 4.0 (or Q4.0) as the blending of traditional quality management practices and techniques with new technologies such as machine learning, cloud technologies, Big-Data, connectivity devices, Internet of Things, and Artificial Intelligence (Sader et al., 2021). Through the integration of various functions, such as supply chain and customer relationship management, the management of these activities were brought to a more collaborative environment. Jacob defined Quality 4.0 as the leverage of traditional quality management techniques which was gained by modern technologies in order to reach a new level of excellence at the functional and operational levels (Sader et al., 2021). He noted that adopting Q4.0 enabled manufacturers to improve their efficiency and effectiveness, which in turn boosted their market share and enhanced brand recognition.

In 2018, Allcock explained how Q4.0 refers to the shift from manual measurement to fully automated manufacturing. This process involves the use of sensors and software to automate the manufacturing process. Schnreiter defined Q4.0 as the process of integrating and managing data related to manufacturing activities and processes (Sader et al., 2021). Quality 4.0 required an analysis system that can monitor and control the entire value chain.

Quality 4.0 combines quality management with digitalization and technology, which provides a management and process dimension to the digital transformation technology driver (Fonseca et al., 2021). Industry 4.0 requires product and process quality, to support flexibility, productivity, planning and implementation of the new processes. Quality 4.0 can improve Industry 4.0's quality and results.

Quality management is related to the four elements of business analysis, namely the organizational structure, jobs, processes, and management systems, and the six business resources which are buildings, equipment, human resources, stocks, technologies, and capital. More specifically with quality management the organization can detect defects in products or processes, trackback its processes, identify the cause of the defect in the resources or analysis data and perform actions to correct the defects and ensure that they do not reappear. The four processes that describe quality management are *total quality management*, *quality methodologies*, *quality standards* and *excellence awards*. Total quality management focuses on human resources, and it is desirable to transfer to the employee level. Quality methodologies install the four quality elements, quality organizational structure, quality jobs, quality control procedures and quality management systems. The goal is continuous improvement with various methodologies, such as Six Sigma. There is a continuous improvement in the quality standards with the difference that it needs certification and renewal every year (e.g., ISO, IEEE, ANSI). According to excellence awards, there is a list of indicators that evaluate the organization in terms of quality management, which are divided into two categories, people enablers and people result (e.g., EFQM model).

The concept of digital transformation is often interconnected with the concept of I4.0 and Q4.0. This concept proposes that the goals of digital transformation are aligned with the goals of quality and that the use of digital tools and methods can achieve these goals. The main driver for I4.0 is a technology and Artificial Intelligence (AI) while Q4.0 focuses on a customer-centric approach. Quality 4.0 refers to the capacity of a product to meet the needs of its customers at any

stage of its life cycle. It can be seen as a way to improve the efficiency of the entire value chain. It can be used to measure and improve the quality of production through digital tools.

Quality 4.0 is often referred to as a major transformation that affects all levels of an organization. The new era of technologies can help people and businesses achieve their goals and needs. They should be used to improve processes and efficiency. The evolution of human capabilities and the fusion of various Quality Control disciplines enable organizations to achieve an agile Q4.0 transition. This can be achieved through the development of the TQM 4.0 environment consisting of the convergence of Industry 4.0, Total Quality Management (TQM), and Quality Control (QC) (Dias et al. 2021).

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Study of the Motivating Factors of the Human Resources Management System in the Municipality of Plovdiv

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Motivation;
Communication;
Efficiency

Abstract: *Motivation can encourage employees to achieve the organization's goal because if workers feel that managers practically communicate with them, it motivates them to perform better and work as a team. Mismanagement of motivation in any organization can lead to demotivation, apathy and even resistance. The symptoms of a lack of inspiration in the workplace are frequent turnover, frequent absences from work, delays, low quality of performed activities, lack of interest in new exercises, etc. Employees with high job satisfaction are more focused on tasks and activities and are more motivated to stay with the organization. The conducted research found low motivation among employees in the municipality of Plovdiv, which is why improving interpersonal communication is a prerequisite for increasing job satisfaction.*

1. INTRODUCTION

Employee motivation is at the core of any organization's competitive positioning. Work motivation is often defined as low, caused by insufficiently good economic, social, and cultural conditions in the workplace. Lowered motivation and even its absence led to a decrease in labour intensity, and the lack of a built and operating effective management system led to the non-fulfilment of official duties. Job satisfaction is the general attitude and motivation of the worker to perform the assigned tasks, which can be influenced by factors such as working conditions, pay and benefits, the philosophy of employees to the organization, exercised control and leadership style of managers, autonomy, recognition, communication, working conditions, the importance of work, colleagues, professionalism, organizational climate, interpersonal relations, working in a cohesive team, etc. Low job satisfaction is often associated with labour-intensive tasks such as processing a lot of documentation, monotony of activities, the tension of expectations of constant shifts in the hierarchy, frequent conflicts with colleagues, feeling overwhelmed, overtime, etc. Motivation varies depending on individual worker behaviour and organizational behaviour. It is essential to mention that all people have different reasons when doing work, as well as different perceptions of the effectiveness of interpersonal communication.

2. SPECIFIC FEATURES OF WORK MOTIVATION

The motive is the basis for the performance of specific actions by the person, and the motives acting in one direction are defined as motivation. In modern psychology, the concept of motivation expresses the directed activity of the person regarding his action. Motivation is the force that causes people to act in a certain way, to treat someone or something in a certain way in a specific situation and in a way that is chosen by them (Balevska & Simeonova, 2016, p. 91). In essence, motivation is a degree of desire and choice of a given person, which is necessary to

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undertake one or another behaviour expressed in an active direction of the person. Motivation describes the wants and needs that direct behaviour to achieve a specific goal, a hierarchical system of many levels in which the various motives are in unity and interaction. When the person realizes a given motive in this system, it becomes a goal and receives an actual motivational force (Paunov, 2009, p. 91).

Mismanagement of motivation in any organisation can lead to demotivation, apathy and even resistance (Yaneva, 2007, p. 428). The symptoms of a lack of motivation in the workplace are frequent turnover; frequent absences from work; delays; low quality of performed activities; lack of interest in new activities, etc. When such symptoms appear, the management team should look for the reasons, the factors that motivate this behaviour and the lack of motivation of the workers. Essential for workplace motivation is interpersonal communication. It is often a barrier to effectively motivating employees. The quality of interpersonal relationships in the workplace determines the behaviours employees use to communicate with each other (Szostek, 2019, p. 2), with effective relationships leading to better engagement, task performance, motivation, innovation, error detection, teamwork, helping others, reducing conflict, and resisting reactions to negative events. Conversely, ineffective relationships between employees negatively impact all aspects of performing organisational activities.

Interpersonal relationships in the workplace are influenced by various factors that determine their effectiveness, such as:

- Organizational climate (working atmosphere, built trust between workers);
- Interpersonal relationships (sharing personal information, contact after work, mutual assistance, celebrating important occasions together, etc.);
- Building interpersonal relations on the part of the organization (meetings with employees, researching their opinions, conducting informal company events);
- Presence of distance between workers resulting from management style.

Effective interpersonal relationships in the workplace depend on the ability to deliver and receive messages in the exchange of information between individuals, as well as generate feedback so that the message can be understood by both parties, i.e. with the method of transmission of information, regard for the feelings of others, providing feedback, efficient use of time and providing comfortable conditions for receiving information (McShane & Von Glinow, 2010, p. 202). Motivation is goal-directed behaviour that forces people to achieve a set goal persistently. The level of motivation of workers, commitment and, accordingly, dissatisfaction with the work in each organization is most often measured by the number of people who left over a certain period. Employees with high job satisfaction are more focused on tasks and activities and are more motivated to stay with the organization. The importance of motivation and job satisfaction in the workplace is evident, as well-motivated and committed workers with high levels of job satisfaction affect both their and organizational performance. Employees with high levels of job satisfaction go to work on time and are usually more motivated to put in the extra effort. On the other hand, employees with low levels of job satisfaction are the least motivated and have more excuses, such as illness or transportation issues etc., compared to satisfied workers.

Job satisfaction is the general attitude and motivation of the worker to perform the assigned tasks, which can be influenced by factors such as working conditions, pay and benefits, the attitude of employees to the organization, exercised control and leadership style of managers,

autonomy, recognition, communication, working conditions, the importance of work, colleagues, professionalism, organizational climate, interpersonal relations, working in a cohesive team, etc. This perception and, accordingly, motivation can be negative or positive depending on the employees' job satisfaction. Low job satisfaction is often associated with labour-intensive tasks such as processing much documentation, the monotony of activities, the tension of expectations of constant shifts in the hierarchy, frequent conflicts with colleagues, feeling overwhelmed, overtime, etc. (Wahyuni et al., 2016, p. 91). Motivation varies depending on individual worker behaviour and organizational behaviour. It is essential to mention that all people have different motivations when doing work and different perceptions of the effectiveness of interpersonal communication.

Modern models and approaches to increase motivation include, in addition to using salary as a motivating factor and removing stereotypes and subjectivism in human resource planning, providing more and more authority, providing positive role models and the opportunity to provide effective feedback connection.

3. DESCRIPTION OF THE STUDY

The purpose of the research is to examine the motivation of employees in the municipality of Plovdiv, as well as to indicate the problems and opportunities for its improvement. The limitations that accompany the research are mainly related to the confidentiality of the information of the researched organization. The study's relevance is determined by the difficulty in attracting and retaining employees in municipal administrations, observed in recent years in Bulgaria.

Research thesis: Employees in the municipality of Plovdiv are not motivated to perform their duties effectively, and improving interpersonal communication is a prerequisite for increasing job satisfaction.

The research questions are:

- What is the level of employee motivation in the organization under study?
- What are the main factors influencing the employees in the municipality of Plovdiv?
- Are there opportunities to improve the motivation of employees in the municipality of Plovdiv?

A survey is used to study employees' motivation in the municipality of Plovdiv. The developed questionnaire consists of 15 closed-ended questions aimed at measuring the motivation of employees from all hierarchical levels in the organization.

4. BRIEF DESCRIPTION OF THE MUNICIPALITY OF PLOVDIV

The municipality of Plovdiv is in southern Bulgaria, and the mayor is the employer of the employees. The structure of employees in the municipality includes the mayor and deputy mayors, secretary, chief architect, general and specialized administration. The individual positions are divided into directorates and departments, with the "Human Resources Management" department having the main functions of developing and updating the staff list of positions, developing salary rules, planning, and organizing employee training, creating documents for concluding and terminating employment relationships, keeping, and storing personal files, etc.

5. RESEARCH RESULTS

Forty-seven employees from the municipality of Plovdiv participated in the research. The largest percentage of respondents are between 40 and 49 age (27%). The most significant percentage of work experience in the municipality of Plovdiv of the surveyed employees is between 5 and 10 years - 38%. 74% of the respondents indicated they were satisfied with their working position. The rest are of the opposite opinion. The employees of the Plovdiv municipality need to be more satisfied with how the work is organized. 64% of employees define it as insufficiently effective, and only 29% as satisfactory. Only 4% of the surveyed employees give an excellent rating. The surveyed employees believe that the higher basic remuneration strongly influences their motivation (the statement is valid for 44% of the surveyed employees). Good working conditions are essential for 26%, and opportunities to receive bonuses for achieving results for 19%. Important factors are also the excellent attitude of the employer and the opportunity for professional development.

The surveyed employees do not change their jobs often, 60% have not changed their jobs in the last five years, and 34% have changed their jobs once. Employees in the Plovdiv municipality are not satisfied with the remuneration they receive. Almost all surveyed employees are unanimous that receiving bonuses motivates them to perform their work duties better, with only 16% having the opposite opinion. It can be assumed that insufficient satisfaction with the salary received and insufficiently effective organization of work in the municipality of Plovdiv are the reasons why 69% of the surveyed workers indicate that they do not accept the goals of the municipality as their own. For 74% of the surveyed employees, the provision of an opportunity by the municipality to improve their qualifications is an important motivational factor for work. Only 41% of the surveyed employees' daily responsibilities in the Plovdiv municipality correspond to their expectations. Employees categorically do not express their opinion at their workplace. Regarding the degree of control over daily decisions related to work duties, the respondents indicate that they mainly have no control (48%) or the control exercised is over a small part of the decisions (44%). 68% of the respondents think they do not have any influence to make the municipality of Plovdiv a better place to work.

6. POSSIBILITIES FOR IMPROVING THE MOTIVATION OF EMPLOYEES IN THE MUNICIPALITY OF PLOVDIV

The survey of employees in the municipality of Plovdiv shows low motivation and satisfaction of workers. Due to the lack of financial resources to increase the salary, the municipality must improve its organizational culture to motivate employees. Organizational culture is a system of values and beliefs adopted by management and all workers, expressed in norms, rules, and standards that are accepted and maintained in interpersonal relationships and communication. The culture of any organization is based on rules and norms that are perceived as key to any activity carried out, being a factor that unites the self-determination of the group of people in the organization through accepted values, contributing to the experience and feeling of belonging and satisfaction of the achievement of the organization's general goals.

Possibilities for improving the motivation of employees in the municipality of Plovdiv:

- Positive climate in communication;
- Overcoming the barriers that prevent effective interpersonal communication;
- Adopting a management style allows organizational culture to be introduced and employee objections to be overcome;

- Building a system of stimulation regarding the perception of the presented values and norms of behaviour;
- Innovative personnel selection process;
- Socialization of employees.

The effective management of cultural diversity in the organization provides an opportunity to improve individual and group indicators to increase interpersonal communication and labour productivity. The set of cultural specifics of any organization forms its cultural appearance. The awareness and compliance with the existing differences are related to the need for increased awareness on the part of managers, who, based on this information, can direct it to the achievement of company goals through the development of personal potential and uniting workers on a moral-value basis. On the other hand, the change in the management style to build an organizational culture requires building values and activities based on a new approach to implementing communication and building relationships and managing employees, through which to achieve an increase in their motivation.

7. CONCLUSION

Strong motivation provides the employer with:
- New ideas for changing the activities performed,
- Getting feedback,
- Ability to increase labour productivity and efficiency.

The benefits of motivation for the individual worker are related to:
- Opportunity for career development,
- Opportunity to perform,
- Receiving additional tangible and intangible benefits.

The key is the role of the organisation's management staff to increase the workers' motivation by determining the built sense of empathy and defining the roles and the desired goals. Leadership is effective when it helps workers to develop and stimulates them to learn new things. Managers need to involve workers in making various decisions related to their activities, ensuring that a sense that managers are fair is maintained. The sense of justice helps to increase satisfaction and empathy with the enterprise and the desire to achieve its goals through the more effective performance of the activities.

8. FUTURE RESEARCH DIRECTIONS

Future research directions are based on the possibilities of using innovative methods to motivate modern personnel accustomed to using technology, receiving, and exchanging information quickly and communicating in a digital environment.

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University-Industry Cooperation, from the Viewpoint of Top-Level Management in Albanian Companies

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Motivational factors;
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Abstract: *Economic development is conditioned upon many actors, where the cooperation of higher education institutions with industry and business plays an important role. Companies are highly interested in the "primary product" of higher education, in the sense of knowledge that benefits students, the absorption of talents, but also in the product of scientific research, patents, start-ups, etc.*

This paper aims to measure the perception of the top-level managers in Albanian companies regarding the challenges and barriers that appear in university-industry cooperation. Through a qualitative analysis, based on the questionnaire of the KALCEA[3] project (Erasmus + CBHE) in a sample of 27 large and medium-sized companies, an attempt has been made to investigate the main factors that increase this cooperation as well as the factors that hinder it. An important role is also paid to the identification of factors that motivate companies and the challenges they will have to face. The findings of the paper are of interest to the industry, universities and politicians and focus mainly on the mentality and culture of cooperation.

1. INTRODUCTION

Higher Education in Albania has for several years undergone a series of reforms in the ongoing efforts to implement the Bologna System and align with the European system of higher education.

Genuine scientific research and applied research are challenges that, in addition to the quality of education and scientific research funds, require a cultural approach and mentality within universities that ask for change and, like any change, encounter resistance and require a strategic approach.

Ad hoc experiences and models exist, but they must be implemented and contextualized with persistence and creativity, to obtain a product that has value and contributes to the national economy. The most recent Albanian law on higher education gives more autonomy to Departments and this can be a good start to facilitate academic entrepreneurship with a connection to the industry (https://arsimi.gov.al/wp-content/uploads/2018/07/AKTET_NENLIGJORE.pdf).

Historical evidence around the world shows that collaborations between universities and industry have given life to many successful discoveries over the years, and there are excellent examples of fruitful collaboration between universities, industry partners and startups (Gann et al., 2018).

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To the question "Why do people value the cooperation between universities and industry?", world-renowned researchers have given the following five reasons (Elsevier, 2021):

- Better potential for impact on society;
- Better outcomes and student opportunities;
- Increase in funding;
- Potential for economic development;
- Use of government programs for financing.

OECD countries have implemented a set of financial, "soft" and regulatory instruments to support the transfer of knowledge from university to industry. The financial instruments include grants for innovation and R&D, tax incentives with a focus on collaboration, and grants for doctoral and postdoctoral students. Regulatory instruments include the regime of intellectual rights (IP), regulations required by student spin-offs, sabbatical periods and mobility schemes for staff; soft instruments include the readiness to build network events (OECD, 2019).

This paper aims to analyze how Albanian companies perceive university-industry collaboration and explore the factors that influence it.

The objectives of this study are:

- to observe the current state of cooperation between companies and universities;
- to observe the purpose of the cooperation of companies with the university;
- to observe the influencing factors, barriers, challenges and results of this cooperation;
- to observe the factors that motivate companies to cooperate with universities.

The research question addressed in this paper is: *What is the approach of Albanian companies toward cooperation with universities and research centers?*

The methodology used is qualitative, based on the questionnaire conducted in WP1 of the Erasmus + CBHE KALCEA project. The questionnaire was answered by 27 top-level managers of large and medium-sized Albanian companies, who were selected from a database of the authors of the paper based on the approach these companies have in cooperation with the academy.

The results of this research can be the basis for research in larger samples, grouped according to the sectors of the economy and where the academic product and the opportunities for impact are more inherent. It remains an important factor, the mentality and culture to build bridges of cooperation and to believe in partnership, private and government funds in support of research at universities.

2. LITERATURE REVIEW

The role of the university has changed over time, university-industry collaboration is not a new phenomenon, but it became more visible around the 1970s, and since that moment it has been accepted by governments and policymakers (Vedovello, 1998). Knowledge is a requirement for economic development, universities are deemed as important centers for learning and innovation for industries in advanced economies. Universities are also competing towards meeting the demand for basic knowledge and skilled human resources (Hall & Rosenberg, 2010). The universities in developing economies are expected to meet the local demand for knowledge-based economies which would bring about socio-economic development.

There are the accepted models of university-industry collaboration: Linear model, Mode 2 framework and Triple Helix framework (Nkrumah, 2015).

Linear model - argues that universities play a major role in economic growth and for that reason, government funding of basic research should be increased (Fagerberg et al., 2005).

Mode 2 framework - argues that the University-Industry interactions should be complemented by interactions with other institutions. It seeks to champion the interconnectedness of a network of several actors in the national innovation system (Fagerberg et al., 2005).

Triple helix model - each actor of the system has to play a specific role while working in close synergy with others: universities produce new knowledge and technologies that can have an industrial application; government acts as a public entrepreneur in addition to its traditional regulatory role in setting the rules of the game; venture capital and large companies act as engines of innovative systems, bringing capital, managerial skills, and a network of relationships that foster the development of innovative businesses (Ankrah & Al-Tabbaa, 2016).

3. RESEARCH METHODOLOGY

The authors of this paper, within the project Erasmus + KALCEA, have conducted a complete study on university-business cooperation, seen from the perspective of both parties. This paper presents part of the study carried out on businesses in Albania, which aimed to analyze how Albanian companies perceive their cooperation with universities and to explore the factors that positively affect it and those that hinder it. With this goal in mind, the authors have decided to observe as objectives:

- The current state of cooperation between companies and universities;
- The purpose of cooperation between companies and the university;
- Influencing factors, barriers, challenges and the results of this cooperation;
- Factors that motivate companies to cooperate with universities.

The research question in this paper is: What is the approach of Albanian companies toward cooperation with universities and research centers?

The methodology of the paper is qualitative; the questionnaires distributed to more than 30 businesses were used as a research instrument, in line with WP1 of the KALCEA project. The questionnaire is composed of 20 closed questions with multiple choices.

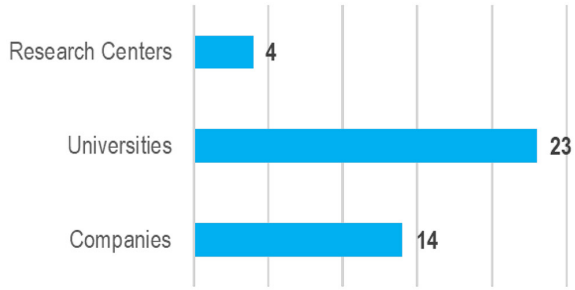
The questionnaire was answered by 27 managers of large and medium-sized Albanian companies, who were selected from a database of the authors of the paper based on the approach the former have in cooperation with the academy. As a limitation of the work, one can see the limited number of responses from business top-level managers, despite the large and mid-scale companies that have answered. It should be clarified that the authors have tried to measure the perception of the top-level managers of important companies in the country; 63% of the companies in the sample are large and mainly they have a rather serious approach to cooperation with universities.

It should be taken into consideration that 98,3% of Albanian businesses are SMEs, 1,7% are large enterprises (with over 50 employees), 86,6% of enterprises are service producers and their

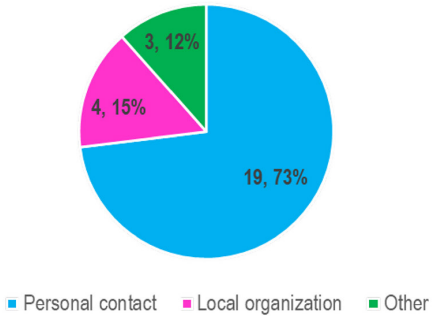
interaction with universities is mainly only for the employment of students (INSTAT, 2021). The sample of businesses consists of 93% private companies; 7 companies have over 500 employees; 4 companies have 200-500 employees; 6 companies have 50-200 employees and 10 companies have less than 50 employees. The respondents are company top-level managers, 44% of them have over 15 years in company management, while 81% of them have over 15 years in management positions.

4. FINDINGS

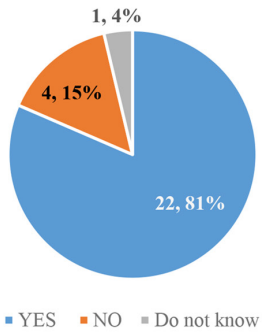
Business top-level managers have answered a series of questions, divided into categories within the same topic. To the question of who the initiator for university-industry cooperation among universities, companies and research centers should be, 85% of them perceive the university and about 50% of them perceive the companies (Figure 1.a).



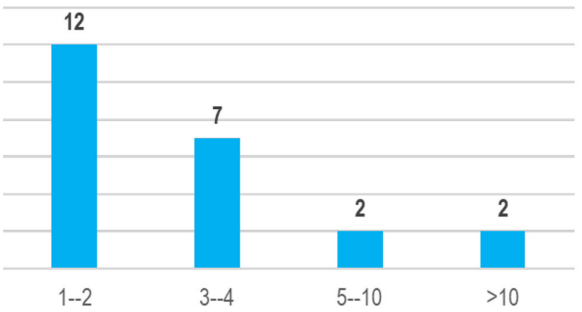
a) Initiator of cooperation



b) Mechanisms for promoting cooperation with universities



c) Cooperation of the company with universities



d) The number of universities that companies cooperate with

Figure 1. University-Industry cooperation
Source: Own research

Regarding cooperation mechanisms, the most useful is that of personal contacts, 81% of managers admit that currently their companies have cooperation with universities (Figure 1.c), 44% of them cooperate with 1-2 universities and 26% cooperate with 3-4 universities (Figure 1.d).

Regarding the purpose of cooperation with universities referring to 4 indicators: Education, Research Work, Monetization and Shared Interest, the results are presented in Figure 2. The perception of university-industry cooperation in *education* has priority internships and the employment of students, then open lectures at the university. Cooperation seems limited in relation to the design of curricula. As far as scientific leadership in the master's and the doctoral cycle is concerned, there is currently an obstacle in the Law of Higher Education, a formal barrier that can be overcome if there is a will to cooperate in concrete and incentive projects.

Regarding *shared interests*, it appears that for companies it is a priority the use of common assets and then participate in each other's boards, and the third choice remains the use of grants and scholarships. Regarding the *research work*, the first choice is cooperation in the research work. Regarding *monetization* as the first choice is seen – the application of the results of the research work.

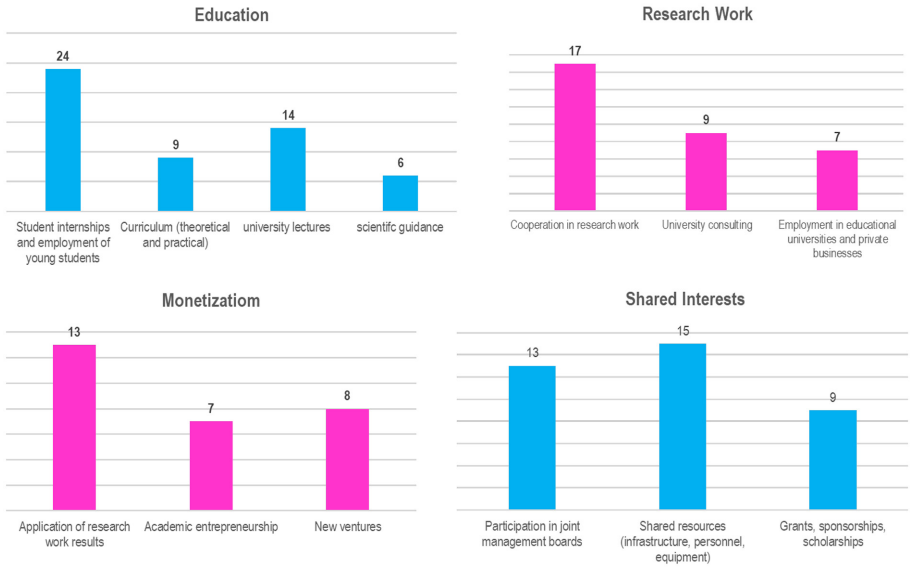


Figure 2. The purpose of cooperation with universities

Source: Own research

When company managers were asked about the results of cooperation with universities currently or in the last three years, the answers obtained are presented in figure 3.

Figure 3. The results of cooperation with the university in the last 3 years

Source: Own research

As can be seen from Figure 3, the most important result of university-industry cooperation seems to be the employment of students, then the creation of new connections between University and Industry and the third choice are suggestions from universities and businesses for problems to be addressed. The current model of cooperation looks far from the triple helix model.

Company top-level managers were asked to identify the 5 factors that mostly influence the growth of cooperation with universities. The distribution of responses is shown in Figure 4.

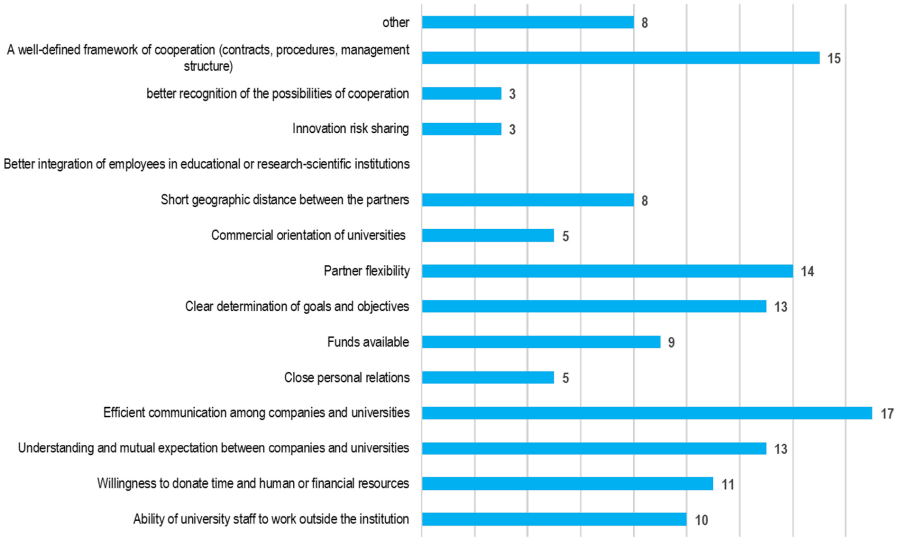


Figure 4. Factors that have the greatest influence on the increase of cooperation with universities

Source: Own research

From figure 4 we can see that the 5 most important factors that influence university-industry cooperation are: *Efficient communication among companies and universities; A well-defined framework of cooperation (contracts, procedures, management structure); Partner flexibility; Clear determination of goals and objectives / Understanding and mutual expectations between companies and universities; Willingness to donate time and human and financial resources.*

Next, company top-level managers were asked about the top 5 barriers that limit business collaboration with universities. The distribution of the responses is presented in figure 5.

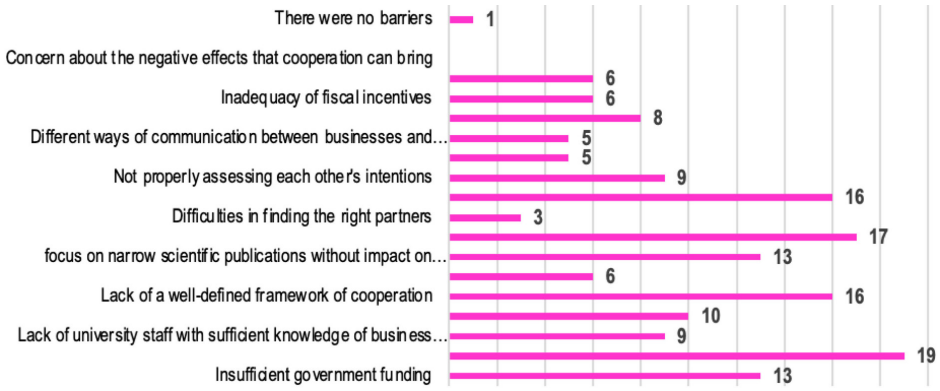


Figure 5. The main barriers that limit the cooperation of businesses with universities

Source: Own research

As one can see in figure 5, the 5 main barriers that limit the cooperation of businesses with universities are perceived: Insufficient private funds; Ignorance of the opportunities that come from cooperation; Lack of common vision/ Lack of a good cooperation scheme- defined; Insufficient government funds; Failure to properly evaluate each other's goals/ lack of recognition by university staff of the real needs of business and its development inside and outside the country.

Industry collaboration with universities certainly has its challenges, thus company top-level managers were asked about these challenges (figure 6).

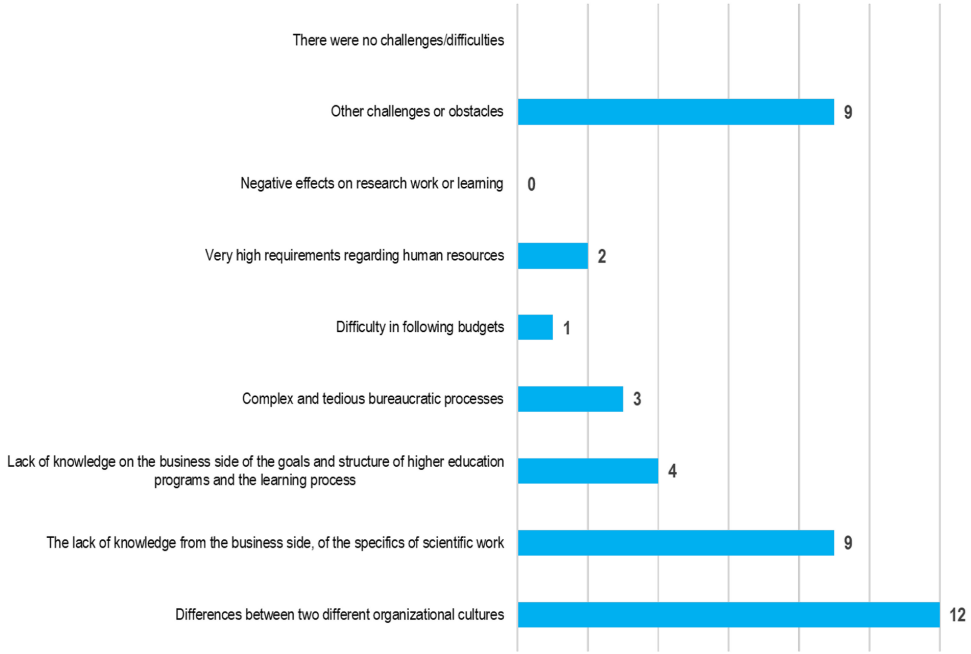


Figure 6. Challenges during cooperation with universities

Source: Own research

The challenges that are perceived as most important to be faced by businesses are: differences between two organizational cultures; Lack of knowledge on the business side of the specifics of research work; and other challenges or obstacles.

The last question is about the factors that can motivate companies to cooperate with universities as shown in figure 7.

Figure 7. Factors that motivate companies to cooperate with universities

Source: Own research

Factors perceived to motivate companies to cooperate with universities and research centers are: *Improving business reputation; Positive impact on society; Improving the professional skills of employees through training; Improving innovative capacities; Benefiting from access to new technologies and knowledge.*

5. CONCLUSION

Since 2004, with the signing of the Bologna Agreement, Albanian universities have been involved in an important process of change and transformation, which, on the one hand, needed to transform the system in accordance with the Bologna process, and on the other hand, internationalize and make them competitive within the country, in the region and beyond. The newest law on Higher Education, in addition to increasing university autonomy, also presents a challenge for scientific research and the generation of funds by universities trying to approach to the implementation of the Triple Helix model in cooperation with the government and industry.

The study carried out through a methodology based on the Erasmus + CBHE KALCEA project, focused on the data collected through a questionnaire with the leaders/managers of 27 important companies in Albania, led to the following conclusions:

The model of cooperation between universities and industry seems to be close to the Mode 2 framework: cooperation exists, but it is mainly focused on the interest of companies for internships and the employment of students (of course also finding talents).

Business representatives perceive that universities should be the primary initiators of cooperation between parties (85%) and only 50% of them see the industry as the initiator of this cooperation. Regarding shared interests, it seems that the priority remains the use of common assets, the last choice remains that of supporting students and staff with grants and scholarships. The results of this research can be the basis for research in larger samples, grouped according to the sectors of the economy and where the academic product and the opportunities for impact are more inherent.

Based on the factors that the industry perceives as more important in cooperation with universities, is suggested that universities should find the right communication channels and build efficient cooperation schemes. It should also be considered that from a strategic point of view, in the lecturer's employment contract or in the performance evaluation schemes, weight should be given to contract jobs with industry and sabbaticals in industry.

The cultural difference between universities and industry is considered a challenge that must be taken into consideration by universities to establish sustainable cooperation. The research work that takes place at the university should be aimed at having as much application as possible in the industry because that is the only way to increase the interest of the industry. The motivation of the industry to work with universities can be inspired through common projects that create an image and social impact first, then through the training of the industry's staff and the creation of spaces for innovation and further access to knowledge and new technologies.

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EFQM Maturity Assessment

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Quality Management (QM);
EFQM;
Critical Success Factors (CSFs)

Abstract: *The paper identifies the approaches of Quality Management Maturity Assessments and proposes the novel Quality Maturity Assessment framework called Glykas Quality Compass (GQC) that evaluates implementation initiatives holistically and comprehensively through a matrix of Critical Success Factors (CSFs) and Enablers. The authors apply the proposed framework in the newly published EFQM Model in order to verify the framework's ease of use and concept validity. The EFQM model criteria were analyzed based on the CSFs and enablers presented in the GQC maturity framework. Based on the results of the analysis, the GQC - EFQM Model correlation table is presented. The results emphasize the importance of the contribution of excellence in improving the quality and performance of organizations that desire long-term results and sustainable value. GQC provides and integrates the CSFs with management principles and organizational resources with business objectives and leads to an integrated framework of quality management and corporate sustainability.*

1. INTRODUCTION

Models of excellence, according to the bibliography, provide a proper framework of reference about the way how one can implement TQM in an organization, as they ensure that the principles and key factors, underlying this philosophy, are fully applied, transferred to the daily activity of the companies as a coherent set and are systematically developed according to schedule. The fundamental concepts (leadership, strategy, people, alliances, resources and processes), which are presented in the models of excellence, bear a strong relationship with TQM factors, representing a valuable guide for organizations that aim to introduce and manage improvement activities following TQM philosophy.

According to Hsu et al. (2021), in actual practice, the principles and theories of TQM are not static but are constantly evolving. The outcome of TQM is organizational commitment and the collaborative effort to achieve business excellence (BE). In the research of Periañez-Cristobal et al. (2021), it is stated that the achievement of the outcomes is dependent on the application of TQM principles and practices. This research refers to the principles, which are based on experts or quality management gurus (Deming, Juran, Crosby), to the models of excellence and, finally, to theoretical or empirical research deductions.

The pursuit of excellence was mainly referred to, until the previous edition (2012), by the European Foundation for Quality Management (EFQM Excellence Award) model. Evans (2008) stated that performance excellence requires a total effort involving a total change in thinking

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rather than a new collection of tools. In 2021, the revised EFQM 2020 model was published, in which the term "excellence" was replaced by the term "outstanding" referring to the organization achieving outstanding results (Nenadál, 2020).

As defined in the EFQM itself: "Outstanding organizations achieve and maintain excellent levels of performance that meet or exceed the expectations of all their stakeholders." Thus, excellence is a way of managing and understanding the organization, which seeks to achieve excellent results not only financially, but also in relation to its customers, employees and society as a whole. An organization is considered as really excellent when, except achieving results in terms of its competitiveness in the market, it has also influenced its groups of interest in a positive and lasting way (Calvo-Mora et al., 2014; Para-González et al., 2022).

In section 2 the paper presents a review of the research on the revised model EFQM 2020. Periañez-Cristobal et al. (2021), argue that the EFQM model of excellence supports organizations to achieve sustainable development through continuous improvement, learning, innovation and process development. It also allows for the prosecution of thorough management review, for the reception of comparison with other organizations, for the availability of a guide to determine and develop strategy, and for the identification of competencies and key resources. It is a self-assessment model in which criteria are defined based on the organization's activities and processes and are evaluated according to its operation and performance (Fonseca, 2022).

Dahlgaard-Park et al. (2018) have conducted a study to compare the historical development of TQM with eight, known management theories. Applying the core values and elements of the EFQM Model of Excellence as a framework for their analysis, they concluded that TQM should be regarded as an evolving theory that adopts and is adaptable to an ever-changing environment. The same researchers, in 2019, studied a four-decade literature and concluded that success in TQM implementation is related to the maximum participation of employees in all the functions of the organization according to proper training, coaching and motivation. There has been highlighted the necessity for an everlasting adaptation concerning the Quality Management frameworks in a holistic way; this necessity was emphasized, based on better tools and techniques that meet the needs of the new services in any organization.

Due to globalization, dissemination and widespread implementation of Quality Management Systems, numerous governments around the world have attempted to establish or have already established National Quality Awards. Their purpose is to support, recognize and promote the efforts of their organizations to implement TQM systems. The National Quality Awards are the highest recognition for those companies that achieve excellent performance and a top-quality degree.

A National Quality Award is legislated to meet the following objectives: to promote knowledge of TQM as an essential element to improve quality and productivity, to provide guidance for the implementation of evaluation and continuous improvement and to be the starting point of a national attempt to increase competitiveness and long-term, financial development of each country.

In section 3 the paper presents a maturity framework that was developed for and is being used in QM implementation assessment called the Glykas Quality Compass (GQC). The model is composed of a ten by ten matrix containing the ten most prominent critical-success factors, which are identified in our literature survey of QM maturity-assessment frameworks and the ten most prominent enablers also identified in the same survey.

To evaluate the validity of the proposed maturity assessment framework and investigate how a maturity assessment matrix can be created especially for EFMQ 2020, in section 4 we present our research efforts on the application o EFMQ 2020 in GQC. The result is the advanced "GQC-EFMQ 2020" matrix. The matrix depicts the relationships of EFMQ 2020 criterions with the critical success factors and the enablers of GQC.

2. EFQM MODEL CRITERIA ANALYSIS

The design of the revised EFQM Model (2020) is based on years of experience in unsteady markets that drive transformation by leveraging the benefits of organizational analysis and future forecasting (Nenadál, 2020). It is based on the connection between the purpose and strategy of an organization, i.e. the cause with the results it achieves (Murthy et al. 2021; Nenadál, 2020; Fonseca, 2022). It is aligned with the United Nations Sustainable Development Goals, to simultaneously deliver performance and ensure transformation, creating lasting value for key stakeholders and achieving remarkable and lasting results (Fonseca, 2022). The EFQM 2020 model represents a significant evolution of the EFQM 2012 model. It emphasizes the necessity of transforming organizations for the future and comprehensive feedback from key stakeholders (Nenadál, 2020). The main difference is the change in the outline of the model and the activation and outcome criteria. The new structure of the model includes five criteria/enablers (leadership, policies, processes, resources and people) and two categories (out of 4) of results (EFQM Model Revised 2nd Edition). The criteria have been renamed and reduced from 9 to 7 while the sub-criteria from 32 to 25 (Murthy et al. 2021).

The criteria, according to the 2nd revised edition, are grouped into 3 dimensions/modules, which are easy to understand by those involved in the practical development of management systems (Nenadál, 2020). They are based on the simple but powerful logic of asking three questions:

1. **Direction:** Two criteria that answer the question "Why" the particular organization exists. What is its purpose and why does it have that particular strategy/direction? Moreover, the question "Why" are we implementing certain policies and practices ensures that only actions that add more value to the organization are taken. The criteria are related to Purpose, Vision and Strategy, Organization and Leadership.
2. **Execution:** Three criteria that answer the question of "How" it intends to respond to execute its purpose and strategy. It is about process design, stakeholder engagement, sustainable value creation, performance and transformation.
3. **Results:** Two criteria that answer the question "What" has the organization actually achieved to date and "What" results it intends to achieve in the future. The outcome criteria are directly related to Stakeholder Perceptions, Strategy and Operational Performance as attributes that drive the organization to success.

When grading the above criteria, Direction and Execution represent 60% of the score while Results from 40% as they are important but represent what has already happened. The greater emphasis on the criteria of the first two dimensions is due to the special importance given to the questions: why an organization exists, if it has the necessary culture to succeed, whom it serves to and how it creates and distributes lasting and sustainable value to its stakeholder groups (Fonseca, 2022).

In its latest edition, the official title of the model has changed from "The EFQM Excellence Model" which was in 2012 to "EFQM Model". The term "excellence" was removed by the

committee and replaced by the term "outstanding" which characterizes an organization that wishes to achieve its best (Nenadál, 2020). In the revised model, the term "ecosystem" was adopted as a keyword emphasizing the interaction and interdependence of organizations as part of a wider system (Nenadál, 2020). According to the EFQM Model Revised 2nd Edition (2020), the use of the term "ecosystem" is based on the vision and planning that will lead each organization to achieve exceptional levels of performance, through transformation and organizational governance that will meet or exceed the basic expectations of its stakeholders. The new EFQM 2020 model also emphasizes the term "sustainable value" as a more general term regarding the value that the organization offers to all key stakeholder groups (Nenadál, 2020).

Critical to the model is the connection between an organization's purpose and strategy and how these are implemented to create sustainable value for key stakeholders and achieve outstanding results. An organization is considered to be truly exceptional when, in addition to achieving results related to competitiveness within the market, it has a positive and lasting impact on its stakeholders (Calvo-Mora et al., 2014; Para-González et al., 2022).

3. MATURITY ASSESSMENT FRAMEWORK IN EFQM 2020

3.1. Maturity Assessment Framework

In recent decades, Total Quality Management (TQM) has become an important aspect of the business environment, and the subject of research due to the great impact it has on individual and organizational performance (Ooi et al., 2009). In a series of studies, it has been argued that TQM is a management philosophy that focuses on organizational and human values. For the implementation of TQM these values should be taken into account and developed to create an organizational culture in which the importance of quality improvement will be felt by all stakeholders (Krajcsák, 2019).

In the literature, many research questions have emerged, during the maturity assessment of Quality Management (QM), regarding the connection of the Critical Success Factors (CSFs) with the Basic Management Principles (Jehangiri, 2017; García-Alcaraz et al. 2019; Asante & Ngulube, 2020). The quality management maturity assessment framework Glykas Quality Compass (GQC), is categorized into four quality management perspectives (philosophies, frameworks, standards and excellence awards) and analyzes the successful implementation of QM through the analysis of ten key quality concepts (Table 1), providing a clear distinction between the use of QM concepts.

The ten concepts follow the Deming cycle or PDCA (Plan, Do, Check, Act), a well-known methodology for continuous improvement that consists of four phases, each of which requires, in a different way, the existence of management principles and organizational resources to implement quality management.

In GQC management principles are considered as necessary conditions or factors to achieve the ten quality concepts which are further subdivided into three categories: five core concepts (customer focus, human resource management, leadership, process, strategy), three intra-core concepts (performance measurement, change measurement, continuous improvement) and two auxiliary concepts (collaborations and corporate social responsibility and information/knowledge management) (Glykas, 2019).

Table 1. The Glykas Quality Compass Table

	Quality Categories																															
	TQM										Frameworks and Methodologies										Standards										Excellence Awards									
	OE				OR						OE				OR						OE				OR						OE				OR					
Quality Concepts	OS	Jds	P	MS	L&B	E	HR	C	I	IT	OS	Jds	P	MS	L&B	E	HR	C	I	IT	OS	Jds	P	MS	L&B	E	HR	C	I	IT	OS	Jds	P	MS	L&B	E	HR	C	I	IT
Strategic Focus																																							
Customer Focus																																							
Process Focus																																							
HRM Focus																																							
Leadership																																							
Performance Measures																																							
Change Management																																							
Continuous Improvement																																							
Partnership & Corp. Resp.																																							
Knowledge Management																																							

Source: Glykas, 2019.

1. Five Core Concepts

- **Strategy**: The strategy defines the type and scope of activities in the long term, the quality management system, the objectives and standards that the organization will apply, and ensures optimal decision-making and the achievement of the required levels of quality and performance of the organization. At GQC the strategic focus is on developing business objectives and critical success factors (Glykas, 2019).
- **Customers**: It is the recipient of the final products/services provided by the organizations. Attracting and retaining loyal customers drive organizations to higher levels of performance. It is perhaps the most important stakeholder group for which the organization seeks to create sustainable value. At GQC customer focus is about practices and processes related to meeting customer needs and expectations (Glykas, 2019).
- **Process:** GQC focuses on managing processes as a sequence of activities (Glykas, 2019). Defining processes includes a series of specific actions, methods, rules and steps (Petridou 2011, p.288). Processes use resources, interact with each other add value for internal and external customers (Zalvanos, 2006, p.97) and contribute to efficiency and the effectiveness of organizations.
- **People:** It includes employees at all levels of an organization. It is the responsibility of organizations and human resources managers to establish policies and practices that promote the skills and behaviors of employees that are necessary to achieve strategic goals (Dessler, 2011). The active participation of employees contributes to the acquisition of new knowledge, the understanding of the importance of quality and their commitment to the organization. At GQC the "Human Resource Focus" includes performance appraisal, education and training, rewards and incentives and career development (Glykas, 2019).
- **Leadership:** According to the literature review, it is a common position that leadership is a critical success factor in quality management and the sustainability of organizations. In today's uncertain, complex, unpredictable and highly competitive environment, leaders should be characterized by special management skills. Transformational leadership is perhaps the nature of leadership necessary to enable an organization to respond to the rapidly changing environment, stimulating the interest of people within the organization, encouraging their involvement at every level, investing in empowerment and development, and motivating employees that will lead to engagement and improved performance (Zavlanos, 2006).

2. Three Intra-Core Concepts

- **Performance Measurement:** Performance measurement is one of the key strategic processes that determine the level of implementation of an organization's goals (Zavlanos 2006; Petridou, 2011). It is a goal-oriented process that aims to ensure that an organization has the necessary processes to maximize the productivity of employees, teams and ultimately the organization itself (Mondy & Martocchio, 2019). The indicators and the performance measurement system should be designed and linked to the organization's objectives, strategy and stakeholder demands. Performance measurement should assess the effectiveness of internal processes in conjunction with their impact on key stakeholder groups (Cagnazzo et al., 2010). Analyzing and interpreting data that will lead to corrective actions is considered essential for performance measurement (Zavlanos, 2006).
- **Change Measurement**: It is an organizational process that helps guide the transition from a current state to a specified desired future state that will bring about positive future outcomes. Change management measurements should be done progressively, planned and with the participation of all employees (Zavlanos 2006) in order to help the stakeholders affected by the change to understand and accept it. Additionally, they should be viewed holistically to provide information that will help the organization make informed decisions about how to adjust its tactics and take the necessary corrective actions to achieve goals.
- **Continuous Improvement:** In GQC, continuous improvement is directly related to the PDCA quality cycle (or Deming quality cycle) for continuous improvement. The PDCA cycle is a methodology consisting of four phases: Plan, Do, Check and Act and different techniques (Glykas, 2019). A key element in achieving continuous improvement is the existence of a culture of continuous improvement and an emphasis on feedback (Deming, 1986) which reveals system weaknesses and lays the bases for improving processes and value-added activities.

3. Two Auxiliary Concepts

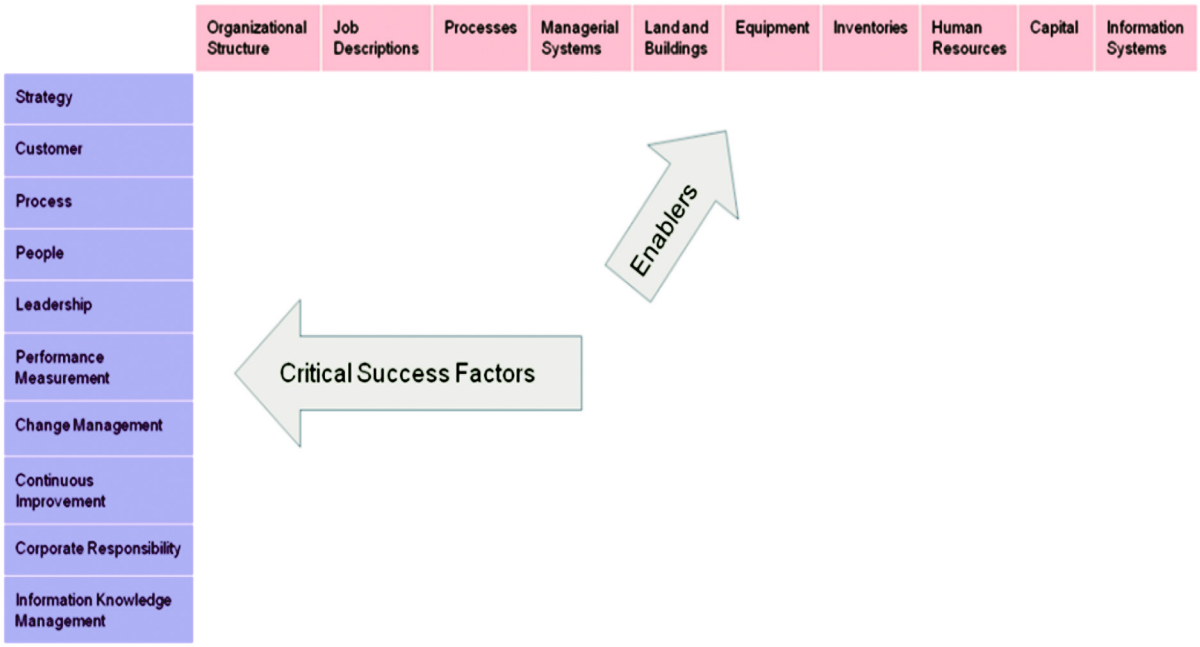
- **Partnership & Corporate Social Responsibility:** Mondy & Martocchio (2019) define Corporate Social Responsibility as "the implicit, imposed or inherent obligation of management to serve or protect the interests of key stakeholder groups outside the organization itself". CSR is reflected in management, the policy and values of an organization (Frolova & Lapina, 2014) and concerns the wider impact of corporate activities on society, environment, economy and all stakeholders. The implementation of CSR activities related to employees, in the long term, can bring about a significant reduction in the costs of the organization, while increasing loyalty and commitment and improving the overall quality of performance (Frolova & Lapina, 2014). The authors in the conclusions of their study noted that the quality management system provides a framework for the implementation of CSR policy, strategy, activities and culture at all levels of management of organizations, creating the basis for sustainable value creation and achieving business excellence. In the GQC maturity framework, partnerships are about an organization's relationships with suppliers and partners, and social responsibility is about the relationship with the wider community (Glykas, 2019).
- **Knowledge Management:** Knowledge management is the process of acquiring, exchanging and exploiting the knowledge and experiences of employees for the benefit of the organization (Iordanoglou, 2008). According to Yusr et al., (2017) study, an organization's ability to acquire and manage knowledge is a critical innovation factor. It helps maximize

collaborative expertise and improve performance by avoiding previous failed approaches and strategies. In GQC knowledge management relates to how knowledge is documented in an organization.

The GQC Maturity Assessment Framework assesses quality management initiatives holistically through a matrix of critical success factors and enablers. The matrix is based on the ten most important critical success factors identified in existing maturity assessment frameworks and the ten best known factors identified in the literature.

Critical factors for achieving the CSFs, according to studies by Shafiqah et al. (2020), Jehangiri (2017), Monge-Mora et al. (2020) is the presence of all the necessary organizational resources. In GQC the six organizational resources identified are: Land and Buildings, Equipment, Human Resources, Inventories, Capital, and Technology and Information Systems (Glykas, 2019). The six organizational resources with the four management principles constitute the ten GQC enablers (Table 2).

Table 2. Framework of Glykas Quality Compass (2019)



Source: Glykas, 2019.

3.2. Application of GQC on EFQM 2020

In order to investigate whether the Glykas Quality Compass (GQC) maturity assessment framework in quality management can be further extended and apply the EFQM model, the EFQM – GQC table (table 4) was created, which provides the relationships of the criteria of the EFQM 2020 model (table 3) and the critical success factors and enablers of the GQC model.

3.2.1. Discusion on GQC – EFQM Table

In the Glykas Quality Compass (GQC), the main management principles (table 2) are considered as necessary conditions or factors to achieve the ten quality concepts in the context of

performance management practices. In the EFQM 2020 organizations use the model to prepare and then undergo external recognition by qualified EFQM assessors who review current activity, identify key strengths and weaknesses and provide relevant insights. The correlation carried out identified significant relationships between the EFQM 2020 model and the GQC, at the level of criteria and critical success factors, which can support and combine organizational excellence with quality in order to improve performance and create sustainable value.

Table 3. Criteria of EFQM 2020

Direction	
Criterion 1	**Purpose, Vision & Strategy**
1.1	Define Purpose & Vision
1.2	Identify & Understand Stakeholders Needs
1.3	Understand the Ecosystem, own Capabilities & Major Challenges
1.4	Develop Strategy
1.5	Design & Implement a Governance & Performance Management System
Criterion 2	**Organizational Culture & Leadership**
2.1	Steer the Organization's Culture & Nurture Values
2.2	Create the Conditions for Realizing Change
2.3	Enable Creativity & Innovation
2.4	Unite Behind & Engage in Purpose, Vision & Strategy
Execution	
Criterion 3	**Engaging Stakeholders**
3.1	Customers: Build Sustainable Relationships
3.2	People: Attract, Engage, Develop & Retain
3.3	Business & Governing Stakeholders – Secure & Sustain Ongoing Support
3.4	Society: Contribute to Development, Well-Being & Prosperity
3.5	Partners & Suppliers: Build Relationships & Ensure Support for Creating Sustainable Value
Criterion 4	**Creating Sustainable Value**
4.1	Design the Value & How it is Created
4.2	Communicate & Sell the Value
4.3	Deliver the Value
4.4	Define & Implement the Overall Experience
Criterion 5	**Driving Performance & Transformation**
5.1	Drive Performance & Manage Risk
5.2	Transform the Organization for the Future
5.3	Drive Innovation & Utilize Technology
5.4	Leverage Data, Information & Knowledge
5.5	Manage Assets & Resources
Results	
Criterion 6	**Stakeholder Perceptions**
Examples	• Customer Perception Results • People Perception Results • Business & Governing • Stakeholders Perception Results • Society Perception Results • Partners & Suppliers Perception Results
Criterion 7	**Strategic & Operational Performance**
Examples	• Achievements in delivering its Purpose and Creating Sustainable Value • Financial Performance • Fulfillment of Key Stakeholders Expectations • Achievement of Strategic Objectives • Achievements in Driving Performance • Achievements in Driving Transformation • Predictive Measures for the Future.

Table 4. Table GQC – EFQM

		Enabler Managerial Principle (EMP)				Enabler Resource (ER)				
		Organizational Structure	Job Description	Processes	Managerial Systems	Land and Buildings	Inventories	Human Resources	Capital	Technology and Information Systems
Critical Success Factors (CSFs)	Strategy	1.1 1.4 1.5 2.1 4.1 5.2		1.1 1.3 3.3 5.1	1.3 7	1.3		1.3 3.2	1.3	1.3 5.2
	Customer	1.2 3.1 4.2		3.1 5.3	7					
	Process	5.1		1.3 5.1 5.3	1.5 5.3			5.3		5.3
	People	1.2 2.1 2.2 2.3 2.4 4.1 4.2 4.3 5.5	3.2	3.2 3.3	7					
	Leadership	1.1 2.1 2.2 2.3 2.4 3.4 4.1 4.2 4.3			2.1			2.3 2.4 4.1 4.2		
	Performance Measurement		1.5	1.5	5.1			1.5		
	Change Measurement	4.2		2.2				4.2		
	Continuous Improvement	1.1 2.2 2.3 3.4 4.2 5.1 5.5		1.1 5.1 5.3	5.1			5.1 5.5	5.5	5.3
	Information Knowledge Management	1.3 4.4 5.3		4.4						5.3 5.4
	Partnership & Corporate Social Responsibility	1.1 1.2 1.5 3.4 4.2 4.3 5.1		1.5 3.3 5.1 7						

From the results of the analysis and correlation of the EFQM 2020 model and the GQC framework presented in the GQC - EFQM 2020 correlation table, it is worth highlighting some inferences.

- **Strategy, Purpose and Vision**, constitute a critical criterion that defines the way to create sustainable value to stakeholders and contribute to improving current and future effectiveness in the EFQM 2020 model, while in GQC it is a critical factor in developing a quality culture and quality management. Though, the design of the **processes** that is the basis in GQC for any development and improvement of the management system is missing from the EFQM 2020 model which does not emphasize the framework of key processes used for the effective implementation of the organization's strategy (Nenadál, 2020). The EFQM 2020 model highlights the role of organizational policies and practices implemented by an organization that have a direct impact, in both models, on the interaction with all key stakeholder groups, on issues related to the organization's financial performance but also on the impact of actions in the environment and society. Organizations that want to achieve outstanding results ensure that strategy and processes are implemented through a set of interdependent and interconnected systems, processes and data that add value to

stakeholders. These are processes that are evaluated on a regular basis and adapted to new data each time, allowing realistic decision-making and ensuring the effective management of potential risk and the trust of stakeholders.

- **Leadership** at all levels is a common important factor for success and improving the performance and quality of an organization. In the EFQM model, leadership has a significant and direct influence on the configuration of strategy and culture, the implementation of processes, the management of resources and key stakeholder groups. Leadership is responsible for developing and communicating a culture of transformation that will create the bases for an agile and adaptive environment focused on success, utilization of the results to date, driving change and creating sustainable value aligned with the purposes and values of the organizations and will be based on the co-creation with the organizations of the ecosystem to which the organization belongs. Establishing and maintaining a sustainable relationship with customers, as a key stakeholder group, is a vital factor that directly affects the achievement of outstanding results. On the same basis in the GQC maturity framework, leadership is a critical success factor and a key quality management principle.
- **Employee** involvement in quality management is vital as human resource management practices encourage value alignment and participation that support sustainability efforts (de Meneze et al., 2022). Investing in employee development and engagement maximize their participation and contribution to the achievement of organizational goals. An organization's employees, the knowledge and skills they possess are an inimitable resource and a competitive advantage for the organization. Organizations that invest in employees provide support, rewards, and side with their personal development by maximizing their potential, encouraging active participation, and ensuring their commitment. Employee involvement in the EFQM 2020 model and GQC appears to be a key factor affecting all key quality management practices and creating a sustainable future. However, the EFQM 2020 model does not present a comprehensive approach to human resource management since it does not provide recommendations on defining skills, competencies and the level of performance of employees (Nenadál, 2020).
  Furthermore, the EFQM (2020) model does not refer to the job description. To recruit, develop and retain human resources, the job description investigates whether the holder of the position get above the duties required by the position and through performance measurement is informed and encouraged to reach the best possible level of performance. In the GQC maturity framework, the job description is a key management principle that provides information about the position but also about the organization itself and its intention to implement quality management systems (Ahmed et al., 2022).
- Learning as part of **knowledge management** is considered a key strategic activity for the growth and sustainability of organizations. The management of existing knowledge and experience can contribute to the creation of new knowledge and consequently to new strategies for the improvement of an organization (Para-González et al. 2022). In the GQC maturity framework knowledge management is a critical success factor in quality management and achieving optimal results. In the EFQM model (2020) the management and exchange of knowledge within the ecosystem leads to the creation of radical innovations through a culture of continuous learning and development. The positive correlation of knowledge management in the two models proves that organizations that leverage prior knowledge and apply continuous learning processes create sustainable value and a strong competitive advantage.
- In the EFQM model, an organization's **corporate social responsibility** is expressed through its values and ethical approach. CSR encourages transparency and stakeholder participation and promotes social responsibility and environmental sustainability without

providing recommendations for measuring and optimizing the impact of an organization's operations, product life cycle and services on public health, safety and the environment (Nenadál, 2020). Corporate social responsibility in the GQC is presented as a critical success factor for quality management and the adoption of corporate social responsibility initiatives is a useful tool for improving corporate performance and the sustainability of an organization. Organizations that demonstrate corporate social responsibility in practice enhance the organization's public image and gain the trust of stakeholders.

- **Change management** has a significant impact on the performance of an organization seeking to achieve excellent results and a long-term sustainable future. The EFQM 2020 model is characterized as a transformational model that promotes change, improvement and long-term sustainability starting with the vision and strategy that each organization will implement and then with management systems and practices. Through evaluation criteria and metrics, it encourages organizations to understand where they are, manage change and improve performance. However, a study by Nenadál (2020) highlights the absence of indicators related to getting results in terms of stakeholder perceptions and strategic and operational performance of criteria 6 and 7. Accordingly, in the GQC, change management metrics are considered holistically and provide information that helps the organization make well-documented decisions about how to adjust its tactics and take the necessary corrective actions to achieve its goals.
- For GQC, the **management of resources and assets** are activators that support the organization's strategy and efficient operation (Zavlanos 2006) while at the same time contributing to the achievement of the desired results. However, the revised EFQM model does not directly refer to land and buildings and inventories. Capital can be considered to be mean to acquire the assets and resources that are considered necessary to achieve optimal performance, achievement of objectives and competitive advantage but are not directly mentioned as criteria that contribute to the improvement of performance, sustainability and achieving exceptional results.
- Regarding **results orientation**, in the revised model there is a clear relevancy between cause and effect (Murthy et al. 2021, Nenadál 2020, Fonseca 2022) to improve performance and create sustainable value. In the GQC framework **performance measurement** results are considered as critical success factors. But this is not the case for the **perceptions of key stakeholder groups**. A study by de Meneze et al. (2022) challenges the perception that financial expectations can be met through a quality management system as they contradict perceptions based on high involvement management and mutual profit perspectives. In addition, a study by Nenadál (2020) highlights the absence of indicators related to obtaining results of criteria 6 and 7 of the EFQM 2020 model. In GQC stakeholders (people) at every level of an organization must participate and contribute to the achievement of its goals organization, without clear reference to their perceptions. Therefore, the results associated with these two factors and the organization's ability to implement its strategy, fulfill its purpose and create sustainable value that can be correlated with the existence of appropriate management systems and predictive models that will provide a clear picture of the current and future state of the organization, as a consequence of the effects of management decisions so far. According to the third stage of control of the Deming quality cycle (PDCA: Planning, Execution, Control, Action), the results obtained from the last two criteria will give the organization the necessary information for further action (stage 4: Action) and the future appropriateness of the organization. In conclusion, in order for an organization to create sustainable value it has to achieve outstanding results that satisfy all key stakeholder groups. Results orientation contributes to understanding current

and future requirements for high performance, setting realistic goals and in turn adds value and sustainability at every level.

- Organizations that wish to **transform** and improve can take advantage of the EFQM 2020 and change the current situation to the desired one by shaping the strategy, implementing processes and managing the results of the model. In the GQC framework, **performance measurement** includes evaluating processes, measuring and determining the performance of the processes implemented by the organization and includes, among other procedures, the evaluation of employee performance in the context of feedback and motivation to improve performance. In the EFQM 2020 model benchmarking focused on performance indicators and while is still listed as a pillar of RADAR methodology logic, it is visibly suppressed in the guidance points (Nenadál, 2020).
- **Technology** and **information systems** are key elements in both models to enable performance in EFQM 2020 and successfully implement quality management in GQC.

In the Glykas Quality Compass (GQC), the main management principles (table 2) are considered as necessary conditions or factors to achieve the ten quality concepts in the context of performance management practices. In the EFQM 2020 organizations use the model to prepare and then undergo external recognition by qualified EFQM assessors who review current activity, identify key strengths and weaknesses and provide relevant insights. The correlation carried out identified significant relationships between the EFQM 2020 model and the GQC, at the level of criteria and critical success factors, which can support and combine organizational excellence with quality in order to improve performance and create sustainable value.

4. CONCLUSION

Organizations use maturity models to evaluate how they work and compare it to best practices. Through comparison, they should be able to create their own roadmap to improve and determine the future desired level of maturity (Glykas, 2019). The holistic approach of the GQC maturity model, which combines CSFs with quality management principles and the use of organizational resources, can be applied to assess the maturity of EFQM 2021 implementation.

The results of the association of GQC with EFQM 2020 emphasize the importance of the contribution of excellence in improving the quality and performance of organizations that desire long-term results and sustainable value. GQC provides and integrates the critical success factors with management principles and organizational resources with business objectives and leads to an integrated framework of quality management and corporate sustainability. Accordingly, the EFQM 2020 model is based on the principle of creating a sustainable future through the criteria of strategy, leadership, corporate governance, stakeholder management to define organizational purpose and culture, and quality management (de Menezes et al., 2022). The criteria and guidelines of the EFQM 2020 model in line with the ten concepts of the GQC maturity assessment model, can support any organization, regardless of sector or size to be flexible in dealing with opportunities and threats, manage change, create sustainable value, improve organizational performance and adopt quality management principles in a general and holistic manner that will support business ethics and meet or exceed the expectations of key stakeholder groups.

The contribution of the present research through the QM maturity framework lies in the implementation of an integrated maturity framework in the criterions of EFMQ 2020. A literature review revealed that GQC is the only maturity model that makes a clear distinction and

incorporates QM perspectives (TQM, Methodologies, Standards, and Excellence Awards). In addition, it provides a clear distinction between CSFs, quality management authorities and organizational resources (Glykas, 2019).

Research specialization is proposed to be applied to future research in a public administrative environment. The need to address the pathogenesis of the public sector, inefficiency and the growing demands of citizens for better services have led to the need to adopt approaches and practices of modern public management (Kritas et al., 2021). Implementation in a public organization evaluated by the criterions and certified of EFQM 2020 will contribute to the creation of a general GQC-EFQM 2020 matrix, by adapting and developing new techniques and methodology to be used as a reference by future researchers in the field of QM maturity assessment and a new toolkit for this case, which will be an extension of the research on implementation in public administration.

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The Level of Development - Students' Perceptions and Beyond: The Case of Balkan Countries

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Students' perception;
HDI index;
Life satisfaction

Abstract: *This paper investigates the level of development in Balkan countries through comparison of the common development indicators. A starting point is the perception of the level of economic development by a group of first year economics students at the Faculty of Economics, Business and Tourism in Split, Croatia. With the students typically not being aware (familiar) of how rich (poor) their country is, this study provides a deeper investigation of the level of development of Croatia and compares it with several countries from the neighborhood. The investigation employs commonly used indicators of economic development - GNI (Gross national income) per capita as usually reported by the World Bank, but also takes into account additional indicators like HDI (Human development index) and life satisfaction indicator. Overall, the study provides an interesting review and comparisons between countries and resolves some misperceptions that are typically present in general public.*

1. INTRODUCTION

The public's understanding of economic indicators is, arguably, vital for a well-functioning society. However, in spite of the commonly established fact that their understanding is extremely low, research on this topic is very scarce (Runge & Hudson, 2020). There are, of course, considerable differences in economic knowledge among different groups of population. One would assume that students of economics, for example, would perform better than the average nonprofessional does, in assessing the economic stance of a country. Our own 20-year experience in teaching economics at the Faculty of Economics, Business and Tourism in Split, however, shows that even students sometimes struggle with understanding the relative position of a country in the world income distribution. This paper, therefore, overviews the level of economic development of Balkan countries through common development indicators, and contrasts them with students' perception of economic development.

As noted by Brandts et al. (2022), more often than not, general public views of the economy are at odds with reality, i.e. with the data as well as theory. They, therefore, label these conditions as misconceptions. Following Bensley and Lilienfeld (2017), they go on to argue that these misconceptions, which represent behavioral and mental processes refuted by psychological research, can be applied to other fields of science also. Analogously, misconceptions exist in economics as well, whereby widespread opinions about the state of the economy can conflict with the empirical evidence. It is important to be aware of these misconceptions, and work on their refute, as they may lead to sub-optimal economic policies. Hopkins (2012), similarly, notes that, in the US, public opinion and presidential approval depend primarily on perceptions of the economic performance, rather than on the actual performance. Despite information on key economic variables being readily available in everyday life, perceptions of economic performance often

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deviate from the actual values. Along the same lines, Hauser and Norton (2017) argue that lay-people's perceptions about the economic stance of a country can affect their attitudes toward various economic matters, even though they can be false. Hauser and Norton (2017) particularly focus on misperceptions of inequality, and find that people tend to underestimate the degree of inequality that exists in their country. In exploring what determines these perceptions, they identify three key factors. First, people tend to generalize, and believe that whatever exists in their immediate surroundings can be applied to the whole economy. Second, the extent of media coverage of a certain topic has a large effect on people's perceptions. Lastly, people who accept hierarchies are more likely to accept higher levels of inequality. A largescale study by Runge and Hudson (2020) investigates the public understanding of economics and economics statistics in the UK, and finds that people typically assess economic issues from their personal economic situation, and that the national economy is something abstract to them. GDP, in particular, is found to be a rather uncomprehensive measure, with less than 50% of the British public being able to define it. Participants in focus groups in this research could not see the connection between the performance of their personal economy and economic performance at the state level.

When it comes to economic indicators, the difference between perception and reality, be it by lay public's or economics students', therefore, seems to be significant and worth exploring. This paper attempts at investigating this issue further by presenting official data on various indicators of development, thus creating a basis for objective valuation of the relative economic positions of selected countries.

The paper is organized as follows. Section 2 presents students' (mis)perception of economic development. Empirical data on the typical indicators of economic development across Balkan countries is presented in Section 3. Directions for future research are discussed in Section 4. Concluding remarks are outlined in Section 5.

2. THE LEVEL OF DEVELOPMENT – STUDENTS' PERCEPTIONS

The level of economic development is an important topic in economics, but it also stands as a subject of great interest and importance in the general public. This comes only natural as it is directly connected with the standard of living people around the world enjoy in their countries. Unfortunately, despite the enormous technological advances and all the economic successes that man has achieved resulting in historically high productivity, the world is still faced with huge inequalities around the globe. While in some countries people live in prosperity and huge wealth, the number of people and countries living in extreme poverty in the least developed parts of the world is stubbornly high and resistant. World Bank is among the institutions that deal with the issue of economic development, strongly recognizing the need to help people around the world rise from poverty. As an institution that investigates these important issues, the World Bank classifies countries into four groups using the indicator GNI (Gross National Income) *per capita*, calculated using the World Bank Atlas method. These four groups of countries are as follows:

1. High-income economies (Rich economies) – a GNI *per capita* of $13,205 or more in 2021.
2. Upper middle-income economies – a GNI *per capita* between $4,256 and $13,205.
3. Lower middle-income economies – a GNI *per capita* between $1,086 and $4,255.
4. Low-income economies (Poor economies) – a GNI *per capita* of $1,085 or less in 2021. (see https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups for more details).

A snapshot from the World Bank country classification (available at https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023) presented below, pictures nicely the dispersion of countries and world regions by income levels (by the level of economic development).

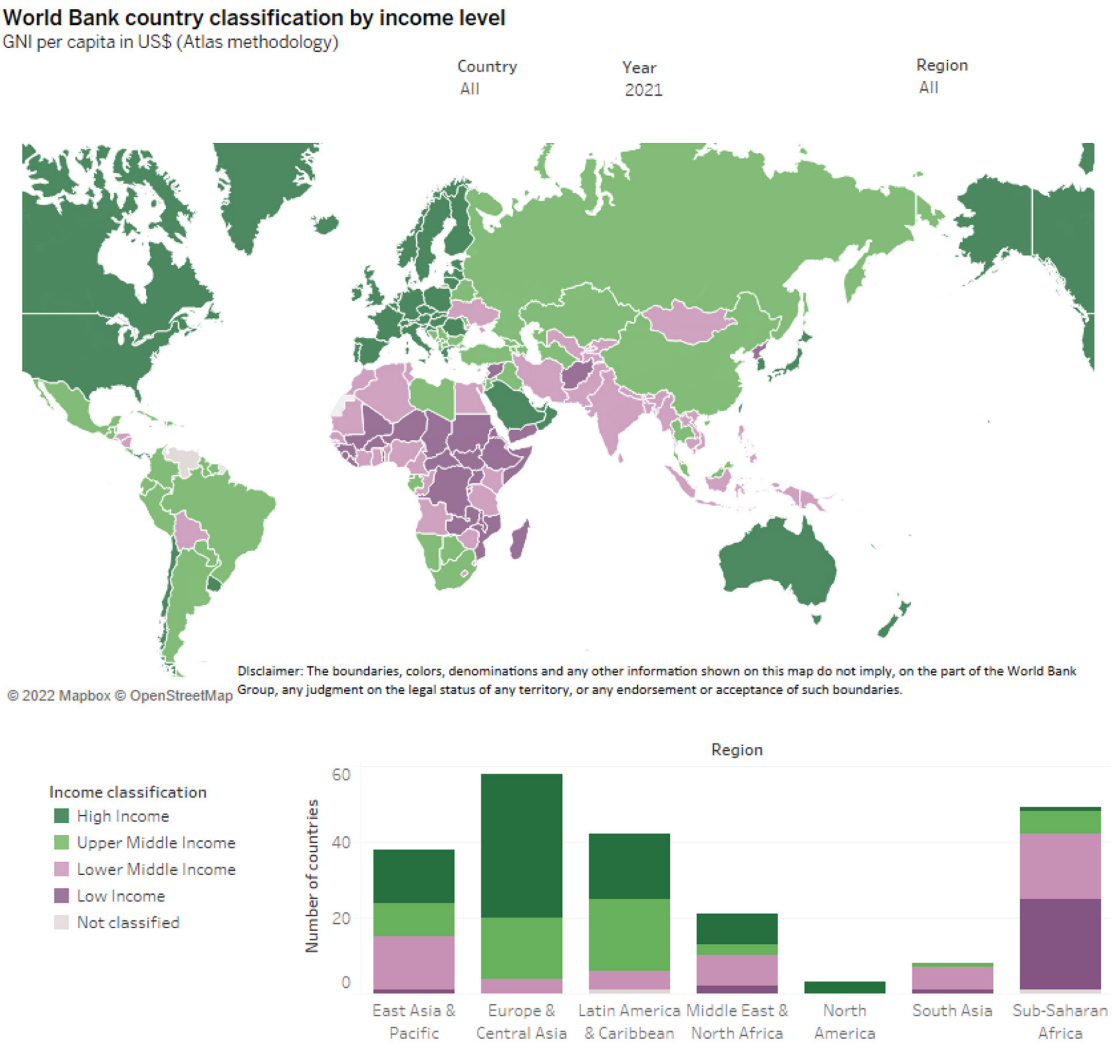

Figure 1. World Bank country classification by income level

Source: World Bank (https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023)

Figure 1 nicely presents the differences in the income level between the countries in the world. As can be seen, the rich economies (high-income countries) are situated in North America, Europe and the Pacific. The poor economies (low-income countries) are mostly in Sub-Saharan Africa and Asia. To provide a comparison, the GNI *per capita* in, for example, Norway is 84090 US$ in 2021, whilst the same indicator in Congo stands at 580 US$, suggesting that GNI *per capita* in Norway is 145 times higher than the one in Congo. Indeed, this difference is gigantic. This difference in GNI *per capita* represents a huge gap in productivity levels and consequently will be reflected in the standards of living people in these countries enjoy.

Using this World Bank classification of countries across the four groups, we investigated as to what first year students at the Faculty of Economics, Business and Tourism in Split, Croatia believed to which group a specific country belonged. This interview (an online game) was conducted

using the Kahoot platform which is often used in playing games with students using their mobile phones. In general, these sorts of games make lectures much more interesting and keep the students more engaged and interested in the topics being discussed. To provide honest and objective answers students were allowed to use nicknames of their choice so that they can participate freely without worrying what their fellow students or teachers will think of their answers. This online game was conducted in December 2021 among first-year undergraduate economics students. The game was played by 100+ participants. A question was posed to 10 countries and students had to pick one answer. One example of the question posed is: "According to the World Bank classification of countries which classifies countries in 4 groups Switzerland belongs to…." and the offered answers included the classification explained above (high income-countries, upper middle-income countries, lower middle-income countries and low-income countries). The students were asked to decide on ten countries as follows: Switzerland, Austria, Congo, Germany, Norway, China, Croatia, USA, Angola and India. The results of this game are presented in Table 1 below.

Table 1. Students' responses about the level of development across different countries

	Switzerland	Austria	Congo	Germany	Norway	China	Croatia	USA	Angola	India
Participants	100	92	101	102	101	102	104	99	95	100
Correct answer	69	29	48	74	58	25	6	76	37	36
% correct answer	69.00	31.52	47.52	72.55	57.43	24.51	5.77	76.77	38.95	36.00
Group as classified by WB	HI	HI	LI	HI	HI	UPI	HI	HI	LMI	LMI
Most believed	HI	UMI	LI	HI	HI	HI	LMI	HI	LI	LMI
	69	56	48	74	58	72	75	76	47	36
Most believed %	69.00	60.87	47.52	72.55	57.43	70.59	72.12	76.77	49.47	36.00

Notes: HI – high income (rich) country; UMI – upper middle income country; LMI – lower middle income country; LI – low income (poor) country

Table 1 reveals many interesting findings. It appears that the first year undergraduate students guessed (answered) most correctly (i.e. with the highest percentage of correct answers) mainly in the group of the richest economies those being USA, Germany and Switzerland with the percentages 76.77%, 72.55% and 69%, respectively. To take USA as an example, the data in the table reveal the following. USA is classified by World Bank in the group of high income (rich) countries. 76 out 99 students (76.77%) correctly answered that USA belongs to the group of high income countries. Among the countries for which the students answered least correctly (i.e. with the lowest percentage of correct answers) are Austria, China and Croatia with percentages 31.52%, 24.51% and 5.77%, respectively. In the case of Austria, World Bank classified this country in the group of high income (rich) countries, while only one third of students correctly recognized this fact. An interesting finding is also that only one quarter of students classified China correctly, i.e. in the group of upper middle income countries (as classified by World Bank). The lowest percentage of correct answers is, interestingly, in the case of Croatia. World Bank classifies Croatia as a high income (rich) country. Only 5.77% of students classified Croatia correctly as a rich country. What appears to be most interesting from these data is that it was Croatian students that classified their own country the least correctly. We repeat: only 5.77% of students were familiar with the fact that Croatia is classified by the World Bank as a rich economy. This suggests that there seems to exist a huge misperception about the level of economic development by Croatian students. Interestingly, this misperception is identified among economics students which are expected to be more familiar with economic matters in society. One has to pose the question of what would the percentages be among, for example, law students or the general public. This immediately invites another, detailed investigation across different professions, or even the general public, not only in Croatia but possibly across different countries which would allow interesting comparisons. The

reader would probably by now start considering the question of how representative the sample under investigation is and whether any strong conclusions may be drawn from a sample of 100 first-year undergraduate students. While this concern, and possible criticism, admittedly, is easy to understand, let us state that we only use this investigation as a starting point to highlight the need to explore the economic facts concerning economic development further, and familiarize society with these important issues. Indeed, low awareness (or consciousness) about economic reality strongly questions the ability of people to make individual or social choices correctly.

Another interesting part of Table 1 reveals which group most of the students (and in which percentage) believed a country belonged to. Attention should be dedicated to those countries in the table where the students' beliefs and official World Bank classifications did not match. This will typically be the case where the least correct answers by students were given (i.e. the countries with the lowest percentage of correct answers). The first country where we can notice this mismatch is Austria. While Austria is classified by World Bank to be a rich (high income) country, only one third of students responded in this vein. Most of the students (60.87%) believed Austria belonged to the upper middle income group. China is also an interesting example but the students' answers here went in the opposite direction, i.e. students believed that China is more developed (has a higher income *per capita*) than is actually the case. Thus, World Bank classified China in the group of upper middle income countries, whilst most of the students (70.59%) believed (wrongly obviously) China belonged to the group of high income (rich) economies. Of particular importance for this study is the Croatian case. As outlined above, the percentage of correct answers was by far the lowest, with only 5.77% of students correctly identifying that Croatia is a rich economy by World Bank classification. This misperception is further exacerbated by the percentage of students believing that Croatia belonged in one of the below-rich income groups. 72.12% of students responded that by World Bank classification Croatia belonged into the lower middle income group, two income classes below the actual income class. These wrong perceptions clearly invite a much broader investigation, probably more of a sociological sort of study being adopted. For the purpose of present study, we use this as a starting point which invites the investigation as to what the actual level of development in Croatia is (apparently different from what is usually thought if the data at hand are to be trusted) and how it ranks to some of the neighboring countries. In the rest of this study we, thus, focus on investigation of the relative level of economic development in Croatia and some Balkan countries, compared to the rest of the world.

3. EMPIRICAL DATA

In this section, we investigate and present graphically the data on various development indicators. We start with the GNI *per capita*, that is used by the World Bank when classifying the countries across the four income groups (i.e. by the level of economic development). We present the data for Croatia, and in order to allow comparison we also include other Balkan countries (by applying the geographical criterion this would include the following countries: Albania, Bulgaria, Bosnia and Herzegovina, Greece, Kosovo,[3] Montenegro, North Macedonia, Serbia, Slovenia and Romania). We use the latest year available, which is 2021.

Figure 2 provides interesting insights into economic development of Balkan countries using the GNI *per capita*, the indicator used by World Bank to classify countries across the four groups explored earlier. The countries which have their GNI *per capita* above the red dashed line are classified by the World Bank as high income (rich) economies. These would include

[3] Under UN Security Council Resolution 1244/99.

Slovenia, Greece, Croatia and Romania. The remaining countries are classified as upper middle income economies (above the blue full line and below the red dashed line). Out of the 11 Balkan countries presented in Figure 2, Slovenia appears to have the highest GNI *per capita*. Greece ranks second, whilst, interestingly, Croatia is ranked third, lagging behind Slovenia and Greece only. We in particular focus on Croatia here, as we used the survey of Croatian students as a starting point for our investigation. Thus, not only Croatia is classified as a high income country, but it also ranks pretty well among the other Balkan countries, outperforming all countries except Slovenia and Greece. Romania and Bulgaria, even though being EU members longer than Croatia, are also behind Croatia. Although the typical perception by people in Balkan countries is that they live in dire economic circumstances, the data in Figure 2 appear to suggest none of the countries would be classified as a poor economy by the World Bank. Apparently it is the case that none of the countries would be classified as a lower middle income economy.

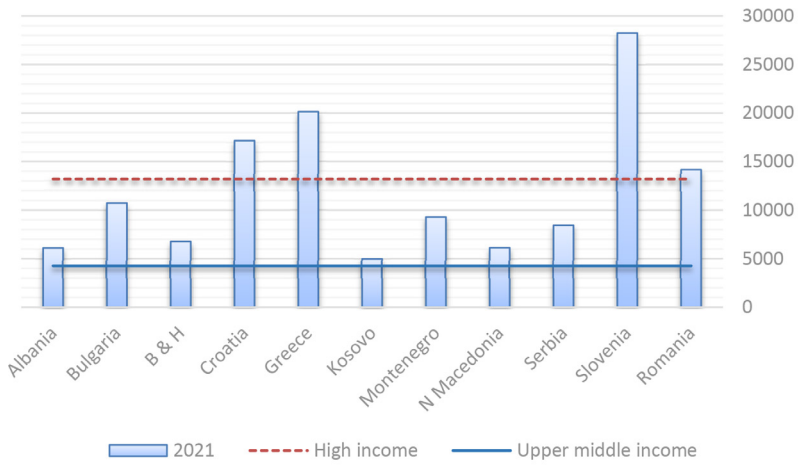

Figure 2. GNI per capita across selected countries (in US $)

Source: World Bank WDI

Economists are, of course, aware that comparisons between countries should also take into account different price levels of goods and services across countries. To that end, the indicators (e.g. GDP *per capita* or GNI *per capita*) may be modified and used in their PPP (purchasing power parity) versions. We present GNI *per capita* in PPP form in Figure 3 below.

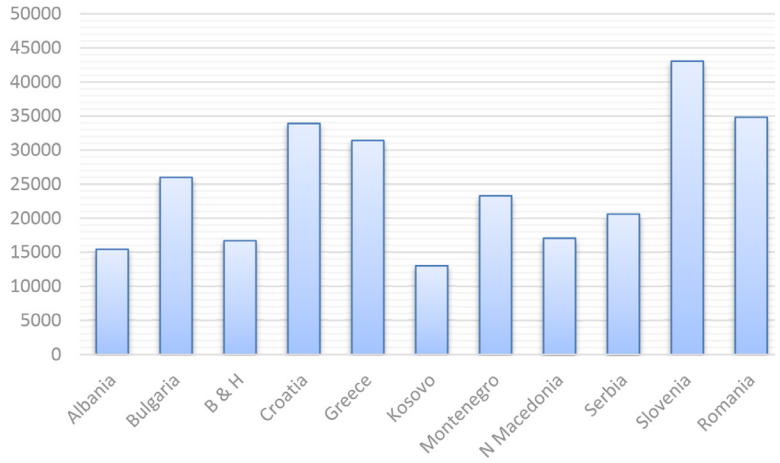

Figure 3. GNI per capita (PPP) across selected countries (in US $)

Source: World Bank WDI

Figure 3 reveals that the differences among countries are less pronounced when PPP data are used. Expectedly, with the PPP modification in all the countries GNI *per capita* is at significantly higher levels. Slovenia ranks first again, whilst Romania follows. Croatia is again in third place, with Greece weakening its position and being ranked only fourth. Kosovo[4] remains at the bottom even with this modification to the GNI *per capita* indicator.

In order to provide somewhat broader perspective on economic development and to account for some of the criticisms of the GDP (or GNI) data we include additional indicators in our analysis (for criticisms of GDP as a measure of wellbeing see for example Stiglitz et al., 2009; Fleurbaey, 2009; Fraumeni, 2022). Namely, economic development is defined by Encyclopedia Britannica as "the process whereby simple, low-income national economies are transformed into modern industrial economies" (Krueger & Myint, 2022). It is often used interchangeably with GDP *per capita*, even though these two terms are not the same. Namely, GDP *per capita* measures economic performance of a country and is useful for making cross-country comparisons of average living standards. However, it also entails some weaknesses. For example, GDP *per capita* does not take into account income distribution, informal economy, ecological and health issues, life satisfaction, etc. Overall, it does not reflect a nation's welfare. The term economic development goes beyond GDP *per capita*, in that it additionally accounts for poverty reduction and income redistribution. One of the key indicators that measure economic development is Human Development Index (HDI).

HDI incorporates three main dimensions of human development: health dimension (measured by life expectancy at birth), education dimension (assessed via mean of years of schooling for adults aged 25 years and more, and expected years of schooling for children of school entering age) and the standard of living (measured by gross national income *per capita*). Overall index results from the aggregation of the above-listed three dimensions using geometric mean. The overall index (column 1), the three dimensions (columns 2a, 2b, 3 and 4), as well as the HDI rank (column 5) out of 191 countries, are given in Table 2.

Table 2. Human development index for selected countries in 2021

	(1)	(2a)	(2b)	(3)	(4)	(5)
	Human Development Index (HDI)	**Life expectancy at birth**	**Expected years of schooling**	**Mean years of schooling**	**Gross national income (GNI) *per capita***	**HDI rank**
Country	Value	(years)	(years)	(years)	(2017 PPP $)	
	2021	**2021**	**2021**	**2021**	**2021**	**2021**
VERY HIGH HUMAN DEVELOPMENT						
Slovenia	0.918	80.7	17.7	12.8	39,746	23
Greece	0.887	80.1	20.0	11.4	29,002	33
Croatia	0.858	77.6	15.1	12.2	30,132	40
Montenegro	0.832	76.3	15.1	12.2	20,839	49
Romania	0.821	74.2	14.2	11.3	30,027	53
HIGH HUMAN DEVELOPMENT						
Albania	0.796	76.5	14.4	11.3	14,131	67
Bulgaria	0.795	71.8	13.9	11.4	23,079	68
Bosnia and Herzegovina	0.780	75.3	13.8	10.5	15,242	74
North Macedonia	0.770	73.8	13.6	10.2	15,918	78
World	**0.732**	**71.4**	**12.8**	**8.6**	**16,752**	

Source: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

[4] Under UN Security Council Resolution 1244/99.

The United Nations Development Programme (UNDP), in addition to publishing the data on HDI, categorizes countries into four categories depending on the level of human development achieved. As can be seen from Table 2, of the Balkan countries in our sample, Slovenia, Greece, Croatia, Montenegro and Romania pertain to the category of Very high human development. Albania, Bulgaria, Bosnia and Herzegovina and North Macedonia are listed in the category High human development. Neither of the countries in our sample pertains to the groups: Medium human development and Low human development. As for the HDI components, the analyzed Balkan countries mostly pertain to high-levels of development in each of the three components.

Finally, acknowledging the fact that high income and/or level of development need not necessarily reflect one's wellbeing, i.e. subjective feeling of satisfaction with one's life, we also look at the life-satisfaction data. Quality of life or life satisfaction indicators typically measure how people evaluate their life as a whole by asking them to rate their satisfaction with life on various scales. These are often used in addition to GDP as an indication of the overall wellbeing in a country. Figure 4 shows the relationship between GDP *per capita* and self-reported life satisfaction in our sample of countries in 2020[5].

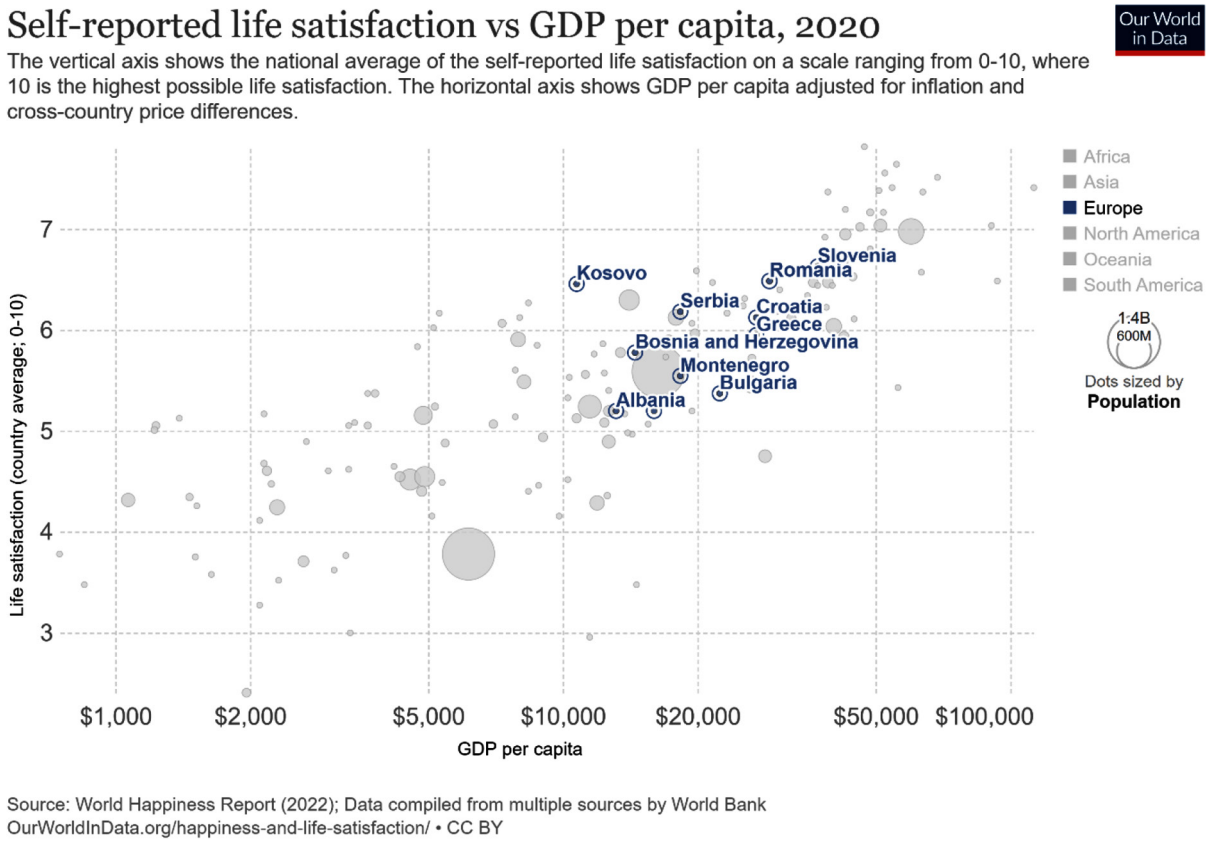

Figure 4. Self-reported life satisfaction vs GDP per capita in 2020
Source: Ortiz-Ospina and Roser (2013)

Figure 4 depicts a clear positive relationship between the two variables, suggesting that in countries with higher GDP *per capita* people report higher levels of life-satisfaction. Moreover, the levels of reported life-satisfaction are high in our sample of countries relative to the rest of the world, with all the countries being above level 5. Figure 5 further shows that once a trend line is added to

[5] The data was not available for 2021.

the above scatter gram, a following picture emerges. The dots that represent Kosovo,[6] Bosnia and Herzegovina, Serbia, Croatia, Romania and Slovenia are all above the trend line, suggesting that people in these countries have a subjective feeling of satisfaction with life that is greater than their GDP levels would suggest. In Albania, North Macedonia, Montenegro, Bulgaria and Greece, on the other hand, one's life-satisfaction is less that one would expect looking purely at GDP numbers.

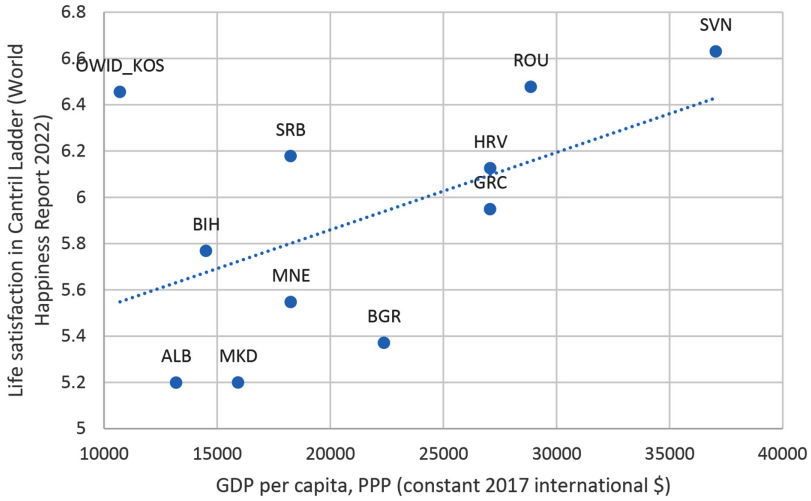

Figure 5. Relationship between self-reported life satisfaction and GDP per capita in 2020 in selected Balkan countries

Source: Ortiz-Ospina and Roser (2013)

Overall, therefore, there is no reason to perceive the observed Balkan countries, and Croatia in particular, as relatively under-developed. More precisely, the data shows that Croatia is ranked as high-income country (according to the World Bank classification); a country with a very high level of human development (according to UNDP classification) and a country with high levels of life satisfaction.

4. FUTURE RESEARCH DIRECTIONS

Level of development and the related standard of living is one of the most important issues in people's life. Given its huge importance, the misperception related to the standard of living people enjoy in their countries comes as a big surprise. While this issue of misperception of development has been present in economic literature, it certainly deserves more attention. One direction for future avenues of research is provided in our study. In particular, we would suggest a broader line of inquiry to be followed with a much higher number of respondents being interviewed about the level of development. In addition to economics students, it would be interesting to investigate students' perception across different scientific disciplines. Additionally, it might be interesting to broaden the country coverage to explore if there are significant differences in students' perception of development among economics students in Croatia and the neighboring countries.

5. CONCLUSION

This paper investigated the level of development across Balkan countries. A starting point for the investigation was the (mis)perception of economic development by a group of first year economics students at the Faculty of Economics, Business and Tourism in Split, Croatia. The

[6] Under UN Security Council Resolution 1244/99.

typical misperception motivated a deeper investigation of the level of development of Croatia and comparison with countries from the Balkan neighborhood. The investigation of the common indicators of economic development like GNI *per capita*, as well as additional indicators like HDI indicators and life satisfaction, suggests that objectively people in Croatia and the neighboring Balkan countries live relatively good lives. This, in particular, holds for Slovenia, Greece, Croatia and Bulgaria which are classified by the World Bank as rich economies. Other investigated countries are classified as upper middle income economies. By HDI indicators these countries also fare relatively well, being classified as countries with either very high or high human development. Overall, the study provides an interesting review and comparisons between countries and resolves some misperceptions that are typically present in general public.

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Industry 4.0 Process-Operations Management Maturity Assessment: A Literature Survey

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Abstract: *The aim is to demonstrate the necessity of evaluating industry 4.0 maturity in order to discover capabilities and opportunities for potential ongoing improvements to company operation management. There will be a thorough review of the literature in the areas of operations management and Industry 4.0. Because there aren't enough tools and terms to help firms assess their attempts to undergo digital transformation, the paper's findings show that they are unable to establish their Industry 4.0 maturity level. It is critical to assess their effectiveness and develop strategies and practices that work by employing evaluation frameworks and models. A digital transformation maturity model is necessary. There is no prior research that offers a comprehensive examination.*

1. INTRODUCTION

Industry 4.0 (or I4.0) is understood as a new industrial stage in which there is integration between manufacturing operations systems and information and communication technologies (Glogovac et al., 2020). Industry 4.0 affects various aspects of our lives, such as employment, consumption, and trade and refers to the process of transforming an industrial facility into a modern one. Industry 4.0 can help improve a firm's financial performance and stock returns. It helps companies improve their efficiency and profitability of manufacturing through increased product connectivity.

Manufacturing organizations are not able to define their I4.0 maturity level. This is due to the lack of tools and definitions that can help them assess their digital transformation journey. Through the use of assessment frameworks and models, enterprises can help themselves in evaluating their progress and develop effective strategies and practices. An assessing digital transformation maturity model is needed to help companies define their digital transformation strategy.

The term maturity refers to a state of being complete, perfect, or ready for the next step in the development of a system. Maturing systems refer to the accumulation of capabilities that can be utilized for a desirable future state. A maturity model is a tool that measures and evaluates an organization's maturity. It can be performed continuously or discretely. Maturity can be labeled as readiness models.

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2. INDUSTRY 4.0 AND MATURITY MODELS

Industry 4.0 (or I4.0) is a conceptual framework that focuses on the continuous evolution of the physical world. Its various components are cyber-physical systems, Internet and future-oriented technologies, and smart systems. The increasing complexity of business operations can be handled through the enhanced connectivity of these human–machine paradigms (Fonseca et al., 2021).

Before the 4th industrial revolution, the 3rd industrial revolution started with the introduction of robots and computers. The 3rd industrial revolution followed the 2nd with the development of mass production and electric vehicles and before was the 1st with mechanical production and steam-powered machines. Industry 4.0 is a framework for uniting the physical and virtual worlds. It features a variety of technologies such as artificial intelligence, 3D printing, Big data and analytics and simulations, etc.

Industry 4.0 is a methodology for transforming manufacturing from a machine-dominated to a digital-dominated state. The Industry 4.0 standard must be thoroughly understood in order to achieve a successful transformation. It's critical to assess Industry 4.0 components and characteristics in order to determine the fundamental pillars of a concrete future manufacturing environment (Oztemel & Gursev, 2020).

Industry 4.0 refers to the digital transformation of the entire industry, which involves the virtual representation of various business models and systems. It is a set of principles that aims to accelerate the evolution of organizational efficiency and adopt new business models that are designed to address the circular economy. Industry 4.0 uses a set of processes and products that are designed to support intelligent and efficient processes. It is supported by nine pillars: The Industrial Internet of Things (IoT), Cloud computing, Big data, Simulation, Augmented reality (AR), Additive manufacturing, Horizontal and vertical system integration, Autonomous robots, and Cybersecurity (CS). The IoT is a concept that enables people and things to connect and interact with each other. Cloud computing provides a variety of advantages, such as reducing hardware complexity, improving system performance, and facilitating data sharing. Big data refers to the large volume of information that can be collected and analyzed quickly, with advanced techniques. Simulation is the process of developing digital twin models that can improve productivity and maintenance performance. Augmented reality improves a person's performance by providing them with the information they need to complete a given task. Additive manufacturing (or 3D printing) is a technology used for the rapid creation of 3D models and prototypes. It can be used for the design and development of new products and business models. Horizontal and vertical system integration, with collaborative scenarios of system integration and real-time sharing. Autonomous robots with artificial intelligence and improved adaptation and flexibility can support different manufacturing processes and decrease production costs. Cybersecurity is related to a high level of information security and involves technology to protect, detect, and respond to attacks (Fonseca et al., 2021).

Artificial intelligence (AI) can help minimize waste and improve efficiency by developing new solutions that can solve real-world problems. Increased automation can improve processes and reduce human stress while reducing environmental impacts. Industry 4.0 can help companies reduce waste and improve the profitability of their product lifecycle by delivering real-time data to their decision makers. Some benefits of I4.0 that have been identified are business processes

integration across the entire value chain, the ability to improve productivity and efficiency, reduce costs and improve the customer's experience, support new business models that allow customers to create value through innovative products and services, improve the quality of products, and minimize the impact on the environment and focus on optimizing resource utilization and social sustainability.

The combination of I4.0 and methodologies can help improve employee morale, reduce lead times, improve product quality, and reduce waste. It is also identified that Industry 4.0's potential negative impacts on sustainability are considerable. These include increased labor-saving technologies and consumption rates, which could result in higher resource consumption and income inequality.

Due to the continuous evolution of industries, quality concepts have also undergone a major change. This has led to the emergence of digital transformation processes, which help organizations achieve better quality and performance. Through the Digital Transformation process, we can transform an organization and its various business models and operations. This process brings new strategic objectives and enhances the organization's capabilities. Digital transformation is driving businesses to create new jobs and improve their operations.

3. INDUSTRY 4.0 AND OPERATIONS MANAGEMENT

Industry 4.0 has been defined as technology advancements, organizational re-designs, operations management developments, and market revolutions in fields such as engineering, management, control, and data science. Industry 4.0, according to Piccarozzi et al. (2018), is the integration of Internet of Things technologies into industrial value creation, allowing manufacturers to harness completely digitized, connected, smart, and decentralized value chains capable of delivering greater flexibility and robustness to firm competitiveness and enabling them to build flexible and adaptable business structures with the permanent ability for internal evolution (Dmitry et al., 2021).

There are only a few studies on industry 4.0 in the operations management research field. Recent studies have revealed that, in the context of industry 4.0, operations management research has mostly focused on industrial applications of technologies including additive manufacturing, the Internet of Things, blockchain, advanced robots, and artificial intelligence (Dmitry et al., 2021). From the perspective of operations management, Industry 4.0 refers to the consistency of technologies, organizational concepts, and management principles that underpin a cost-effective, responsive, resilient, and sustainable network that is data-driven and dynamically and structurally adaptable to changes in demand and supply by rapid rearrangement and reallocating its components and capabilities.

Researchers have provided several overviews of the changes in organization, technology, and management that have culminated in industry 4.0 during the last four decades. The 1980s and 1990s saw a shift from stable markets served by mass production to increasingly volatile variety and volume market environments that necessitated adaptable, small-lot manufacturing using technologies like flexible manufacturing systems (FMS) and reconfigurable manufacturing systems (RMS) (Dmitry et al., 2021). Advances in manufacturing and information technology enable and support the development of computer-integrated manufacturing (CIM) and automated manufacturing processes, which are enabled and supported by novel systems such as enterprise

resource planning (ERP) and modular and fractal factories. The key management and organizational principles of these periods were flexibility and integration.

To serve the increasingly unpredictable new market models, the evolution between 2000 and 2010 was marked by the development of management principles such as coordination, collaboration, decentralization, and agility. Advances in information and manufacturing technologies, such as multi-agent systems, complex adaptive systems, RFID, and APS (advanced planning systems), enabled the adoption of these new organizational principles (Dmitry et al. 2021). The virtual enterprise framework, as well as vendor-managed inventory (VMI) and collaborative planning, forecasting, and replenishment (CPFR) principles, were developed around the same time. In virtual firms, supply chain dynamics included so-called competence cells or agents networking. Collaborative control theory is another contribution that can be considered a watershed moment in the development of industrial enterprise systems. Collaborative control is based on the idea of combining decentralized agent-oriented control with bio-inspired coordination and control, adaptation, and learning.

The constituent components of a nascent Industry 4.0 (e.g. collaborative robots, sensors, agents, modular factories, Internet-of-Things (IoT), etc.) were familiar to some in the industry in the early 2010s, but their relative utility and utilization contexts and requirements were not evident (Dmitry et al. 2021). Attempts to connect these local solutions frequently failed. Following significant advancements in data processing and robotics technologies, this became practical later. Industry 4.0 is producing major consequences such as digital supply chains, smart manufacturing, and cloud manufacturing. Sensors, autonomous guided vehicles (AGVs), blockchain, additive manufacturing, augmented reality, Big data analytics, track&trace systems (T&T), and mobile robots are all helping to construct cyber-physical systems (CPS) in production and supply chains.

New disruptive manufacturing and supply chain business models have emerged, in which supply chains are no longer thought of as inflexible physical systems with the fixed and static allocation of specific processes to specific enterprises. Separate physical firms provide supply, production, logistics, and sales services at different periods, resulting in dynamic process allocation and supply chain topologies. Electronic merchants, for example, are leveraging their massive transactional and behavioral customer data to provide customers with new options to try, experience, and purchase their products (e.g., Amazon with Alexa). Logistics and supply chain control with real-time data, dynamic resource allocation in Industry 4.0 customized assembly systems, improving forecasting models using Big data and combining optimization, machine learning algorithms, and agent-based modeling for supply chain resilience are all examples of digitalized supply chain and operations (Dmitry et al. 2021).

Intelligent logistics solutions, such as the IoT-based Omni-Channel Logistics Service, can help manufacturers, retailers, and logistics providers exploit synergies and facilitate real-time self-optimization. Supplier relationship management is also determined by integrated information systems and enhanced forecasting methods (SRM) (Caiado et al., 2021). Blockchain technologies can help with real-time information sharing from the supply chain to numerous parties for increased transparency, allowing suppliers and buyers in virtual markets to employ intermediate manufacturing resources and services.

Industry 4.0 is drastically transformed operational Operations Management tasks and decision-support systems, particularly in manufacturing and logistics. Manufacturing is the primary

application of Industry 4.0 engineering technology and infrastructure. The majority of data processing technologies are used in the decision-making domains of planning and sourcing. The communication component of Industry 4.0 dominates the logistics space.

One of the key features of Industry 4.0 is an individual approach to customers, which is why concepts for customer involvement/integration in the value creation process (Customer Order Decoupling Point, Co-Creation, Co-Development, and so on) are becoming increasingly important for manufacturing operations management (Koleva & Andreev, 2018).

The advantages that are expected to accompany Industry 4.0 appear to be numerous. Automation improves product quality while also increasing the efficiency of industrial processes. This is especially relevant when considering the transformation that many businesses are going through as a result of Industry 4.0. Lower product processing time, manufacturing cost reduction, improved value chain coordination, enhanced process flexibility, better customer service, and higher product customization are a few of the benefits that Industry 4.0 technologies can provide in the management of operations. Because many of these benefits are centered on process automation, they can provide outputs for a variety of areas within operations management, particularly in technology management. Additionally, automated processes can improve all actions carried out in a company, resulting in improvements in all areas of operations management.

Industry 4.0 technology can still transform a company's core competences, and it's been highlighted as an enabler of several operations management concepts, such as agile manufacturing and mass customization. Lean manufacturing is a commonly utilized method that strives to reduce waste while increasing productivity and quality following customer needs (Schumacher et al., 2016). The application of the lean strategy is based on a human-centered approach to numerous management ideas and practices. This technique is frequently cited in contrast to the consequence of implementing Industry 4.0 technologies, which tends to reduce human involvement.

4. INDUSTRY 4.0: CHALLENGES AND OPPORTUNITIES

In the current setting, global industries are confronted with significant economic issues as a result of the rapid rate of societal and technical development, such as declining natural resource availability, rising energy prices, an aging workforce, and market globalization. Customer demands for enhanced product-service innovation, product diversity, quality standards, support services, and immediate gratification are also on the rise.

In order to meet these difficulties, industrial businesses must be able to manage their entire value chain flexibly and responsively. Companies require virtual and physical frameworks that enable close collaboration and rapid adaptation across the whole lifecycle, from product development to distribution.

Industry 4.0 is a set of pull applications and push technologies that enable the high level of sustainability required in future factories (Landeta Echeberria, 2020). Industry 4.0 addresses today's resource and energy efficiency concerns, as well as urban production and population change, by enabling ongoing resource productivity and efficiency.

Internet-based and Internet of Services are two of the most widely pushed technologies, with fresh improvements in computational capacity favoring cloud computing and services. These

technologies have the potential to usher in a new generation of service-based industrial systems with on-device and cloud-based features. Talented employees, a robust IT infrastructure, economic power, and forward-thinking manufacturers are required to develop these technologies and applications successfully.

An Industry 4.0 factory has the potential to predict future products and respond to increased variety and complexity at low cost and with minimal environmental effect.

Management challenges in adopting Industry 4.0 are challenges that pertain to managerial issues in implementing Industry 4.0. These difficulties can include, for example, a lack of financial resources, a lack of personnel resources, security concerns, and so on. These issues can arise as a result of either the overall deployment of the Industry 4.0 concept or the implementation of a specific Industry 4.0 technology category.

Technology implementation challenges in Industry 4.0 relate to specific technical issues that arise during the deployment of Industry 4.0. Device incompatibility, data analysis, algorithm development, and other issues are examples of these problems. Technological obstacles are associated with the execution of a given technology category.

Industrial artificial intelligence is constrained by the physical nature of the systems and processes it manages, which other types of artificial intelligence are not. Retrieving industrial data in sufficient quantity and diversity to train industrial or defense artificial intelligence is extremely difficult. Industries are hesitant to divulge data that could reveal product manufacturing processes. The demand for competence has increased. Industrial artificial intelligence models are more difficult to create, train, and test, and the costs of failure are higher.

Industrial artificial intelligent systems frequently rely on data gathered via sensors that attempt to digitally represent the real environment, as opposed to *born digital* data captured, for example, from web interaction logs (Fuller et al., 2020). This method can produce intrinsically noisy datasets. Sensor data might be quite large. Obtaining this information and keeping it for analysis might be a difficult task. Simulation is frequently utilized due to the high expense of acquiring training data under a wide range of scenarios. High-fidelity simulations, often known as *digital twins*, can be very effective, but they can be difficult to design and maintain, as well as computationally costly to run (Fuller et al., 2020). At training issues, the success of *deep learning* has fueled a lot of the recent buzz regarding artificial intelligence. The majority of these achievements are based on supervised learning issues, in which deep neural networks are trained with labelled training data. Testing artificial intelligent systems on live production lines, industrial equipment, warehouses, and other industrial systems is both costly and disruptive due to testing expenses and complexity. As a result, simulation is frequently used to train and evaluate industrial artificial intelligent systems, which has its own set of issues. Modern industrial systems are exceedingly complicated at huge state spaces, with tens or hundreds of inputs that machine learning algorithms can optimize. This may necessitate the employment of advanced approaches to reduce the problem and ensure convergence to a solution, resulting in more complex development and training routines, both in terms of time and expense.

A factory using Industry 4.0 technologies is smarter than any other factory, requiring greater intervention from artificial devices, including robots, and minimizing employee engagement. Different factories, on the other hand, require different smart device configurations, and smart

device development takes a long time and a lot of money before it can be used in an Industry 4.0 facility.

The Fourth Industrial Revolution was originally assumed to be a digital revolution sweeping the manufacturing industry. Industry 4.0 is now defined as the digital transformation of all industrial value chains (Ghobakhloo & Iranmanesh, 2021). Implementing specific digital technologies and adopting valuable design concepts are hallmarks of Industry 4.0's digital revolution.

Low or high tier modern digital breakthroughs or advanced manufacturing technologies that enable the digital industrial revolution are Industry 4.0 technological developments. Low tier Industry 4.0 technology developments include smart sensors, industrial robots, smart wearables, and machine controllers, which can be procured and installed as discrete digitalization initiatives inside the industrial environment. Industry 4.0's higher tier technology trends, such as the industrial Internet of Things (IoT), Cyber-physical Production Systems (CPPS), and digital twins, are built on the integration of a variety of lower tier digital and operations technologies, such as networking infrastructure, sensors, machinery, and even connected human components.

Industry 4.0 design principles, as a building block of digital transformation, are required conditions for industrial value chain members to reap the benefits promised by the Industry 4.0 transition. Previous research has shown a wide range of Industry 4.0 design principles (Ghobakhloo & Iranmanesh, 2021). Horizontal and vertical integration, real-time capability, and client focus are some of the most commonly acknowledged Industry 4.0 design ideas. Scholars have been very interested in discussing the benefits and problems of Industry 4.0 for social medias. Another common research topic is evaluating social medias' behavior in integrating Industry 4.0 technology trends. The most popular research streams have been strategic management of digital transformation, company value generation strategies for competitiveness, and digitalization maturity evaluation.

Industry 4.0 was defined by Kagermann and Wahlster (2013) as a smart factory, a manufacturing unit with horizontal and vertically integrated operations (Schumacher et al., 2016). In order to produce smart products and services, the smart factory relies on a high level of connectivity that enables end-to-end digital integration across the value chain. The particular manufacturing unit is part of a network that shares information and knowledge with other units, suppliers, and customers. Automated and digital technologies work in a completely connected environment with entire information transparency, as data from processes is always available. The following research focused on framing Industry 4.0 by outlining the capabilities of linked technology and data applications. AM, augmented reality, CPS, Big data, CC (CPS), and IoT are some of the technologies usually linked with Industry 4.0.

Implementing Industry 4.0 has a significant organizational impact that is directly linked to the digital transformation process. Adoption of technologies such as IoT and CPS, as well as the ability to treat data and integrate processes inside internal departments and with external partners, encourages innovation and changes in business models. New technology may allow for alternate production methods and/or the creation of new value propositions. In any event, data derived from manufacturing processes or interactions with suppliers or consumers is a valuable resource. Data can be utilized to give useful information for predictive or corrective reasons, to increase process efficiency, or to develop new revenue streams in situations where services add value. The relationship between the supplier and the customer in a collaborative process can be

used to produce value through services. As a result, the offer becomes more complex, and the value proposition may comprise customized products and services resulting from value co-creation between the supplier and the client. The integration of the value proposition with distribution through digital platforms generates a new sort of customer connection downstream in the value chain, where the digital, physical, and social components interact to create a customer experience that ensures long term engagement.

While the potential of Industry 4.0 for the service of manufacturing is extensively documented, some authors acknowledge its relevance to service-providing activities that are not directly tied to manufacturing processes. Along the supply chain, integration of processes and data generation allows for inventory tracking, information exchange, and collaborative ordering, while smart labeling may deliver interactive content to the final consumer. Similarly, supply chain 4.0 and the incorporation of building information modeling may aid the construction industry.

Products, devices, and services become smarter as a result of the integration of microprocessors with AI techniques, possessing not just processing, communication, and control capabilities, but also autonomy and sociality. Adaptive and flexible robots, in combination with artificial intelligence, make it easier to manufacture various items by recognizing the lower segments of each part. This segmentation proposes lower manufacturing costs, shorter production times, and shorter wait times in operations. In manufacturing systems, adaptive robots are particularly beneficial throughout the design, manufacture, and assembly phases. As an example, allocated tasks are broken down into smaller subproblems, which are then assembled into a series of modules to address each subproblem. Integration of the modules is required at the end of each subtask to arrive at an optimal solution. Co-evolutionary robots, which are energetically independent and have scenario-based thinking and reaction-focused operating principle, are one of the sub-technologies underlying adaptive robots.

Embedded systems, also known as Cyber-Physical Networks (CPS), are a type of technology that helps to organize and coordinate networking systems between physical infrastructure and computing capabilities (Ustundag & Cevikcan, 2018). In order to achieve decentralized actions, physical and digital tools should be merged and connected with other devices. Embedded systems are systems that combine physical reality with novel features such as computation and communication infrastructure.

An embedded system must meet two main functional requirements, advanced networking to provide real-time data processing from the physical infrastructure as well as information feedback from the digital structure, and intelligent data processing, decision-making, and computational capability to support the physical infrastructure (Ustundag & Cevikcan, 2018). RTLS technologies, sensors, actuators, controllers, and a networked system that transforms and transfers data or information from every device are used in embedded systems for this purpose. In terms of using computational intelligence supported by learning methodologies such as case-based reasoning, information acquisition can be obtained from data processing and data gathering.

Additive manufacturing is a group of new technologies that uses an additive method to create three-dimensional objects directly from digital models, primarily by storing and combining the products with appropriate polymers, ceramics, or metals (Ustundag & Cevikcan 2018). Additive manufacturing begins with the creation of computer-aided design and modeling, which organizes a collection of digital features for a product and sends descriptions of the products to industrial

machinery. By adding material layers, the machines use the sent descriptions as blueprints to create the item. The layers, which are measured in microns, are repeatedly added until a three-dimensional object is formed. Plastics, other polymers, metals, and ceramics are common raw materials. They might be in the form of a liquid, powder, or sheet. In this regard, additive manufacturing is divided into two parts, software for creating 3D objects and material procurement.

Although there are hurdles to present technologies, particularly in production processes, 3D printers and additive manufacturing have unequaled properties. For example, for some products, additive manufacturing procedures outperform traditional manufacturing mechanisms, such as molding previously inconceivable geometries like pyramidal lattice truss systems (Ustundag & Cevikcan, 2018). The printing technique reduces waste by just using the resources that are required. A networked system that includes ordering and injection molding selection is also required to monitor process variables and parameters on a specific interface. Customer needs are included in the manufacturing design, and the necessary components for the manufacture of these plastic parts are obtained ahead of time. The metal blades are encased in the injection molding machine, and the design features information system combines the individual design process phases with correct additive manufacturing system operations. In addition, a laser-marking phase is used in the manufacturing process.

Another important topic for the contribution of networked system integration in the Industry 4.0 revolution is cloud-based operation. Cloud computing and cloud-based manufacturing and design are both included in the term cloud (Ustundag & Cevikcan, 2018). Cloud manufacturing refers to the coordinated and networked production that makes products accessible on demand. Demand-based manufacturing creates and operates reconfigurable cyber-physical manufacturing processes by bringing together a collection of distributed manufacturing resources. The primary goal is to improve efficiency by lowering product lifecycle costs and enabling optimal resource utilization by dealing with fluctuating demand customer-focused projects. Cloud-based design and manufacturing operations suggest integrated and collaborative product development models based on open innovation through social networking and crowd-sourcing platforms (Ustundag & Cevikcan, 2018).

Virtualization technologies are based on augmented reality (AR) and virtual reality (VR) tools, which are defined as the integration of a computer-supported reflection of a real-world environment with additional and useful data (Ustundag & Cevikcan, 2018). Virtual information can be included into real-world presentations with the goal of enhancing human perceptions of reality through the use of augmented items and features. Existing VR and AR applications do this by associating graphical interfaces with the user's current environment view. Users can directly influence visual representations of elements by performing instructions on the screen and interacting with these menus referenced by ad hoc feedbacks, which is the primary job of graphical user interfaces.

Visualization technologies must meet four functional requirements, scene capture, scene identification, scene processing, and scene visualization (Ustundag and Cevikcan 2018). For implementation, handheld devices, stationary visualization systems, spatial visualization systems, head mounted displays, smart glasses, and smart lenses are used. Key issues for the adaption of visualization scenarios, on the other hand, include providing a realistic environment for a better user experience, adding important information via meta graphics, and enriching users' perception through color saturation and contrast. Approaches for visualization technologies' displays

are based on three foci, video-based adaptation, which uses the camera to aid enhanced information, optical adaptation, in which the user provides information by wearing a specific display, and projection of mentioned items (Ustundag & Cevikcan, 2018).

Various types of simulation, such as discrete events and 3D motion simulation, can be used to improve product or process planning in a variety of situations. For instance, simulation can be used in product development, testing, and optimization, as well as in the development and optimization of manufacturing processes and facility design and improvement (Ustundag and Cevikcan 2018). In the context of Industry 4.0, simulation can be viewed as a useful tool for tracking the effects of various parameter changes and facilitating visualization in decision-making. Simulation tools can be utilized in conjunction with other Industry 4.0 basic technologies.

Communication and networking can be characterized as a link between individually defined physical and dispersed systems (Ustundag & Cevikcan, 2018). Machines can interact via communication tools and devices to achieve predetermined goals, with a focus on embedding intelligent sensors in real-world settings and processes. Distributed computing and parallel computing for data processing, Internet Protocol (IP), communication technology, embedded devices such as RFID tags or Wireless Sensor Networks (WSN), and application are the major needs for communication and networking (Ustundag & Cevikcan, 2018).

Industry 4.0 transformation necessitates extensive data collection and processing. As a result, the security of data storage and transfer protocols is a critical issue for businesses. Regarding data exportation technologies' security, privacy regulations and standardization of communication protocols, personal authorization level for information sharing, and detection and reaction to unexpected changes and unauthorized access by standardized algorithms, security should be provided in both cloud technologies, machines, robots, and automated systems (Ustundag & Cevikcan, 2018).

5. INDUSTRY 4.0 MATURITY MODELS

A maturity model or framework is a structured approach designed to support companies moving toward Industry 4.0 by providing comprehensive guidance on how to initiate a roadmap. The term maturity is used to define, evaluate, and form guidelines and a basis for evaluating an organization's progress. The purpose of a maturity model is to describe the level of the perfectness of an entity, such as a new business model or newly developed software. The main idea of a maturity model is to identify maturity levels associated with different aspects of an organization's progress in achieving performance.

According to Suh et al. (2017), an organization's maturity, which indicates its ability to plan, use, and control information systems internally, is considered an important consulting factor for business success (Bandara et al., 2019). They proposed a maturity framework to assess the maturity level of information systems. The framework consists of three main dimensions, such as information system quality success, information system utilization success, and information system utilization success. The first dimension, information systems quality success, is weighted by system quality, information quality, and service quality. The second dimension, success in using information systems, is weighted based on usage and user satisfaction. The third dimension, the effectiveness of information systems, is measured in terms of operational excellence and strategic positioning (Bandara et al., 2019).

An assessing digital transformation maturity model is needed to help companies define their digital transformation strategy. A maturity model is a tool used to measure and evaluate an organization's maturity. It can be used to identify processes and procedures that are ready to be executed. Readiness models as synonyms are intended to capture the starting point and allow to start of the development process. This distinction between readiness and maturity pertains to the various stages of a maturing process. Readiness assessment takes place before engaging in the maturing process whereas maturity assessment aims for capturing the as-it-is state whilst the maturing process. In the production domain, recent readiness and maturity models have been proposed for example in energy and utility management, in eco design manufacturing. Below are the following models and tools for assessing readiness or maturity (Schumacher et al., 2016).

The concept of the *IMPULS – Industry 4.0 Readiness Model* is based on a comprehensive data set and offers details of various dimensions and items. The model is well-documented, and its results are explained transparently. Other approaches listed in Figure 10 provide only a limited overview of the development process and do not provide a base for comparison. Industry 4.0 Maturity Model aims for an extension of existing models and tools through its strong focus on organizational aspects (Schumacher et al., 2016). Schumacher et al. (2016) propose a model to gain solid data about the current state of manufacturing companies in order to understand industry 4.0 strategies to extract potential success factors. This model presents a set of 62 key maturity items that are grouped into nine main company dimensions. The objective is to provide a conceptual framework for analyzing the various dimensions of Industry 4.0. It helps assess an organization's Industry 4.0 maturity and reflects the suitability of its current strategy. The model consists of nine dimensions, four of which serve as basic drivers and the rest as organizational drivers. The nine dimensions are product, customer, operations, technology, strategy, leadership, governance, culture, and people. These dimensions are weighted according to six factors including use of the Industry 4.0 roadmap, availability of resources, communication and documentation of Industry 4.0 activities, suitability of the business model, digital transformation strategy, and alignment of Industry 4.0 with the corporate vision. Maturity for each dimension is calculated using a weighted average so that the overall maturity level of the organization is represented in a radar chart (Schumacher et al., 2016).

To the evolution path, each item undergoes five maturity levels. The first level involves a description of the lack of attributes that support the concepts of Industry 4.0 and level 5 represents the state-of-the-art of required attributes. Measuring, determining, and representing the enterprise's maturity follows a three-step procedure: measurement of maturing items in enterprise via questionnaire, input of calculation of maturity level in nine dimensions software supported and output of representation and visualization of maturity via maturity report and radar charts.

The evaluation of maturity is carried out using a standardized questionnaire that consists of one closed-ended question per item. The answer type is Likert-scale, reaching from 1 *not distinct* to 5 *very distinct*. The objective is to find out respondents that have basic knowledge regarding Industry 4.0. The answers to the questions serve as data input to the model and determine the maturity level.

Several models have been developed to assess an organization's maturity in industry 4.0, with the majority of the models focusing on the manufacturing sector. As a result, the maturity models' application to the service sector is quite limited.

Despite the fact that there are numerous maturity models, there is still room for improvement in order to best fit the chosen business. A maturity model, also known as a framework, is a

structured method that was created to help organizations navigate the industry 4.0 journey by giving thorough assistance. The term maturity is used to define, measure, and create a framework for analyzing a company's progress. A maturity model consists of major characteristics that must be evaluated in order to measure an organization's maturity in the adoption of a new business model or software system. As a result, it has a variety of maturity levels.

The majority of models have numerous maturity stages, but most of them do not focus on the features that must be addressed at each level in order for the organization to continue to improve. To comprehend the maturity level of industry 4.0 and increase performance to the next maturity level, it is necessary to analyze how an organization operates under each facet of the maturity assessment model.

Even if organizations compromise advanced technologies to redesign their operations in order to benchmark with world-class performance, sustainability is important. Because Industry 4.0 is still in its development, it's critical to outline the structure and technique of implementation guidelines explicitly. As a result, there is a need to advise enterprises that are transitioning to smarter operations in order to improve their capabilities.

6. CONCLUSION AND FUTURE RESEARCH

Industry 4.0 had an impact on employment, consumption, and trade, among other things. It was demonstrated how Industry 4.0 can benefit a company's financial performance and stock returns. Increased product connectivity helps organizations enhance their manufacturing efficiency and profitability.

Manufacturing organizations are unable to determine their Industry 4.0 maturity level, according to the findings of this paper. This is due to a lack of tools and terminology that can assist them in evaluating their digital transformation efforts. Enterprises can assist themselves evaluate their success and build effective strategies and practices by using evaluation frameworks and models. To assist companies in defining their digital transformation strategy, it is required a digital transformation maturity model.

The aim was to analyze the impact of technological applications on operations management. The paper defined operations management and examined some of its business applications.

The goal is to assist businesses in developing their capabilities so that they can take advantage of the opportunities given by Industry 4.0.

Organizations must assess the maturity of industry 4.0 in order to identify present capabilities as well as prospects for possible continual improvements. As a result, developing a maturity model for the optimal fit is critical.

Operations Management necessitates an investigation into the major components and sectors of a business, such as procedures, models, and strategies. A number of operations strategies have been found to have a significant and beneficial impact on organizational performance. The appropriateness of an individual strategy or a mix of methods that may benefit a given industry is one of the areas of future research. It is advised to conduct a study on the impact of digital transformation and its application in industrial operations management.

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Impact of the Ukrainian Crisis on Investments in Online Market in Slovakia

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Abstract: *This article provides a comprehensive analysis of the impact of the Ukrainian crisis on investments in marketing and the online market in Slovakia, in the context of the largest military conflict in Europe since World War II. Given the changing perception of normality in society and the significant impact of economic sanctions against Russia by the EU and the US on the global macroeconomic picture, the paper focuses on the Slovak online market as a relevant case study.*

The article first examines the current state of the online market in Slovakia and the influence of political and economic factors on its development. It is analyzed how economic sanctions and geopolitical tensions, directly and indirectly, affected the business of Slovak companies in various segments.

In the second part of the paper, the needs and opportunities for the improvement of the online market in Slovakia are reviewed, taking into account the current challenges and uncertainties.

As the main goal of this work, the author wants to show how the current crisis, caused by the events in Ukraine, can be successfully overcome by adapting the market to the new rules of business, using the experience and knowledge gained during the crisis years during the Covid-19 pandemic. The paper ends by summarizing the key conclusions and provides recommendations for further development of this topic, to encourage experts, researchers and decision-makers to work together to solve the challenges brought about by the Ukrainian crisis.

1. INTRODUCTION

Thanks to the increasing penetration of the internet and the widespread use of smartphones and other digital devices, the online market in Slovakia has experienced significant growth over the past few years. This growth has led to a shift away from traditional media, such as print newspapers and magazines, towards digital media consumption.

The media market in Slovakia can be described as a collection of all existing and potential customers who purchase certain products and services. An industry represents a group of companies that provide a product or category of products that are close substitutes. This includes all products and services offered on the market (Kotler, 2004).

Slovakia's online media market is characterized by a combination of local and international subjects, including news portals, social media and digital marketing agencies. The main Slovak news portals are SME.sk, Aktuality.sk, Denník N, TVNoviny.sk and Topky.sk which offer a mix of general news, sports, entertainment and lifestyle (IABmonitor, Gemius Audience, 2022). Besides them, there are also international platforms like Google, Facebook and YouTube – which also have a significant presence in the market.

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Digital advertising is becoming more and more important in Slovakia, as companies recognize the potential for targeting specific groups and measuring the effectiveness of their campaigns through online platforms. Digital marketing agencies in the country offer a variety of services such as search engine optimization (SEO), social media marketing, content marketing, and pay-per-click advertising.

However, since the beginning of the crisis in Ukraine, the online market in Slovakia is also facing challenges, such as the spread of misinformation and fake news on social media platforms. This has led to an increased emphasis on media literacy and the importance of promoting reliable sources of information. One of the biggest challenges for the online market in Slovakia, but also in the whole world, was the crisis caused by the Covid-19 pandemic, which has not yet ended, and we already have a crisis caused by the events in Ukraine. The current events in Ukraine can be called a humanitarian disaster that has a noticeable negative impact on both the Slovak and European economies and brings an increased level of uncertainty (Národná banka Slovenska, Vojna a dopady na ekonomiku, 2022).

The beginning of 2022 was a challenging period for employees in positions of marketing experts. On the one hand, companies exerted significant pressure on the suspension of communication, i.e. the reduction of investment in advertising. On the other hand, marketers were faced with the imperative of finding the most effective methods and channels of communication to ensure the survival of companies while minimizing losses in the market. In this context, the analysis of adaptation and innovation in marketing strategies provides a deeper insight into the evolution of the industry and contributes to the understanding of the key factors for success in turbulent times.

2. RESEARCH GOAL

The primary goal of this research is to demonstrate the potential for market development even in the context of a global crisis, such as the largest military conflict in Europe since the end of World War II. This paper was written to contribute to the development of this topic in the European context. To achieve such a goal, it is necessary to clarify concepts, research successful examples from practice on the Slovak market, present solutions and provide recommendations for future market development.

The research goal of this paper is to analyze the current state of the market and the factors that affect the entire online market in Slovakia. Also, this paper intends to examine the obstacles, needs and potential opportunities arising from a quick reaction and adaptation to market demands in the crisis that has affected the whole world, and especially Europe.

Hopefully, this analysis will serve as a basis and stimulus for the development of new strategies that will be applied and later implemented in practice. Along with summarizing the conclusions and recommendations, this research aims to contribute to encouraging further development of this topic in an academic context.

3. METHODS AND METHODOLOGY

The research presented in this paper was carried out using a wide range of scientific methods and procedures. In the first part, I analyzed the current state of the market in the period from

the first half of 2021 to the first half of 2022, using data obtained from the company IAB Slovakia (2022). Additionally, statistical data publicly available on the official website of the National Bank of Slovakia was analyzed. In this research, a joint study carried out by ČSOB bank and the research agency Datang was also analyzed.

The methodology includes the identification of research assumptions, as well as the methods and sources used in the work. The results were obtained as part of the main analysis through comparative and descriptive analysis. Based on this, a list of recommendations has been compiled that can be useful for future research and development on this topic.

4. THEORETICAL BACKGROUND

The media space (traditional media) plays a key role in our daily life. Apart from the media space, we must also take into account the cultural space as a symbol of the social environment, and the cyberspace that includes new digital and mobile media, including platforms and virtual space. All these spaces influence the type of information we will encounter, and the way we will spread, store and apply it. The media space affects the distribution of information to individuals and the way they interpret it, while the social and cultural space functions as a virtual gateway that allows access to information (Šoltésová, 2016).

In the first half of 2022, the Slovak online market amounted to about 87 million euros. When compared to the same period of the previous year marked by the Covid-19 pandemic, a 10% increase was recorded (IAB, Výdavky do internetovej reklamy za polrok, 2022).

Table 1. Spending in online advertising 1HY 2021 vs 1HY 2022

Ad Format	1HY 2021	1HY 2022	% Change
Non video display	30 256 737 €	31 331 893 €	3,60%
Paid for search	17 550 986 €	19 306 085 €	10,00%
Video display	16 027 187 €	16 715 979 €	4,30%
Classifieds and directories	9 290 618 €	11 706 740 €	26,00%
Native	4 103 694 €	4 568 782 €	11,33%
Other	1 463 121 €	3 264 653 €	123,13%
- affiliate advertising	N/A	1 900 128 €	N/A
- digital audio advertising	425 283 €	744 481 €	75,00%
TOTAL:	**78 692 343 €**	**86 894 132 €**	**10,42%**

The growth achieved in the Slovak market in the first six months of 2022 can be considered satisfactory, especially taking into account the forecasts for the European market. If we consider the geopolitical situation in the world, the military conflict in Ukraine has brought uncertainty to the entire European region, which means that companies are becoming more cautious when it comes to investing in marketing. As a result, we have a slowdown in the growth of investments in online advertising. The reason for the slower growth of advertising in Slovakia is the reduced advertising budgets of the state administration, the significantly lower growth of multinational companies compared to the previous period and the saturation of the market with video advertising by Slovak media companies. In order to increase publishers' income, it is necessary to provide additional media space. However, its production and/or implementation can be relatively expensive. It is assumed that this will be the biggest challenge for Slovak publishers in the future, considering that video advertising is globally considered a key factor for the potential growth of the overall online market.

From the table, we can see that different formats contributed to the overall growth of the market in the first half of 2022. Formats such as Classifieds and directories with an increase of 26%, search with an increase of 10% and native advertising with an increase of 11% contributed the most to this growth. In terms of percentages, the highest growth was recorded by audio advertising, as much as 75%, but in absolute numbers, it still did not exceed the figure of 1 million euros per year. If we look at display advertising, here we have a growth of 3.60%, which is the lowest recorded growth of all formats, however, in absolute numbers, display advertising has the largest share in online advertising.

5. EXAMPLE

85% of entrepreneurs in Slovakia felt the consequences of the war in Ukraine

The research, the consequences of the war in Ukraine felt by 85% of entrepreneurs in Slovakia, was carried out by the company ČSOB Bank and the research agency Datank in a representative survey where 300 companies of different sizes were included (ČSOB, 2022).

In the aforementioned analysis, only 15% of companies did not feel the consequences of the conflict in Ukraine on their business. In contrast, more than 50% of companies expressed a moderate to severe impact of the war on their business.

Among the surveyed industries, the transport and warehousing sector was the most affected, where only 9.1% of the surveyed representatives managed to continue their activities, while the other 36.4% reported very significant negative effects. Entrepreneurs in the field of agriculture, forestry, fishing, as well as accommodation and hospitality services also critically assess the situation. On the other hand, companies operating in the IT and communications sector reported the least consequences, which is expected given the nature of their activities.

6. CONCLUSION AND RECOMMENDATIONS

This paper aimed to review the current state of the online market in Slovakia. The overall economic and geopolitical events in the world also have an impact on the development of the online market in the Slovak Republic. The current situation has been reflected in the change in consumer behavior and the increased focus on corporate social responsibility. In order for companies to successfully face these challenges, it is necessary to adapt marketing strategies to new market conditions, take advantage of innovations and develop the credibility of their campaigns. In the future, the development of investments in online advertising in Slovakia will depend on several factors, including the stabilization of the geopolitical situation and the ability of companies to adapt to new market conditions.

During the research and analysis of data from available sources, I concluded that the online market did not behave in accordance with the expectations that there would be an assumed drop in income. On the contrary, the growth of the online market in Slovakia since the beginning of the crisis in Ukraine in the first half of 2022 compared to the same period in 2021 was recorded as much as 10.42%.

If we analyze the research conducted jointly by ČSOB Bank and the research agency Datank, we come to know that in the first months of the crisis in Ukraine, the state did not adequately

and timely respond to all challenges and provided adequate financial assistance to companies. This led to a situation where as many as 85% of companies felt the consequences in their operations due to poor engagement or rather non-engagement of the state.

Based on the conducted analysis, I would like to propose several key steps that are of crucial importance for the continued growth of the online market in Slovakia. It is recommended that the Government of the Slovak Republic intensify communication with small and medium-sized enterprises, providing timely financial support or various tax incentives. Such measures can significantly contribute to the improvement of the entire online market in the country.

One of the most important recommendations is that the entire segment of the online market should focus more on local companies in this year of crisis, and with that help local companies to invest more money in advertising, which would probably lead to an even greater increase in the online market in Slovakia.

Based on previous experiences with various crises, which arose as a result of the COVID-19 pandemic, I recommend that leading companies in Slovakia engage and support the development of the local online market. To achieve this, companies should redirect part of their advertising budgets, otherwise allocated to global platforms such as Facebook, Google and YouTube, to local media companies, which would encourage the expected growth of the overall market.

I hope that this paper will serve as an incentive and inspiration for the development of new strategies, plans, and contribute to further progress in the research on this topic.

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A Contribution to Analysis of the Space Productivity in a Seaport

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Abstract: *After the general theoretical introduction on port development trends, space productivity is taken into consideration in this paper. As an object of research is selected open storage area at the Dry Bulk Cargo Terminal in the Port of Bar (Montenegro). Some of the group of basic operational features of the Dry Bulk Cargo Terminal are taken into consideration. Based on data series on cargo quantities stored within the open storage area at the Dry Bulk Cargo Terminal, from the period from January 2014 to July 2022, related utilization rates are calculated. In that context, the intensity of the influence of different subjects (port terminal operator, exporter/importer, etc.) on port space productivity is analyzed. The principal direction of actions aiming to increase space productivity at the Dry Bulk Cargo Terminal in the Port of Bar (Montenegro) is identified, too.*

1. INTRODUCTION

Seaports play a role of utmost importance and act as an incentive for the development of the national economy in general (Nguyen, 2020).

The importance of seaports for countries cannot be underestimated. Ports work to encourage all industries so that they can export them to countries abroad and also works to open new businesses and projects (https://tijaratuna.com/en/importance-of-seaports/).

Ports must be agile and flexible to be able to quickly respond to rapidly changing economic, geopolitical and environmental realities (ESPO, 2022). Also, ports are important for the support of economic activities in the hinterland since they act as a crucial connection between sea and land transport (https://www.vliz.be/projects/sail/fiches/10.pdf).

According to Deloitte Global Port Advisory (2020), key development trends in the port sector in the time horizon to 2030 are Space productivity; Waterfront redevelopment; Reshoring of industries; Port infrastructure; Changes in supply and demand; Impact on trade; More technological solutions; More cyber risk; Less focus on physical infrastructure investments; Overcapacity; Niche markets; Shift from big, bigger, biggest to green, greener, greenest; Sustainability; Shorter trade routes; Increased trade; New resources; A physical trade platform; Impact on Maritime trade; Technology as a competitive advantage; Sustainability as a competitive advantage; Collaboration between carriers; Collaboration at ports.

Ports are crucial for the European transport business, for Europe's competitiveness, and have a huge potential for job creation and investment. There is a forecast: a 50% growth of cargo handled in European Union ports is predicted by 2030. The European Commission has estimated that by 2030 between 110 000 and 165 000 new jobs can be created in ports (European Commission, 2013).

[1] Port of Bar, Obala 13. jula 2, 85 000 Bar, Montenegro

The major challenges facing ports are (European Commission, 2013): High predicted growth, a structural performance gap in Europe, the changing nature of shipping (the size and the complexity of the fleet are increasing, deployment of bigger vessels for short sea shipping and feeder services, recent trends in logistics and distribution systems attract more value-added services within a port's area, energy trades are changing).

Pre-existing megatrends – generators of port development – are (UNCTAD, 2021): geopolitical, technological, and environmental.

In addition, in references (PTI, 2021; Piernext, 2022) is stated that the starting point of the maritime traffic study in Europe in the 2040 Horizon has been to identify the trends which have the highest degree of consensus: economic trends, environmental trends, social trends, trends linked to supply chains, such as the increasing appearance of global disruptions; the development of electronic commerce and circular economy or the role additive printing or autonomous transport can take, trends in maritime transport, mainly the development of mega-ships.

2. SPACE PRODUCTIVITY

Space productivity, according to Deloitte Global Port Advisory (2020), is related to the shortage of space in the existing urban ports. Innovation and automation can contribute to increasing efficiency, i.e. by raising berth and terminal occupancy. It is therefore expected that technological developments will increasingly be used to tackle the challenges of space scarcity.

On the other hand, in (ESPO, 2022) is recognized that the scarcity of available port land enlarges the case for port cooperation. In considering how best to accommodate increasing trade demand, in (https://www.portvancouver.com/projects/) is given an example of a business objective: Making the best and most efficient use of existing land and facilities.

One of the key components of the space in a port is an open storage area, for different cargo types (dry bulk cargoes, general cargoes, containers, ...). Taking open storage area for dry bulks as a topic of further consideration, it can be said that, in general, the capacity of an open storage area for storing dry bulk cargoes, C (t), is a function of the following parameters: net size of the area, P_n (m^2), storing height, h_i (m), the specific density of dry bulk cargo stored, ρ (t/m^3), coefficient of the storage volume utilization, k. It can be interpreted by the following relation:

$$C = f(P_n, h_i, \rho, k) \quad (1)$$

Quantity of cargo stored at any moment, v, on the open storage area, Q_t (t), can be defined based on the following equation:

$$Q_v = q_0 + [(\Sigma q_{jt} + \Sigma q_{kw} + \Sigma q_{ls}) - (\Sigma \delta_{mt} + \Sigma \delta_{nw} + \Sigma \delta_{os}) \quad (2)$$

Where:

q_0 (t) – initial cargo quantity stored;
q (t) – quantities transported to an open storage area by trucks, wagons, ships, in a certain period;
δ (t) – quantities delivered from an open storage area by trucks, wagons, ships, in a certain period;

Maximal dry bulk cargo quantity stored, Q_{max} (t), in open storage area is a maximum of quantities of stored cargo, Q_v (t) (according to equation (2)), which can be interpreted as follows:

$$Q_{max} = g(Q_{v1}, Q_{v2}, ..., Q_{vp}, ..., Q_{vr}) \quad (3)$$

Space productivity of an open storage area, S_p (t), related to dry bulk cargoes, in one of possible variants, could be defined as dry bulk cargoes quantities passed through that area for a certain period, V (h), as given by the relation (4):

$$S_p \text{ (t/period of time)} = f[\Sigma(q - \delta)_v, Y_x) \quad (4)$$

Where:

$\Sigma(q - \delta)_v$ – cargo quantities stored (for all cargo types);
Y_x (h) – storing period of each cargo type, x;

3. A RESEARCH ON THE SPACE PRODUCTIVITY OF THE OPEN STORAGE AREA AT A DRY BULK CARGO TERMINAL

In this paper segment are shown results of research on space productivity of the open storage area at the Dry bulk cargo terminal in the Port of Bar (Montenegro).

3.1. Object of Research

The object of research is the open storage area (its space productivity) at the Dry bulk cargo terminal in the Port of Bar. Some of the group of basic operational features of the Dry Bulk Cargo Terminal in the Port of Bar are systematized in Table 1. The total size of the open storage area is area: 27,845.1 m^2 (length x width (m) = 556,90 x 50 m); the dimension of 26 m corresponds to the maximum outreach of the gantry cranes towards the open storage area, as well as the outreach of the mobile harbour cranes in relation to their optimal positions towards the line of the key.

3.2. Objective of Research

The objective of the research has the following components: **to define** the utilization rate of the open storage area at the Dry bulk cargo terminal in the Port of Bar (related to storing volume); **to define** parameters that determine space productivity of the open storage area at the Dry bulk cargo terminal and analyzing their variations over the time; **to identify** the intensity of influence of different subjects (port terminal operator, exporter/importer, ...), participating in the supply chain realization, on space productivity; **to define** principal directions of actions aiming to increase space productivity at the Dry bulk cargo terminal in the Port of Bar;

3.3. Research Methodology

Basic elements of the research methodology, adjusted to the object of research, are given in Table 2.

Results of the Research

Due to the limited volume of this paper, in further parts will be shown results of the research R_2 and R_4 (as per elements of Table 2.).

Table 1. Operational features of the Dry Bulk Cargo Terminal in the Port of Bar

Berth		(1)	01
Berth length (m)		(2)	185,63
Water depth (m)		(3)	14,00
Ship draft (m)		(4)	12,80
Availability of the shore port machinery	Yes	(5)-1	*
	No	(5)-2	
Type of the port machinery		(6)	Ship to shore gantry cranes (3 pcs.), SWL: 12 t, rail mounted, movable by all three berths; outreach to open storage area: 26 m;
Cargo types which can be handled (LB – Liquid bulks; DB – Dry bulks; G – Lo-Lo - General Lo-Lo; C – containers Lo-Lo; G - Ro-Ro – General Ro-Ro;	LB	(7)-1	
	DB	(7)-2	*
	G Lo-Lo	(7)-3	*
	C	(7)-4	
	G Ro-Ro	(7)-5	
Cargo handling operations – ship to shore (and vice versa) (sum of possible handling operations)		(8)	Dry bulks: Ship to shore-open storage area/truck/wagon (and vice versa); ship to silo (and vice versa) (8); General Lo-Lo: ship to shore-open storage area-distant close warehouse/truck/ wagon (and vice versa) (8);
Availability of open storage area behind the berth		(9)	Yes. Dimensions: 185,63 x 50,00 m

Table 1. - continuation

Berth		(1)	02	03
Berth length (m)		(2)	185,63	185,63
Water depth (m)		(3)	14,00	14,00
Ship draft (m)		(4)	12,80	12,80
Availability of the shore port machinery	Yes	(5)-1	*	*
	No	(5)-2		
Type of the port machinery		(6)	Mobile harbour crane Liebherr LHM420 (on rubber tyres); SWL: 124 t; maximal outreach: 48 m; Mobile harbour crane Liebherr LHM550 (on rubber tyres); SWL: 144 t, maximal outreach: 54 m; Remark: by these two berths can be used and gantry cranes installed by the berth 01.	
Cargo types which can be handled (LB – Liquid bulks; DB – Dry bulks; G – Lo-Lo - General Lo-Lo; C – containers Lo-Lo; G - Ro-Ro – General Ro-Ro;	LB	(7)-1		*
	DB	(7)-2	*	*
	G Lo-Lo	(7)-3	*	*
	C	(7)-4	*	*
	G Ro-Ro	(7)-5		
Cargo handling operations – ship to shore (and vice versa) (sum of possible handling operations)		(8)	Containers: ship to shore-open storage area/truck/wagon (and vice versa) (6) Liquid bulks: Ship – reservoir (1); Dry bulks: Ship to shore-open storage are/ truck/ wagon (and vice versa) (6); General Lo-Lo: ship to shore-open storage area-distant close warehouse/truck/wagon (and vice versa) (8);	
Availability of open storage area behind the berth		(9)	Yes. Dimensions: 185,63 x 50,00 m	Yes. Dimensions: 185,63 x 50,00 m

Source: Author, based on Port of Bar, 2022.

Table 2. Elements of the research methodology

Methodology phase, PH_i	Expected result, R_j
PH_1: An analysis of cargo quantities stored within open storage area at the Dry bulk cargo terminal for the period from January 2014 to July 2022, per cargoes types and in total;	R_1: Quantities (data series) of cargoes stored within open storage area at the Dry bulk cargo terminal , per cargoes types and in total, for the period from January 2014 to July 2022;
PH_2: Calculation of utilization rate of the open storage area at the Dry bulk cargo terminal for the period from January 2014 to July 2022; identifying principal influential factors on the utilization rate values;	R_2: Utilization rate of the open storage area at the Dry bulk cargo terminal for the period from January 2014 to July 2022; influential factors on the utilization rate;
PH_3: Identifying intensity of influence of different subjects (port terminal operators, exporter/importer, ...), participating in the supply chain realization, on space productivity at the Dry bulk cargo terminal;	R_3: Intensity of influence of different subjects, participating in the supply chain realization, on space productivity at the Dry bulk cargo terminal;
PH_4: Defining principal directions of increasing space productivity at the Dry bulk cargo terminal;	R_4: Principal directions for increasing space productivity at the Dry bulk cargo terminal;

Source: Author

Result 2 – A) Utilization rate of the open storage area at the Dry bulk cargo terminal for the period from January 2014 to July 2022

In table 3 are given the results of analyses of the utilization rate of the open storage area at the Dry bulk cargo terminal for the period from January 2014 to July 2022 – it's variant related to the utilization of available storing volume. Basic values of the utilization rate, k_1, are calculated based on the input parameters recognized in the process of analyzing performances of the open storage area at the Dry bulk cargo terminal (Table 1).

Volumes per cargoes types are calculated according to the following equation:

$$\text{(volume per cargo type) } [m^3] = \text{(cargo quantity stored) } [t] / \text{(specific density of cargo) } [t/m^3] \quad (5)$$

Calculated available volume 1 is defined based on the following values of parameters: open storage area dimensions – length x width (m) = 556,90 x 50 m; up to a part of the storage area width of 26 m, storing at a height of 8 m, at the remaining part of the open storage area, of 24 m width, storing at height of 4 m.

In order to establish bases for conclusions on the simultaneous influence of characteristics of open storage area and used port machinery–implemented cargo handling technology, in Table 4. are presented calculated values of utilization rates k_2 and k_3.

Calculated available volume 2 is defined based on the following values of parameters: open storage area dimensions – length x width (m) = 556,90 x 50 m; up to a part of the storage area of 26 m width, storing at height of 10 m (comparing with variant 1, height is increased for 2 m), at the remaining part of the open storage area, of 24 m width, storing at height of 6 m (comparing with variant 1, height is increased for 2 m).

Calculated available volume 3 is defined based on the following values of parameters: open storage area dimensions – length x width (m) = 556,90 x 50 m; up to a part of the storage area of 26 m width, storing at a height of 10 m (storing height remains the same as in variant 2), at the remaining part of the open storage area, of 24 m width, storing at height of 10 m (comparing with variant 2, height is increased for 4 m).

Table 3. Utilization rate of the open storage area for the period from January 2014 to July 2022

date	(1)	2014, 1 January	2014, 1 April	...	2022, 1 July
Volume 1-C1-bauxite;density (t/m3) [18]: 1,7t/m3	(2)	2,223.01	2,223.01		56,343.91
Volume	(3)	1,482.00	1,482.00		37,562.61
Volume	(4)	8,920.18	2,443.33		0.00
Volume 4-C4-salt; density (t/m3) [19]: 1,05t/m3	(5)	0.00	0.00		705.41
Volume 5-C5-petrocoke; density (t/m3) [20]: 0,44t/m3	(6)	0.00	0.00		0.00
Volume 6-C6-iron ore; density (t/m3) [18]: 2,2t/m3	(7)	0.00	0.00		0.00
Total volume (m3)		13818.79	7163.19		63133.56
Calculated available volume (m3)	(9)	169,297.60	169,297.60		169,297.60
Utilization rate, k1	(10)=(8)/(9)	0.08	0.04		0.37

Source: Author

Table 4. Values of utilization rates k_2 and k_3

date	Total volume (m^3)	Calculated available volume 2 (m^3)	Calculated available volume 3 (m^3)	K2	K3
2014, 1 January	13818.79	224,987.60	278,450.00	0.06	0.05
2014, 1 April	7163.19	224,987.60	278,450.00	0.03	0.03
...					
2022, 1 July	63133.56	224,987.60	278,450.00	0.28	0.23

Source: Author

Result 2 – B) influential factors on the utilization rates values

Taking into account the results of analyses shown in tables 3. and 4., the following key groups of influential factors on utilization rates values, k_i, can be defined: **cargo characteristic** (specific density, angle of repose, ...); **parameters which characterize implemented cargo handling and storing technology** (type of port machinery, SWL of used port machinery, positional flexibility of used port machinery, an outreach of used port machinery, etc.); **parameters which characterize open storage area** – the existence of elements which contribute to increasing utilization of available storing volume (e.g. reinforced concrete blocks);

Result 4 - Principal directions for increasing space productivity at the Dry bulk cargo terminal

Respecting previously shown results of research, following principal directions of increasing space productivity of open storage area at the Dry bulk cargo terminal can be defined: **improving implemented cargo handling and storing technology** (introducing new port machinery with an increased level of technological adequacy; here is considered the necessity of analyzing investments justification, fully respecting, among other, port investment capability); **improving performances of the open storage area** – building elements which contribute to increased utilization of the available storing volume; **improving the level of coordination between subjects participating in the supply chain realization**;

4. DISCUSSION OF RESULTS

Only two cargo types – bauxite and scrap metal - were registered on all dates analyzed through the period from January 2014 to July 2021.

Utilization rate of the storage volume, k_1, ranges from 0.03 (October/2014 and October/2015) to 0.76 (January/2020).

Utilization rate k_2 is within the range of 0.02 (October/2014 and October/2015) to 0.57 (January/2020).

Utilization rate k_3 has values from 0.02 (October/2014 and October/2015) to 0,46 (January/2020).

The biggest stored cargo quantity (April/2021): 177,796.36 t does not correlate with the biggest utilization rate of the available storing volume (January/2020) which directly suggests that throughput structure (types of cargo handled and stored and their characteristics) of the port (terminal) has a significant influence on the space productivity – quantity passed through the certain area in the concrete period.

5. CONCLUSION

Optimization of space productivity in a seaport has to be one of the priority business objectives. It is determined by the general efforts to maximize available resources and potential utilization and to allow the biggest cargo quantities to pass through the concrete peace of space in a certain period.

In this paper were taken into consideration some elements on which space productivity is depending on (cargo characteristics, parameters that characterize implemented cargo handling and storing technology, parameters that characterize open storage area, and level of coordination between subjects participating in the supply chain realization). Demands related to space productivity are very relevant for the ports with limited available open storage areas and a lack of potential to expand it up to the necessary level. Among others, it is important to recognize the existence of a correlation between space productivity and overall throughput in a seaport.

The author plans to continue engagement in this field, being focused in the next phase on the research of mentioned correlation between space productivity in a seaport and the structure of its annual throughput.

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Elements of Food Security in the Current Geopolitical Context

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Abstract: *Given the current context - the health pandemic, the armed aggression of a state - the food security of the entire population of the globe is an essential element. Therefore, in this paper, and considering the most relevant and newest articles on food security in Romania and Europe, the authors will try to analyze the effects listed above, following which the problem of providing food to a growing population could be a problem with relentless considerations in the current environment, but also in the sustainability of this situation. Therefore, in the following, the authors will make an analytical approach to the studied ones and they will try to conclude what should happen in crises so that food security represents a landmark on the work agenda of the governors.*

1. INTRODUCTION

In the second half of century XX, the world economy experienced rapid development. Statistical and economic indicators reflect this economic progress. Development and economic policies have led to the gradual degradation of environmental factors, with the slow but sure destruction of ecological systems. If global management continues to be geared towards excessive production and consumption without complying with environmental protection regulations, climate change and disruption will be exacerbated.

The 21st century is an explosive one in terms of global population growth. In February 2022 it was 7.930.443.166 inhabitants. The population of the European Union in 2021 was 447,3 million citizens. For Governments, the challenge is to apply sustainable technologies that combine productivity with sustainable development. The EU advocates for food, social security and the health of its citizens. Its policy aims to promote protection measures against threats in various fields. Member States' policies need to be complemented and harmonized with EU policies, adapting their legislation in this regard, including in terms of food security. Food security policies are a security challenge in this area. It is a key component that must respond to social change in society, climate change and the growing needs of populations. Ensuring "sustainable development" and "sustainable consumption", which emerged as a concept at the 1992 Rio de Janeiro Environment Conference, are defining elements today. Man transforms renewable resources into non-renewable resources through the aggressive exploitation of the soil, water, flora and fauna.

Interventions made in nature through the use of inappropriate technologies can lead to irreversible effects. Soil and water are very important environmental resources of a country, which

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aggressively exploited can have an impact on the quality of the environment, but also on human health. According to data from the National Institute of Statistics, Romania has an agricultural area of 14,6 million ha, with 8,7 million ha of arable land and a dense hydrographic system, with 4.864 watercourses.

It is the 6th largest agricultural area among EU member states. Agricultural land is a national resource that must be protected and rationally exploited. Globally, in 2022 on 1.956.359 ha there were desertification and on 1.141.410 ha there were soil erosion phenomena. Agricultural overexploitation and pollutant emissions lead to a decrease in organic matter content and loss of biodiversity. Desertification is also gaining ground due to climate change. The principle of food sovereignty, sustainability and the ability to react in extreme cases were verified during the years 2020-2022 when the health crisis COVID-19 was a "test" that overlapped with the resulting economic crisis. Green agriculture and SMART agriculture are elements of sustainable development. In Romania, in 2020, only 470,000 ha were cultivated in an ecological agricultural system.

2. STRATEGIC AUTONOMY IN FOOD - AN OPPORTUNITY FOR THE EU

According to the European Commission, strategic autonomy is the EU's ability to make its own choices and shape the world around it through leadership and involvement, reflecting its interests and strategic values. This allows the EU to be stronger, both economically and geopolitically, by the following:

- is sustainable and responsible, taking the lead in the international arena in shaping a greener and fairer world, strengthening existing alliances and working with many partners;
- is open to trade and investment, which helps the EU economy recover from the crisis and remain globally competitive and connected;
- is able to take a stand against unfair and coercive practices and is ready to exercise its rights, while promoting international cooperation to address global issues.

Strategic food autonomy needs to be better defined with regard to food systems. We believe that the EU should be better prepared for future crises. Therefore, we believe that this should be part of the EU's recovery plan, for example through the use of "Next Generation EU" funds. To this end, strategic autonomy should be based on food production, labor and fair trade, with the general objective of ensuring food security and sustainability for EU citizens through fair, sustainable and resilient food supply chains. Amid the global crisis caused by the COVID-19 crisis, there is a glimpse of the economic crisis - the effect of this pandemic, as well as the global crisis that occurred as a result of the invasion of Ukraine by Russia. In this sense, the agri-food sector must ensure food stability and security as a strategic sector of Romania. The EU needs a system to prevent situations where, due to interdependencies, events such as power outages and network outages or cyber-attacks become uncontrollable. Examples include a city that has to be isolated for several weeks, a power outage that lasts for several days, a food company, or a retailer that is the target of a cyber-attack.

In order to improve adaptation mechanisms, it is necessary to develop existing food systems, while diversifying them, including business models for farm shops, urban agriculture, vertical agriculture and the approach based on local production for local needs in general, which means wider implementation of research and innovation results by farmers and cultivators, thus helping to minimize the risk of 'food waste' and specialization of production. At the same time, the benefits of an

efficient distribution system from farms to processing points and markets need to be strengthened. The population working in agriculture must be supported because the food of a nation is a priority, an indispensable good, and the agri-food sector is essential. The three types of crisis that have manifested themselves in the last 3 years have brought agriculture back to the forefront.

The Great Union (1918) brought to Romania an agricultural area of 6,5 million ha of agricultural land. After the First World War, "agriculture remained the most important branch of the economy. Although production per hectare for both, corn and wheat, was well below the European average, Romania, due to its large arable area, ranked first in Europe and 5th in the world in the production of corn and on the 4th and respectively 10th place in the production of wheat. Romania was in first place in the world in sunflower production (Gros, 2016). Globally, at present, "food demand has exceeded supply. First, supply is very low in Africa and other poor areas; second, climate change has shocking influences in Australia, Europe and other growing areas; third, part of food production was diverted to organic fuels; fourthly, the grain supply was not very large, the surplus was small, so prices exploded; fifthly, trade barriers for prices to rise in importing countries" (Sachs, 2018; Fox, 2011).

At present, some of these phenomena have emerged and there is a sharpening trend with the prospect of fighting for a new world order. According to specialized studies, climate change with possible temperature increases of 3^0-6^0 C by the end of the 21st century will lead to intensification of natural disasters, drought, sea and ocean level rises and conflicts over natural resources.

3. DIVERSIFICATION OF EU FOOD SYSTEMS

In the current geopolitical context, "Romania has a duty to convince the other EU partners that without solidarity and innovation, we cannot move forward. The European Union must pursue a policy designed to support farmers in providing goods and services to citizens" (I.E.R., 2019). The Common Agricultural Policy (PAC) plays a vital economic, social and ecological role. It should stabilize markets during crises while providing a safety net for farmers and processors and protecting the environment, labor, climate and animal welfare. The PAC plays a role in maintaining strategic production capacity, food security and sufficiency. The PAC needs reform. Green agriculture is a priority; in the wake of the armed conflict in Ukraine, an important goal is to increase agricultural production to supplement grain imports from Russia and Ukraine.

Romania entered the European Union with a large deficit in terms of productivity in agriculture; Romania's strengths were the resources that led to economic growth and stability.

Farms, fertile land and water are strategic assets and must be protected to some degree throughout the EU: they are the basis of our strategic food autonomy. By its geographical location and size, "Romania is a small state [...] that can benefit from its elites a favorable context. Geopolitics is a science practiced by the great powers" (Dungaciu, 2014). Global food flows have been disrupted by the invasion of Ukraine, a country with huge agricultural potential and an important role in world grain production.

In some European countries, agricultural land is protected by law. Agricultural land is a resource that does not reproduce, is rare and represents the food security of a country. The restrictions imposed by their own legislation refer to the limitation of land concentration, the avoidance of speculation and the maintenance of such land for agricultural use. The phenomenon of

"seizure" of agricultural land has been studied by the European Union institutions as an alarm signal for the Union's agricultural productions (Szőcs-Boruss, 2015). Rising energy prices have a direct impact on all goods, including food. According to the Farmers' Training House (AFR), Romania had record wheat production in the agricultural year 2021. World wheat production is 775 million tons compared to the estimated 786 million tons needed for consumption. The demand is very high and the prices are constantly rising.

After the COVID-19 crisis, an economic crisis broke out, which was overcome by the drought of 2020. The political factor also led to rising prices: many countries imposed tariff barriers on the export of raw materials. Russia's attack on Ukraine has blocked grain exports from Ukraine. About 20 million tons of wheat and corn are blocked due to this conflict. Among the countries that buy wheat from Ukraine and Russia are (Table 1):

Table 1. Cereals purchased from Ukraine and Russia

Country	Cereals percentage, %
Turkey	75
Egypt	70
Tunisia	52
Kenya	34
Nigeria	31

Source: Gallup, 2022.

The war is leading to global food security risks. The consequences of the war in Ukraine are increasing hunger and also make products more expensive (Nițu, 2021). For example, as for wheat, its price reached 386 Euros/ton, with an advance of 44% compared to four weeks ago and, going backwards, it is double compared to three years ago, according to EuroNext data. The price of maize also rose by almost 40% in just one month and stood at 346 Euros/ton, but the highest level since the outbreak of the conflict was 368,5 Euros/ton. Also, the reason should certainly tell us that even in cases where an increase in prices is imminent, for various reasons we cannot buy enough of any product, so the benefits of an overstock are limited. For certain social categories, however, any saving of money, given that purchasing power continues to erode visibly, cannot be ignored. In our opinion, these situations are an alarm signal that indicates a significant risk of declining consumption. AFR claims that in Romania there are fewer and fewer farmers doing high-performance agriculture. "In 2020 in Romania there were 2,887,000 agricultural holdings that used 12.8 million agricultural lands. The provisional results of the General Agricultural Census 2020 show that the agricultural area decreased by 543.000 ha, i.e. 4,1%. The average area increased / agricultural holding with a legal personality from 190,78 ha to 194.,8 ha. In the current geopolitical context, a food crisis is possible, not because of its lack of food, but because it will be too expensive for too many people" (Nemes, 2022). The events in Ukraine cause new difficulties in the activity of Romanian farmers: the increase in the price of diesel, unstable markets, and the lack of fertilizers on the market. According to the current President of France, Emmanuel Macron, "Community agriculture must be transformed to continue producing, pursuing agricultural independence." Many countries are facing large increases in food prices. It is necessary to reduce dependence on the food system, to eliminate excessive dependence on energy imports, fertilizers, animal feed, and supply chains.

In the context of the armed conflict in the vicinity of Romania, a possible food crisis is to be feared by the citizens of Romania. Romania is the largest producer of sunflower without the EU with 3 million tons in the agricultural year 2021. The production of corn was 16 million tons, with Romania being also in 1st place and the production of wheat with 11 million RON ranked 4th (figure 1).

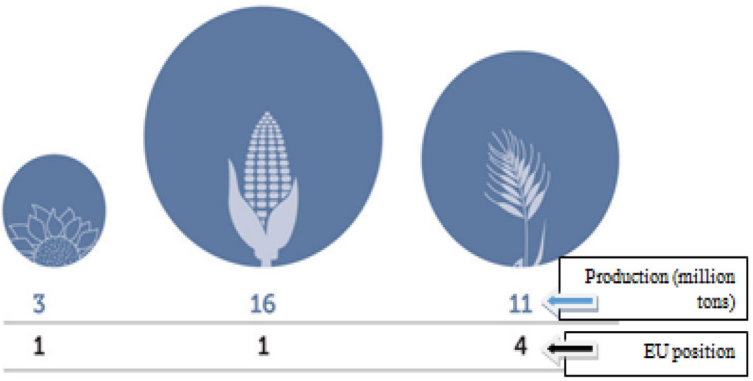

Figure 1. Romania's position in the EU on the main cereal crops /2021
Source: European Commission; Hostiuc, 2022.

Romania is among the top 10 sunflower producers in the world. These are: Ukraine, Russia, Argentina, Turkey, Hungary, Romania, France, Bulgaria, Spain, Kazakhstan (figure 2).

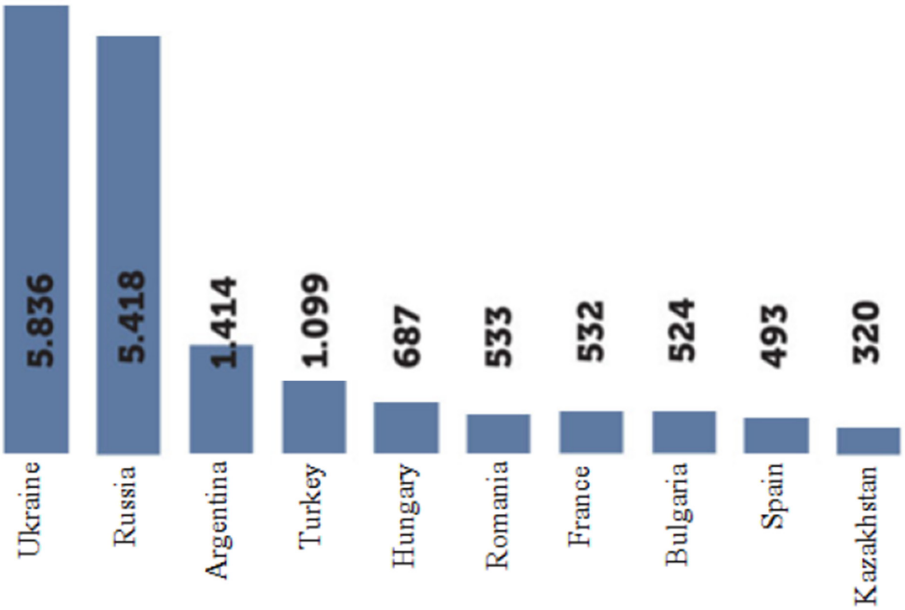

Figure 2. Top 10 sunflower producers in the world (thousand tons) / 2019
Source: FAOSTAT; Hostiuc, 2022.

The agri-food sector is the area in which farmers and producers face great difficulties and increasing pressure. Romanian farmers have demanded that the Ministry of Agriculture be included in the Supreme Council of National Defense (CSAT), because food security is very important in the current international context.

4. RESILIENCE AND SUSTAINABILITY OF FOOD SYSTEMS

Recent events caused by the COVID-19 pandemic, extreme weather conditions due to climate disruption and cyber-attacks demonstrate the need to improve the resilience and sustainability of food systems. Under the 'Farm to Consumer' (F2F) strategy, the European Commission is drawing up an EU Food Supply and Food Security Emergency Plan and a related mechanism for responding to the food crisis. This would contribute to raising awareness of risks and include identifying, assessing, mapping and monitoring key risks by testing the strengths of critical systems

at both EU and Member State level, leading to the introduction of measures to address the problems encountered. In order to ensure long-term production of sufficient and healthy food and viable livelihoods, natural resources must be used sustainably, conserving soil and water resources, combating climate change and declining biodiversity, and protecting animal welfare. The EU should also strengthen local and regional production in order to combine well-balanced food production and processing with a low carbon footprint. According to the FAO, our humanity and food security are facing many new and unprecedented threats, such as extreme weather events caused by climate change, disease and pandemics. Agriculture faces many risks that, in a hyper-connected world, interact with each other. The FAO notes in its report that, over the period 2020/21, food prices have risen to their highest level since 2011. A common finding is that price volatility is partly driven by speculation. The UN and the OECD note that by 2020, between 720 and 811 million people will be starving. Nearly one in three people in the world (2,37 billion) did not have access to adequate food by 2020, an increase of 320 million people in one year.

The COVID-19 pandemic demonstrates that food security should not be taken for granted, not even in Europe. All the actors and all the activities along the food chain are hyperconnected. During the pandemic, countries introduced trade restrictions. Even within the EU, Member States have taken unilateral measures to close borders, which have made it difficult to transport food and seasonal workers. Due to the ability of farmers and food chain partners to adapt quickly, production, processing and distribution continued to work. The Commission has also taken steps to maintain the functioning of the internal market. However, many entrepreneurs have been economically affected by the crisis as travel, tourism and food services have been shut down.

5. CONCLUSION

Romania is the largest producer of sunflower seeds in Europe. Therefore, Romania, as it produces more than it consumes, provides the raw material for the European Union through exports. The crisis in the region must increase the processing capacity of products in the country so as not to be affected by disruptions in supply chains. Romania has agri-food resources to turn into a finished product to ensure the food security of its citizens. The energy crisis has influenced the results of Romanian farmers with a major impact on production costs. It is necessary to establish long-term strategies with the integration of European policies in their own activities. It was found that it is necessary to increase the efficiency of production factors, the availability of alternative practices, in case of crisis, sustainability, but also the fight against food waste, as well as reducing the dependence on chemical fertilizers. The European Union is preparing a detailed action plan to ensure food security within the Union, eliminating deficiencies resulting from excessive dependence on imports of energy, fertilizers, and feed from one supplier or too few suppliers. There is a need to apply consolidated measures and incentives for the development of agriculture and the use of all agricultural land. The European Commission is invited by the European Parliament to suspend all Green Pact initiatives that have a negative impact on food production. The EU must ensure that borders remain open and that the manpower and logistics needed for food production and distribution ("green corridors") are maintained, both within the EU and to third countries. This requires a strong coordination mechanism between Member States, the EC and third countries. It is emphasized that the current crisis has shown that there are weaknesses; disruption of agricultural activities and trade flows with worsening financial difficulties for many European families. Strategic autonomy must be seen as an opportunity for the EU to ensure its security of food supply and to set high standards of food sustainability, especially in the context of the European Green Pact and the UN Sustainable Development Goals. The European food sustainability challenge needs to be

addressed both internally and externally, and the opinion will also examine possible ways to protect and improve the availability of sustainable food for all European citizens, especially in times of crisis. Food security should be approached from an international, national and local perspective. As is already known, 55% of the world's population lives in cities where few fresh foods are produced - the so-called "food deserts". The UN predicts that this percentage will increase to 68% by 2050. Forecasts show that urbanization, combined with the global growth of the world's population, could add another 2.5 billion people to the urban population by 2050. The level of urbanization in Europe will increase to about 83.7% in 2050. In the EU's internal market, food is transported daily in most rural areas and from processing points to supermarkets in urban areas. However, local farms and online stores have enjoyed increasing popularity among consumers during the 2020/21 isolation measures. The development of short supply chains contributes to Europe's resilience. Local channels should correspond to the needs of the population and the specific characteristics of the territories and climatic conditions. Processing capacity should be further developed at the local level.

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Analysis of Agriculture in the European Union

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Abstract: *With its agricultural policy, the European Union wants to encourage member states to invest in agricultural production, production and promotion of quality agricultural products, care for the environment, development of rural areas, increase market transparency, and encourage innovation in agriculture. The main challenges for agricultural production in the European Union are global market competition, economic and political crises, climate change and rising costs of production factors. The European Union wants to provide support for the sustainable income of agricultural holdings and the stability of the agricultural sector, and it contributes greatly to the financing of agriculture in the member states. In this way, the aim is to ensure the long-term security of the food supply and the agricultural diversity of the member states. The paper states the objectives of the agricultural policy of the European Union, researches and analyzes data on the number of employees in agriculture, the age structure of farmers, the size of agricultural holdings, agricultural and livestock production, fishing and promotional activities of agricultural production in the European Union.*

1. INTRODUCTION

The European Union wants to encourage its member states to invest in agriculture and it provides opportunities through the co-financing of agricultural holdings; most of all, it wants to incite young people to engage themselves in the agriculture business. The European Union strives to have greater exports than imports of agricultural products, because this will mean an increase in the number of people employed in agriculture, and as a result, a greater share in the gross national product will follow. Considering that the common agricultural policy represents a set of different measures and programs that are subsidized by the European Union, its goal is to ensure acceptable prices and the quality of agricultural products and to meet the income and preservation goals of rural heritage. With the enlargement of the European Union, there have been an increase in the workforce and the quantity of available arable land. This paper analyzes the agricultural activity of the European Union and the objectives of the agricultural policy.

2. EU AGRICULTURAL POLICY

Agriculture is defined as an activity that is closely related to the cultivation of useful plants and animals, for the purpose of processing, transportation and commerce of plant and animal products produced by one's own activity (Petrač, 2002). During recent decades, we have seen major changes in the agricultural policy of the European Union, and the reason for this is to help farmers so that they can face the various challenges on what they encounter. With these changes, the European Union covered an extremely wide range of areas, which include: food quality, traceability, trade and promotion of agricultural products from the EU. The European Union

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helps finance the farmers, especially those farmers whose goal is to increase ecological efficiency and effectiveness (European Union, 2022).

The Common Agricultural Policy (CAP) represents ten key objectives on which the common agricultural policy will be based in the course from 2023 to 2027. The agricultural goals within the EU are as follows (European Commission, 2022): better positioning of farmer in the food supply chain: here, the goal is to increase market transparency and introduction of more effective mechanisms and fight against climate change: the goal is to reduce greenhouse gas emissions and to proceed with the advancement of execution of sustainable energy and improving carbon sequestration (carbon uptake by plants through photosynthesis), care for the environment: the aim is to effectively manage natural resources (of air, water and soil), encouragement of sustainable development and reducing upon dependence on chemicals, preservation the landscape and encouragement of biodiversity: the aim is to increase ecosystem services, preserve landscapes and habitats, as well as to contribute to reducing and stopping the loss of biodiversity, encouraging generational renewal: here, the goal is to attract and provide great support to the new and young farmers, and to support dynamic rural areas: the goal is to increase the employment rate, to harmonize gender equality, which includes the representation of women in agriculture and the local, internal development of the rural area, which includes sustainable forestry and circular bioeconomy, and also protection of food quality and health: here, the goal is to ensure safe and high-quality food that will be produced in a sustainable way, and the aim is to reduce wasting of food, to encourage knowledge and innovation: the goal is to modernize and digitize agriculture and rural areas, to ensure a fair income for farmers: the aim is to support the sustainable income of agricultural holdings with the aim of providing food and agricultural diversity, when increasing competitiveness: the goal is to increase competitiveness through a greater focus on research, as well as technology and digitalization.

From the aforementioned objectives, it can be concluded that the European Union wants to support the sustainable income of agricultural holdings and keep hold of the resilience of the agricultural sector throughout the EU, in order to achieve the long-term security of food supply and agricultural diversity, as well as the economic sustainability of agricultural production.

The support that is offered to young farmers (income support) that national authorities must accomplish is as follows (by the regulation of the European Commission, 2022): the making of allocations of up to 2% of the total funds that are intended for income support, to decide on how many hectares will be allocated per farm for young farmers (it's maximum is 90 hectares), to choose a quality method for calculating payments for young farmers, also to investigate whether the users of the program for the young farmers have the relevant knowledge and skills and whether they meet certain conditions, after starting a business by the user, to provide young farmers with grants through a period of five years, and also to ensure certain advantages to young farmers.

3. PHYSICAL CHARACTERISTICS OF AGRICULTURAL PRODUCTION IN THE EU

According to data based on the statistical structure of the agricultural economy, in 2013 the total labor force of the member states of the European Union was 9,5 million working units. The share of regularly employed workers was 92%, which amounts to 8,7 million work units. Compared to the results from 2007, the number of work units decreased by 2,3 million in 2013. During the period from 2007 to 2013, almost all member states experienced a decrease in their

workforce, except for Ireland, Malta and Hungary, where these members recorded an increase in their workforce. The largest decline was experienced by: Bulgaria, Cyprus, Italy and Slovakia, where the labor force fell by at least one-third. With regards to the regularly employed workers, Latvians are the largest in terms of their percentage, because they have almost all regularly employed workers, while Spain features the smallest share of regularly employed workers (Eurostat, 2022). Figure 1 shows the share of regularly employed workers in agriculture in 2013 in the European Union.

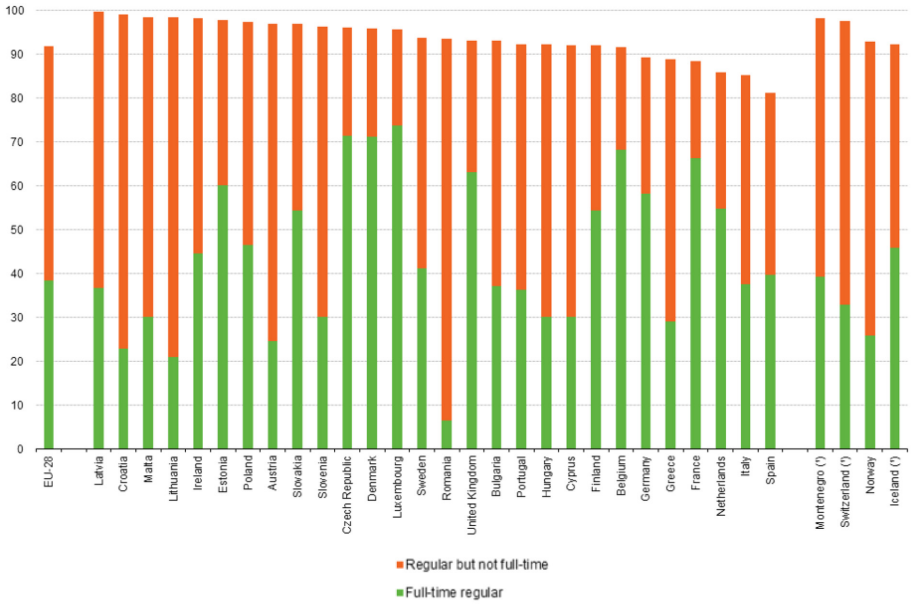

Figure 1. Presentation of the share of regularly employed workers in the agricultural economy in 2013.

Source: Eurostat, 2022.

Figure 2 shows the age structure of farmers in the European Union in 2016.

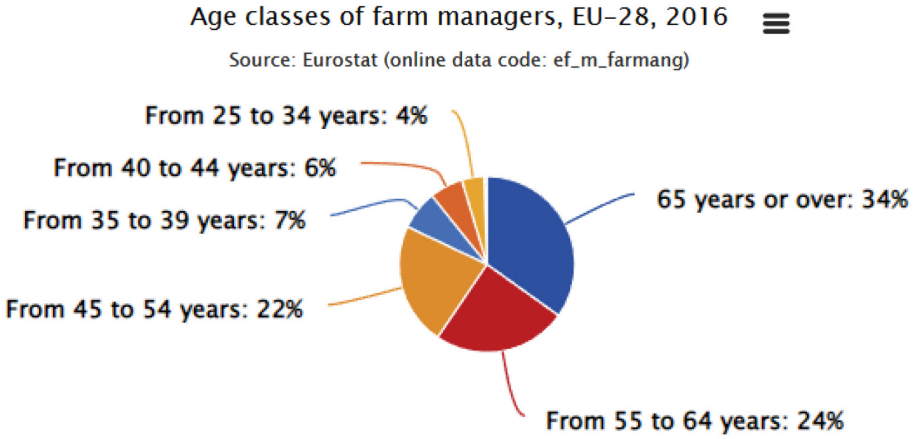

Figure 2. Age structure of farmers in the European Union in 2016.

Source: European Commission, 2022.

From Figure 2, it can be seen that the largest share of individual farmers is older than 65 years of age, which is certainly not a good sign for future events, as even 34% of those over 65 years of age are engaged in agricultural activities. Also, there is a large percentage of workers between 45 and 64 years of age, which amounts to 46%, which means that, according to these data, as

many as 80% of those over 45 years of age are engaged in agricultural work, while the youngest (up to 25 years) is only 2%, which does not represent a good situation for the European Union and sets before it a great challenge to encourage young people to engage in farming. Figure 3 shows the average size of farms in the European Union.

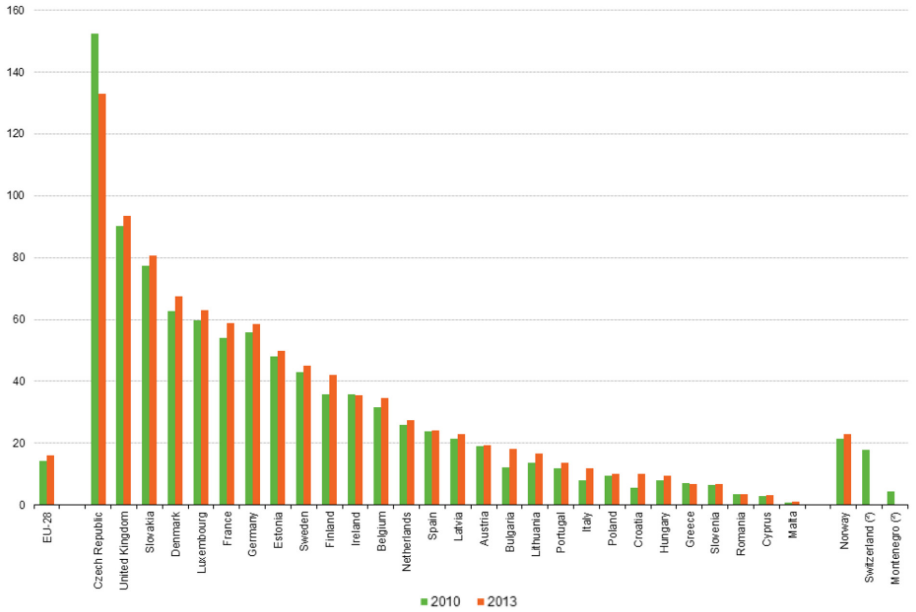

Figure 3. Average size of agricultural holdings in the European Union
Source: European Commission, 2022.

Following the main statistical findings in 2013, 10,8 million observed agricultural holdings were recorded. The analysis found that 6,5 million or 59,8% of these farms achieved a regular result of more than 2000 Euros. The member states of the European Union used approximately 175 million hectares of agricultural land, which is approximately 40% of the total land area. France and Spain have the largest share of used agricultural land, with 15,9% and 13,3% shares, respectively, while the shares of Germany and the now former member of the European Union, the United Kingdom recorded to be below 10%. Romania has the largest number of agricultural holdings with 3,6 million and one-third of all agricultural holdings were present in Romania. From Figure 3, it can be seen that the Czech Republic has the largest agricultural holdings in 2013 with 133 hectares while the United Kingdom was behind it and even six member states have the size of agricultural holding that was less than 10 hectares in size. When compared to 2010, it can be seen that almost all of the member countries have experienced an increase in the size of their agricultural holdings except for the Czech Republic, whose agricultural holdings fell by approximately less than 20 hectares, and Greece and Ireland, which experienced a slight decrease. In 2013, the total utilized agricultural area amounted to 40% of the total land area observed in the group of EU member states. The rest of the land, which amounts to 9%, belongs to the agricultural economy for types of land that have not been used (2,3%), or in the form of forest areas (6,7%).

The largest share of the production of plant products that belong to farming is the production of cereals and oilseeds. The cereal group includes the production of corn, wheat, barley, oats and other grains, while the oilseed group includes the production of rapeseed, sunflower, soybeans and others. According to data, cereals are being produced in the largest quantities, especially wheat (the total amount of wheat produced for 2022 amounts to 134.000 tons). Wheat is followed by corn with almost 60.000 tons produced, and barley with slightly more than 50.000

tons produced (European Commission, 2022). Almost two-thirds of the produced grains are used for animal feed, one-third for human feed and a very small share is used for producing biofuels (3%). The most commonly used oilseed is rapeseed, represented by almost 60% that is followed by sunflower and soybeans. Oilseeds are used for food products, animal feed, industrial needs and fuel (European Commission, 2022). According to data from 2021, the number of livestock in the EU amounted to 142 million pigs, 76 million cattle, 60 million sheep, and 11 million goats. Per Eurostat, most of the cattle are raised in several member states, and Spain, France and Germany own most of the cattle. Spain leads the list with 24% of pigs, 25% of sheep and 23% of goats in the EU, while France leads the list with 23% of cattle in the EU. The Republic of Croatia, when compared to the EU in terms of the percentage of cattle is at the very bottom, together with Latvia, Estonia, Luxembourg, Cyprus and Malta. When observing at the percentage that is related to pigs, the Republic of Croatia is slightly below the average (Agroklub, 2022). According to data from the European Commission for 2016, the EU exports most of its beef to Turkey, followed by Bosnia and Herzegovina and Switzerland. The EU is closely related to imports from other countries from South America. Most beef is imported from Brazil, followed by Uruguay and Argentina. The problem was in the relationship between imports and exports, because until 2015 the EU's trade balance was negative, and after that period the relationship between imports and exports began to gain back the balance (Agroklub, 2022).

According to data from 2018, Estonia and Italy have the largest number of people employed in fisheries in the EU. The European Union imports much more seafood than it exports them. Given that Estonia has the largest number of employees in fisheries, it was expected that it would also have the largest allocated funds from the European Maritime and Fisheries Fund. The Republic of Croatia is in the average field in terms of allocated funds from the EU fund (European Parliament, 2022).

The Common Fisheries Policy (CFP) has been first formulated when the Treaty of Rome was agreed. In the beginning, it had a connection with CFP, but over time it has become independent. The main goal is to ensure sustainable fisheries and provide permanent income and jobs. According to the last reform of the CFP from 2013, an effort has been made to ensure the long-term ecological sustainability of activities in the fishing sector, with the goals of ensuring the realization of economic and social benefits, and also benefits for employment (European Parliament, 2022).

4. PROMOTION OF AGRICULTURAL PRODUCTS IN THE EU

The European Union wants to help its farmers (producers) sell their own agricultural products, given the current situation on the large market, and at the same time to help them with the creation of new jobs that will result in the growth of agricultural products and security of diet in the EU in the future time. Promotional campaigns are designed to provide new opportunities on the market to farmers and the food industry, and to help the development of existing businesses. There are two types of promotional activities (European Commission, 2022): promotional activity carried out by a European trade or inter-trade association that is co-financed by the EU and promotional activity that is executed directly from the EU such as, for instance, participation in communication campaigns and fairs and diplomatic offensives by commissioners in third countries, due to the development of trade in agricultural and food-stuff products. Policy rules dictate that EU funds can be used for promotion and information initiatives in EU member states and also in non-EU countries.

In 2022, the European Commission has allocated 185,9 million Euros to promote activities about agricultural and food products from Europe on the domestic and foreign markets. Campaigns that

are aimed at countries outside of the European Union mainly take place in the markets that are characterized with high growth potential, such as: South Korea, Mexico, Canada and Japan. The financial amount that the European Commission has prepared for promoting the activity is quite large, but it indicates that they want to ensure a secure future for the member countries of the European Union (European Commission, 2022). The European Union invests considerable resources in the promotion of ecological agriculture. Ecological agriculture is a complete system of agricultural management that encourages the natural activity of the soil, ecological system and people, and also ecological processes, biodiversity and natural cycles (Srpak & Zeman, 2018).

5. CONCLUSION

The advantages of agricultural production in the EU are as follows: production tradition, diversification of culinary traditions and modernized production. The biggest problem of agricultural production in the EU is the old population that is engaged in agriculture production, and the departure of young people from the countryside.

One of the European Union's goals is to motivate young people to work in agriculture, in order to maintain a more secure future in terms of feeding the population. It is difficult for farmers to secure wages that will keep workers in the countryside, but this is exactly where the European Union brings help with its subsidies. By means of the common agricultural policy, the EU strives to achieve its goals: to modernize agricultural production, co-finance investments in agriculture, adopt the measures that would incite interest in young people to engage in agriculture, increase exports, ensure further quality and diversity of its products, etc. The EU invests considerable resources in the promotion of the quality of its agricultural products, in order to gain even more access to large markets, such as Mexico, Canada, South Korea, and others. Due to diverse climatic conditions, modernization of farmers, fertile soil and the quality of its products, the EU is one of the largest producers and exporters of agricultural products in the world.

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Bulgarian Agriculture - Principles, Traditions and Development of the Organic Agriculture

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Traditions;
Organic agriculture

Abstract: *Agriculture as a traditional branch has a strategic importance for Bulgaria, not only because it ensures food security, and creates raw materials for many other industries and sectors of the national economy, but also provides work and income for a significant part of the population in rural areas. When we talk about agriculture as an economic activity we must always consider it in direct correlation with rural areas and their vitality. The sector is among the most dynamically developing in terms of modernization, robotization, digital transformation, also provoked by the ambitious goals related to climate and green challenges on a global scale. Precisely the agricultural sector is at the center of the circular economy and bio-based societies, preservation and development of the regions, and is in close connection with the development of science - from applied to the top - called to carry humanity into the next era. Bulgarian agriculture has deep traditions in society, its history can be traced back in time. But in the circumstances of globalization, facilitating access to imported food, it is important to increase the competitiveness of Bulgarian agricultural products. In recent years, there is more and more talk about ecologically clean production, and Bulgaria is no exception because it is making serious attempts to develop organic agriculture in the country.*

1. INTRODUCTION

Agriculture is a branch of the economy for the production of plant and animal products to meet the needs of the population and industry. Agriculture is traditionally one of the most important sectors of the Bulgarian economy. Regardless of all the problems and contradictions in its development after 1990, the sector remains one of the pillars of Bulgarian socio-economic life. The stable positive development of the country's economy in recent years has reduced the relative weight of agriculture in terms of the gross domestic product it creates and the level of employment; but, despite this, the agricultural sector will continue to play a significant role in the Bulgarian economy in the future and will determine to a significant extent the general state of the country. The main branches of agriculture are crop and stock-breeding.

The agricultural sector, both globally and in Bulgaria, faces many challenges - climate change, the attitude towards the environment, the development of the economy and trade, social and demographic changes, the health status of people, the rural economy and regional development and the development of science and technology.

A new stage in the development of Bulgarian agriculture is the development and popularization of organic or ecological agriculture. As an agricultural practice, it is related to the evolutionary development of traditional agricultural practices and the new attitude of producers to the environment in which they carry out their activity, i.e. to natural resources.

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2. STAGES OF DEVELOPMENT OF BULGARIAN AGRICULTURE

Traces of agricultural activity have been found on Bulgarian lands since prehistoric times. Many artefacts found in different parts of present-day Bulgaria reveal that domesticated animals provided food, skins, wool, and bone material for agricultural implements. After the establishment of the Bulgarian state, the cultivation of a number of cultivated plants, mainly cereals - wheat, barley, rye, oats, millet - emerged as the main livelihood for the Bulgarians. After Liberation (1878), agriculture in Bulgaria was enriched with new agricultural crops - sugar beet, tomatoes, alfalfa, sainfoin, etc. Vegetables were mainly grown for own needs. Fruit nurseries and gardens are established in agricultural schools. Valuable fruit species and varieties from the European range are imported and propagated. The state takes care to improve stock-breeding. The first state livestock farms and scientific units were opened, which assisted in the importation and distribution of more productive breeds, in the improvement of local ones and the creation of new breeds, in their nutrition and breeding, etc. In general, however, during this period, agriculture in Bulgaria was extensive and low-productivity. After September 9, 1944, the Bulgarian communist party, using the resources of the state dominated by it, made a spectacular attempt to implement a complete change of the model of Bulgarian agriculture. Pursuant to the Law on Agrarian Reform adopted in 1946, over 200 decares of land was nationalized. Obviously, agriculture has been affected by many negative consequences of an economic and political nature, as a result of which the production of agricultural products of both plant and animal origin has greatly decreased.

Since 1984, the country has been forced to import large quantities of wheat. The permanent import of agricultural products traditional for Bulgaria, such as: wheat, corn, sunflower, beans, garlic, potatoes, soybeans, etc. has started. The export of fruits and vegetables, of grapes for fresh consumption is greatly reduced. The country spent more than 800 million dollars on the import of agricultural products. As a result of this incorrect economic policy, during the period 1944-1989, the number of people employed in agriculture decreased to 17% of the active population (750 thousand people), and this very important agricultural sector provided only 11% of the national income in 1990. Of all goods exported from Bulgaria, only 1,8-2,2% are unprocessed agricultural products, not because the export of industrial products was high, but because the necessary amount of fresh fruits and vegetables was missing. A large part of our agricultural products have a very high content of nitrates, and this makes them uncompetitive in world markets. Concerning the development of agriculture in our country during this period, it is worth clarifying some of the frequently encountered terms in specialized literature - extensive and intensive development. The extensive path of development is expressed in an increase in agricultural production by increasing arable land and the number of farm animals. The intensive path is associated with an increase in average yields per hectare and the productivity of domestic animals. This can be achieved by using intensive methods of work in agriculture, expressed in mechanization, chemicalization and irrigation (artificial watering). The excessive use of fertilizers and pesticides, to which the agricultural production in Bulgaria was subjected, although it led to a significant increase in the average yield per hectare of cultivated area, which reached a record 480 kg wheat and in places even 850 kg corn, led to many environmental problems that adversely affected the development of this industry.

In general, Bulgarian agriculture has always been, and continues to be, polycultural - i.e. numerous cultivated plants and various types of domestic animals are grown.

When we talk about agriculture as an economic activity we must always consider it in direct correlation with rural areas and their vitality. And to be aware of its two important aspects,

economic and social – ensuring food/nutrition security and maintaining biodiversity on the one hand and maintaining the vitality of rural areas on the other.

Agriculture is of strategic importance for Bulgaria, not only because it ensures food security, and creates raw materials for many other industries and sectors of the national economy, but also provides jobs and income to a significant part of the population in rural areas. At the same time, the sector is among the most dynamic developments in terms of modernization, robotization, and digital and digital transformation, also caused by ambitious goals related to climate and green challenges at the global level. It is precisely the agricultural sector that is at the center of the circular economy and bio-based societies, the preservation and development of the region, and is closely related to the development of science - from applied to the top - that is called to carry humanity into the next era.

3. DEVELOPMENT OF ORGANIC AGRICULTURE IN THE COUNTRY

Bulgarian agriculture has a long historical development, passing through different paradigms, to reach the modern stage of development and the introduction of the so-called organic or ecological farming.

Unlike the developed countries, however, in our country, we move from one paradigm to another without a clear transition, without the old paradigm being finished, and in recent times the transition from one paradigm to another is connected with an imported influence. The example of Bulgarian agriculture from the 70s of the 20th century is a recent one. Under Soviet influence and for the first time in Eastern Europe, an attempt was made to create a socialist agribusiness. However, the attempt was unsuccessful. The application and acceptance of Bulgaria into the EU bring Bulgarian agriculture to a new development - acceptance and implementation of the so-called "green" paradigm (Boyadzhiev et al., 2021).

The first agricultural paradigm from a historical point of view is the pre-productivist one. This is a natural product, in which the vast majority of what is produced serves the self-satisfaction of the immediate producers. The goal is to meet nutritional needs and fight hunger. The main problem is uneven production, which in its primitiveness and low productivity is entirely dependent on seasonality, while consumption is much more uniform over time.

The second paradigm is the productivist one. With it, industrialization and the market economy push agriculture so far that unprecedented changes in its proportions and structure occur, and the system of agribusiness and the global common market are created. All kinds of policies, and reforms are implemented, and the concept of "green revolution" is born. The goal is ever-increasing production in the hope that its outpacing consumption rate will mitigate and combat hunger. The change in the geography of agricultural plants and animal breeds continues. Each new variety and breed spread in just a few years all over the world. At the end of the period of filling this paradigm, the greatest social changes occur world wars, socialist states, the collapse of the colonial system, the binding of international relations with world organizations, including the FAO, as well as binding treaties. Industrial society is exhausting itself, and along with the eternal problems of hunger and thirst, of peace and health, there are problems with waste and various violations of nature and the environment. The third agricultural paradigm is the post-productivist one. It corresponds to post-industrial society. The share of those directly employed in agriculture is negligible, an ever greater part of agricultural production undergoes ever more in-depth processing and processing,

and trade is looking for new and new forms for the realization of overproduction. The next paradigm, the fourth, in which we are at the moment, is associated with the concepts of ecology, green economy, territorial approach, circular economy, strategies, etc (Boyadzhiev et al., 2021). Organic farming is such a production system that does not allow or completely exclude the use of synthetic fertilizers, pesticides, growth regulators and feed additives, and in which the crop and crop residues are relied upon to maintain and improve the soil's nutritional status, manure, green manure and biological plant protection. It is important to realize that organic farming is much more than the exclusion of pesticides and mineral fertilizers. This is a different manufacturing method, which is non-holistic in nature, involving the implementation of many preventative measures. Organic production can only be successful if its overall concept is understood and applied (Mitev, 2019).

The organic sector in Bulgaria has been rapidly developing during the past years. According to Eurostat data, in 2017 Bulgaria had a total area of 136 618 ha (2016 – 160 620 hectares) of cultivated as organic, up 13 646 ha. In 2017 the organic area in Bulgaria has increased 10 times compared to 2007. For example, Romania has an increase of only 2 times. The above absolute figures tell us only part of the story. Although this is a big increase, the whole organic area represents only 2.72% of total utilized agricultural area (UAA) in Bulgaria (in EU – 7.03%).

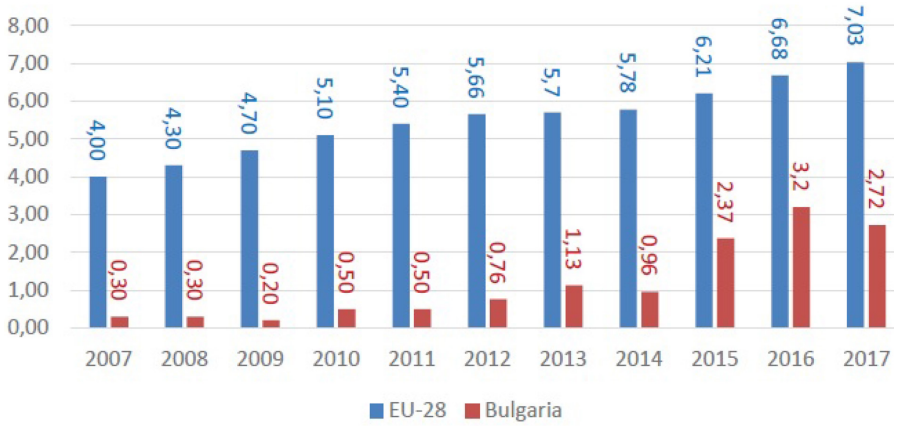

Figure 1. Share of areas in total utilized agricultural area (UAA), %

Source: Mitova (2021) by Eurostat

Of the total number of operators, producers seem to take the lead. When analyzing the number of organic holdings in comparison to the total number of holdings in Bulgarian agriculture, a diverging trend is observed. Available data shows that the number of organic farms is increasing while there is a consolidation of conventional agricultural holdings in the country (Mitova, 2021).

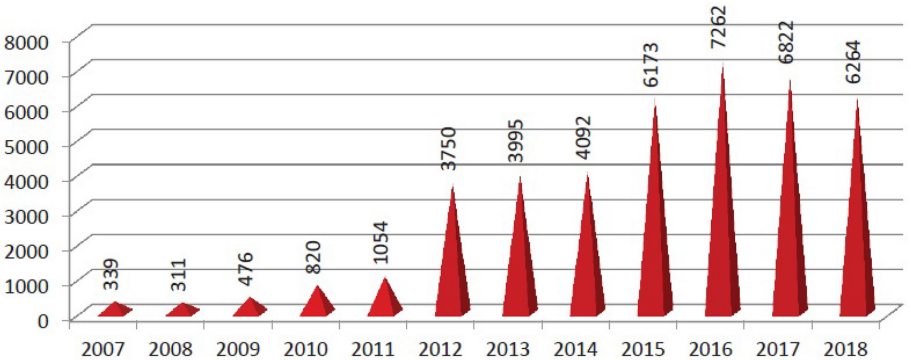

Figure 2. Certificated registered organic operators in Bulgaria

Source: Mitova (2021) by Eurostat

Bulgarian organic products are quality and competitive - according to unofficial data, more than 90% of Bulgarian organic products are exported to EU countries, the USA and Japan. By size of certified areas for the collection of wild fruits, herbs and mushrooms, Bulgaria ranks second in the EU, and fourth in number of certified bee families. Bulgaria is the largest producer of organic rose oil in the world. National regulation for organic farming is harmonized with the requirements of the European Union (Mitev, 2019).

An important aspect is the type of production (arable crops and perennials) of organic farms. The choice of type of production in the regions and Member States depends on various factors (including the technical aspects of organic production and the structure of consumer demand). A large part of the land is used for permanent meadows and pastures, but also for perennials (such as fruits) and for cereals. When considering the organic farming area compared to the total area of the different agricultural holdings in Europe, the available data show that organic crops (in total) account for 5% of the total area cultivated in the EU-28. The comparison of the main categories of use for the biological sector shows interesting features. The share of permanent crops is high in the organic sector (15%), as the demand for fruit and vegetable products is among the highest in the organic market. The share of permanent meadows and pastures represents more than 50% of the total area occupied for organic production.

Conversely, cereals cover more than 30% of the total EU farmland, but a lower percentage of organic land use. The explanation lies in the fact that organic farming systems are wider than conventional farming (greater dependence on grazing on permanent pasture). Permanent meadows and pastures are often eligible for agri-environment payments and are easier and less risky to transform into the organic sector than other crops (e.g. field crops). Depending on the national characteristics of agri-environmental and/or environmental payments for rural development and the characteristics of land use at regional level, this could lead to preference for the development of permanent meadows and pastures for organic production (Branzova, 2019).

4. CONCLUSION

The development of Bulgarian organic agriculture is among the priorities of the state policy, especially the Ministry of Agriculture and Food. Their work is aimed at maintaining the trend of increasing the number of organic operators and the size of the areas, as well as increasing the species diversity of organically grown crops and farm animals. The benefits of biologically produced foods and products for human health, as well as the biological method of production as sparing the environment and conserving natural resources, are increasingly popularized. Therefore, the fact that the issues of healthy eating and sustainable use of natural resources concern increasingly large groups and communities of people both in the EU and in our country, also contributes to this.

In conclusion, we can formulate several more important conclusions about organic production in Bulgaria - first of all, it marked a noticeable growth after the country acceded to the EU; organic farming is more profitable than conventional farming; the development of organic vegetable production and fruit growing shows a permanent trend of growth in the regional aspect; organic production is highly dependent on local markets and the solvency of the population.

Unfortunately, producers of organic products are also faced with some problems, mostly related to the high prices of biological preparations and fertilizers and the high risks of losses, which partly hinder the future development of more producers. With the help of the implemented policies in the field, as well as the different types of subsidies, solutions are sought to reduce the threats to organic producers.

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Taxation of Agricultural Sector in Albania

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Abstract: *Agriculture contributes about 20% to the Gross Domestic Product in Albania. It is one of the main sectors of the Albanian economy, which supports and impacts other important sectors such as tourism, product processing and exports.*

In the conditions of the globalization of the economy, the free movement of goods and capital, and multilateral and bilateral agreements for the removal of tariff barriers, Albanian agriculture faces the challenges of very strong competition from the countries of the region, EU countries and beyond. In these conditions of strong competition, what can make Albanian agriculture survive, is that its products appear not only in the domestic market and those of the region but also in the international markets of goods and products. The ambitions of our country for the development of intensive, year-round, coastal and mountain tourism, elite and agrotourism, requires the increase of the quantity, quality and lowest possible prices of agricultural and livestock products, in order to avoid the competition of imported goods that can be traded at lower prices.

How should agriculture, farmers, livestock, agricultural and livestock production be stimulated? Should they be incentivized through exemptions from the tax system or should the process of stimulating production through subsidizing the elements of agricultural and livestock production be used more efficiently?

The strategy implemented in our country has strengthened tax exemptions for inputs, agricultural and livestock products, farmers' income, etc. This strategy intends to promote the cooperation of agricultural and livestock production in Agricultural Cooperation Societies by offering minimum tax rates.

Considering the great impact that agriculture has on the economy, especially in the tourism sector, we will deal with the tax policies applied in the agriculture and livestock sector and the effects of tax incentives over the years. The objective is not only to support the farmers and livestock farmers with funds but also to ensure tax relief and stimulate tax treatment for agricultural and livestock production, aiming to increase competitiveness not only in the regional market but also in the EU market, without compromising the quality of the product.

1. INTRODUCTION

Agriculture has been the main branch of the Albanian economy in most of the periods that our country has gone through after the declaration of independence. From 1912 till the end of the Second World War, Albania was an entirely agrarian backward country. Even during the 45 years of communist rule, agriculture was still the dominant sector of the economy, especially in the first 20-25 years. The regime of the time, based on its interests, undertook very deep reforms in the field of stimulating agricultural production, starting with the draining of marshlands and the benefit of agricultural land, its reclamation and systematization, the construction of a national land irrigation network, the construction of dams, reservoirs and canals for irrigation and

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drainage. Initially, the agricultural land was divided between the peasants through the Agrarian Reform, to pass in the following years and decades to the total collectivization of the agricultural sector, which, despite increasing agricultural production through concentrated work, mechanization, and the use of chemical fertilizers, did not make possible an intensive sustainable development of agriculture sector, due to the mechanism of the centralized economy itself, which stimulated laziness and the waste of common property, completely inhibited private initiative and the peasant's interest in increasing agricultural and livestock production.

The year 1990 found Albania in a problematic economic stagnation, with an agricultural sector that not only did not meet the needs of the population with agricultural and livestock products but also, due to the organization of agricultural cooperatives and state farms, had resulted in the apparent impoverishment of population in the village, which made up 65% of the population in the country. The first reform undertaken by the Albanian political class in the new conditions of political pluralism was the dissolution of cooperatives and agricultural farms and the granting of land owned by former cooperatives and used by former farm workers. The agricultural land was thus fragmented into tens of thousands of small parcels, where in the following years it would be impossible to apply modern methods for increasing production. Albanian agriculture has been organized in this way since 1990. The various governments that ruled the country, have tried to stimulate and support agriculture, but within the limits allowed by a modest income budget such as the Albanian state budget (Bank of Albania, 2000).

The agricultural sector is considered one of the priority sectors for the development of the country. This is because a large part of the population still lives in the village side, whereas about 40% of the labor force is employed in the private sector of agriculture, approximately 460 thousand farmers. Apart from the fact that it forms 20% of the country's Gross Domestic Product, agriculture is meanwhile a very important factor in the supply of the tourism industry. At the same time, the development and growth of agricultural production affect the increase of agricultural exports and the decrease of imports, gradually improving the balance of payments.

In the last 5 years, exports of agricultural products have increased by an average of +10.07% compared to the previous year, while imports of agricultural products have been generally stable and without growth during the years 2017-2020. Only in 2021, they are presented with an increase of 12.8%, but this is conditioned by the very large increase in the prices of food goods in international markets due to the war in Ukraine. However, the average increase in imports in the last 5 years is 5.4%. So, the exports of food products have increased with a growth 2 times higher than imports, which shows that Albanian agriculture is meeting the needs of the local market in sustainable growth.

If in 2017, exports of agricultural products were as much as 28% of the volume of imports of the same products, in 2020 and 2021, they were as much as 35% of the volume of imports, this indicates the gradual reduction of dependence on imports of goods for food and livestock consumption.

Table 1. Import and export 2017-2021

Year	2017	2018	2019	2020	2021
Import	106,738,000,000	106,508,000,000	110,365,000,000	110,927,000,000	130,017,000,000
Export	30,081,000,000	32,334,000,000	35,374,000,000	39,050,000,000	44,469,000,000

Source: Institute of Statistics, 2022.

As we pointed out, the development of the agricultural sector has been the priority of the Governments after the 90s, which have tried to support agriculture with various subsidizing, stimulating and facilitating measures such as:

- Investments in the improvement of agricultural land;
- Investments in drainage and sewerage networks;
- Supporting farmers with funds from EU support programs;
- Support with subsidies from the state budget;
- Support through exemption from taxes and duties;
- Support through the fiscal system by relieving the agricultural sector from taxes and duties;
- Support through the farmer's compensation scheme.

2. RESEARCH DATA AND METHODS

Agriculture constitutes one of the most dominant and potential sectors of the Albanian economy, as a result, the exemptions or fiscal incentives for this sector have been greater or more frequent in relation to other sectors. To measure the effects of fiscal incentives, in order to ensure a facilitating and stimulating fiscal treatment of agricultural and livestock production, data for the period 2015 - 2021 were used.

3. RESULTS

3.1. Fiscal Measures Taken to Stimulate Agriculture

The agricultural sector has generally been outside the focus of taxation as a sector. This is with the good intention of stimulating it, and increasing investments and production. Fiscal measures have been numerous and for long periods, among which we can mention the most important:

a. Exemptions from Value Added Tax in support of the agricultural sector for:
   - importing animals for fattening;
   - animal feed and equipment needed during animal transport;
   - machines and equipment in the function of realizing investment contracts in the active processing and agribusiness sector;
   - agricultural machinery imported by farmers and merchants;
   - live animals of the breed, donated by different donors.

b. Exemption from Excise
   - reimbursement of excise duty for fuels used in greenhouses with heating for agricultural production;
   - excise-free diesel for farmers.

c. Exemptions and reduced fees for agricultural enterprises (Agricultural Cooperation Societies).
   - reducing the income tax of enterprises organized in Agricultural Cooperation Societies from 15% to 5%;
   - there is no turnover limit for benefiting compensation under the scheme.

d. Exemptions and reduced tariffs for agricultural inputs
   - Reduced VAT by 10% for the import and sale within the country of agricultural inputs, earlier its total exemption.

e. Incentives for the individual farmer
   - VAT compensation for the farmer in years: 20% and 6% of the selling price of the product to traders and producers;

- increasing the registration limit in the VAT scheme for farmers from 5 million to 10 million ALL. So, for sales up to 10 million ALL per year, the farmer uses only the auto-invoicing scheme, without having to register as a taxpayer or to pay income tax as a business.

In international practices, which aim to support the agricultural sector and farmers, one of the following mechanisms is generally applied:

1. The inclusion of farmers in the VAT scheme, allows them to credit (deduct) the VAT paid on the purchase of inputs from the VAT calculated for the sale of agricultural products.
2. The non-inclusion in the VAT scheme of farmers, but exemption from VAT of inputs that participate in the production of agricultural and livestock products, or;
3. The non-inclusion in the VAT scheme of farmers, as well as compensation of the VAT that the farmer pays in the purchase of inputs, through the auto-invoicing system from his buyer.

Mechanisms 2 and 3 have been adopted due to the fact that the farmer in these cases is not a VAT-taxable person and there is no mechanism to release the VAT paid on the purchase of inputs from the VAT calculated for the sale of agricultural products and livestock, as it happens in the case of scheme 1. However, the scheme implemented in our country includes all possible stimulating elements:

a) The exclusion of farmers from the VAT scheme for turnover up to 10 million ALL per year;
b) The return of VAT paid on the purchase of some inputs;
c) The exemption from VAT of agricultural inputs;
d) The exemption from VAT and excise duties of many other goods (live animals, fuel, etc.)

The farmers' VAT compensation scheme is designed to support (compensate) the agricultural producer, thus aiming to reduce production costs. Then, by offering agricultural products at competitive prices, it also impacts the growth of exports or domestic production. EU countries apply a certain methodology in calculating the specific importance of the agricultural product, inputs and outputs used for it, resulting in a necessary compensation level of around 6% which is sufficient to cover that part of the VAT paid on the purchase. Meanwhile, the VAT compensation scheme with the level of 20% that was applied in our country, represented the highest rate applied, not only in the countries of the region but also beyond them.

Until 2014, the VAT compensation scheme in agriculture was applied at the rate of 6%. In 2014 the fees increased from 6% to 20%. In 2019, fees were reduced again to 6% after another fiscal incentive was undertaken, through the exemption from VAT of agricultural inputs.

The 2019 fiscal package, starting from the strategy for further incentivizing the agricultural sector and finding new effective schemes, which bring these incentives and benefits to the farmer, as they were designed for, it is intended to stimulate the reduction of costs of agricultural products. This cost reduction is intended through the revision of the fiscal treatment of agricultural inputs, using a reduced rate of VAT on their import, or exemption from VAT, as a measure that will lead to the reduction of production costs. At the same time, besides the revision of the agricultural input handling policy, the parallel compensation scheme would also be revised. This is due to the fact that the compensation was given explicitly for the compensation of VAT paid for inputs. By this logic, in December 2018, the Assembly decided to exclude agricultural

inputs from VAT and at the same time to apply VAT compensation to the vehicle invoice at the rate of 6%. This compensation at the level of 6% will balance some other tax costs charged to the farmer, which are not resolved through the exclusion of inputs from VAT, such as VAT on fuel or electricity.

Table 2. Level of VAT compensation

Year	No. of taxpayers who have submitted their VAT return	No. of taxpayers with purchase from the farmer	Buying from local farmers	Farmer compensation rate	VAT received by the farmer
2015	38,081	827	4,667,517,055	20%	933,506,270
2016	40,976	1,376	10,489,013,588	20%	2,097,802,721
2017	42,898	1,230	11,814,280,177	20%	2,362,856,042
2018	59,018	1,397	14,107,557,453	20%	2,821,511,463
2019	61,081	638	12,895,817,129	6%	773,749,031
2020	62,577	603	13,604,322,300	6%	816,259,385
2021	35,000	580	11,215,660,410	6%	672,940,000

Source: Author's Calculation

The table above shows that, despite the fact that the VAT compensation level was reduced from 20% to 6%, the purchases of economic operators from farmers have not decreased, on the contrary, they have increased in 2019 and 2020. So, the decrease in the compensation rate has not inhibited the production and sales of agricultural products. For the period from January 2014 - June 2021, farmers were subsidized by the state budget through the VAT compensation scheme for about 9.98 billion ALL or 99.8 million USD.

The change in the farmer's compensation scheme and the reduction of the compensation from 20% to 6% does not impact collectors, local producers of agri-food products and exporters.

- VAT is a consumption tax, it is paid by the final consumer, not by the collector, nor by the agro-processing producer, or the exporter.
- The change in the VAT level of the auto invoice, both in the case of its reduction and in the case of an increase, even increases or decreases the subsidy for the farmer, it does not affect the costs and profits of the trader or exporter.

3.2. Effects of Stimulus Fiscal Measures

a) Imported agricultural machinery without paying VAT. The effect of the VAT exemption for the years 2019 - 2021 is ALL 922 million (Table 3).
b) Agricultural inputs exempted from VAT. The effect of the VAT exemption for the years 2019 - 2021 is ALL 4.86 billion (Table 4).
c) Live animals for fattening exempted from VAT payment. For the period from 2017-2021, the unpaid VAT for their import is 1.45 billion ALL (Table 5).
d) Other tax exemptions (Table 6).
e) Excise-free oil subsidy for farmers in the amount of 800 million ALL/year.
f) Subsidizing livestock farmers with 10 ALL/liter of milk delivered, paying an amount of 300 million ALL/year.

Total of Tax Exemptions for 2021 (Table 7).

Table 3. The effect of VAT exemption on imported agricultural machinery

Year	VAT excluded	VAT paid
2017		151,423,000
2018		124,012,000
2019	183,317,000	
2020	343,545,000	
2021	395,280,000	

Source: Author's Calculation

Table 4. The effect of VAT exemption for agricultural inputs

Year	VAT excluded	VAT paid
2017		1,163,927,000
2018		987,799,000
2019	1,530,091,000	
2020	1,429,990,000	
2021	1,932,385,000	

Source: Author's Calculation

Table 5. The effect of the VAT exemption for live animals

Year	VAT excluded
2017	254,359,000
2018	272,564,000
2019	316,441,000
2020	249,325,000
2021	328,943,000

Source: Author's Calculation

Table 6. Effects of other tax exemptions

Year	Unpaid excise tax from fishing	Unpaid excise duty on heated greenhouses
2016	263,000,000	214,000,000
2017	302,000,000	242,000,000
2018	363,000,000	280,000,000
2019	351,000,000	310,000,000
2020	478,000,000	334,000,000
2021	384,000,000	292,000,000
Total	2,141,000,000	1,672,000,000

Source: Author's Calculation

Table 7. Tax exemptions for 2021

Tax exemptions/benefits	Billion All
The farmers' VAT compensation scheme of 6%	0.67
VAT exemption for imported agricultural machinery	0.4
VAT exemption for agricultural inputs	1.9
VAT exemption for Live Animals	0.3
Unpaid excise tax from fishing	0.38
Unpaid excise duty on heated greenhouses	0.92
Excise-free oil	0.8
Subsidizing livestock farmers with 10 ALL/liter of milk delivered	0.3
Total amount of benefits	5.1

Source: Author's Calculation

4. FUTURE RESEARCH DIRECTIONS

The data used in this paper are secondary data, without the possibility of obtaining data from farmers and collectors. One of the biggest problems of the agricultural sector in this country is the lack of registration of farmers as well as the non-declaration of activity on their part, so the only access to data from public institutions may not fully reflect the reality.

In order to expand this work, to measure the real effect that the fiscal changes over the years have had on the category of farmers, as well as to determine which is the most effective government incentive, direct contact with farmers would be necessary.

5. CONCLUSION

This study aims to measure the effects of fiscal incentives in the agricultural sector. Due to the role of this sector in the economy, employment and well-being of Albania, as well as the high contribution to GDP, the Albanian government over the years has been oriented towards fiscal policies that help and encourage agriculture.

Based on the analyzed data, tax exemptions for the agricultural sector resulted in continuous growth after 2014, and for the year 2021, this sector is exempted from taxes and duties with 5 billion All or 50 million USD.

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The Chaotic Wheat Producer Price Growth Model

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Abstract: *Movements in wheat producer prices are indicators of changes in the fundamentals of supply and demand. This paper creates the chaotic wheat producer price growth model and explains the local stability of the wheat producer price in the period 1991-2020 in the U.S., Germany and the Russian Federation. This paper confirms the stable growth of wheat producer price in those countries in the observed period.*

1. INTRODUCTION

Guegan (2009) focuses on the use of dynamical chaotic systems in Economics and Finance. According to Guegan (2009), chaotic systems are complex systems that belong to the class of deterministic dynamical systems.

Namely, mathematicians were the first to be interested in this theory. In biology, scientists have used chaotic deterministic systems since the 1970s (May 1976). In physics, it is a long tradition for researchers to use these models. In economics, people working on stability and instability have flirted with bifurcation theory since the 1980s. Between the years 1986 and 1998, a lot of studies in economics used chaotic systems, following the idea of Grandmont (1988) (Guegan, 2009).

Chaos theory started with Lorenz's model (1963). Chaos theory has been applied in economics by Day (1983), Goodwin (1990), Medio (1993), Lorenz (1993), Jablanovic (2022), etc.

Stability of motion and chaos theories can detect sensitivity to initial conditions. Tapia Cortez et al. (2018) explain mineral commodity prices dynamics. Their paper examines the chaotic behavior of annual copper prices between 1900 and 2015. They combine chaos theory, stability of motion and statistical techniques to reconstruct the long-term dynamics of copper prices. Their study recommends that the use of chaotic behavior improves our understanding of mineral commodity markets. In this sense, it improves the performance of traditional techniques for selecting key factors that influence market dynamics (Tapia Cortez et al., 2018).

The basic aim of this paper is to construct the chaotic wheat producer price growth model. The model is estimated.

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2. THE MODEL

The chaotic wheat producer price growth model is presented by the following equations:

$$D_t = \alpha - \beta P_t \; \alpha > 0, \quad \beta > 0 \tag{1}$$

$$S_t = -\gamma + \delta P^e{}_t \; \gamma > 0, \quad \delta > 0 \tag{2}$$

$$\frac{P_{t+1} - P_t}{P_t} = \mu\left(D_t - S_t\right), \quad \mu > 0 \tag{3}$$

$$\mathrm{P_t} = P^e{}_t \tag{4}$$

Where P_t – is the wheat producer price; P^e – the expected wheat producer price; S_t – supply function of wheat; D_t – demand function for wheat; μ – the adjustment coefficient; α, β – the coefficients of the demand function for wheat; γ, δ – the coefficient of the supply function of wheat. (1) defines demand function for wheat; (2) defines supply function of wheat; (3) determines the relation between wheat producer price growth rate and surplus of demand for wheat; (4) explains relation between producer price for wheat and the expected producer price for wheat. By substitution one derives:

$$P_{t+1} = [1+\mu\ (\alpha+\gamma)]\ P_t - [\mu\ (\beta+\delta)]P_t^2, \quad \alpha, \beta, \mu, \gamma, \delta > 0 \tag{5}$$

It is important to introduce p as $p = P / P^m$, where p range between 0 and 1. P^m is the maximal size of the producer price in its time series . Further, growth rate of the producer price of wheat is obtained as:

$$p_{t+1} = [1+\mu\ (\alpha+\gamma)]\ p_t - [\mu\ (\beta+\delta)]\ p_t^2, \quad \alpha, \beta, \mu, \gamma, \delta > 0 \tag{6}$$

This model given by equation (6) is called the logistic model. It is possible to show that iteration process for the logistic equation

$$z_{t+1} = \pi\, z_t\, (1 - z_t)\ ,\ \pi \in [0,4],\ z_t \in [0\ ,1] \tag{7}$$

is equivalent to the iteration of growth model (6) when we use the identification

$$z_t = \frac{\mu\left(\beta+\delta\right)}{\left[1+\mu\left(\alpha+\gamma\right)\right]} p_t \ \text{ and } \ \pi = \left[1+\mu\left(\alpha+\gamma\right)\right] \tag{8}$$

Using (6) and (8) we obtain:

$$z_{t+1} = \frac{\mu\ (\beta\ +\delta\ )}{[1+\mu\ (\alpha+\gamma)]}\ p_{t+1} = \frac{\mu\ (\beta\ +\delta\ )}{[1+\mu\ (\alpha+\gamma)]}\ \{\ [1+\mu\ (\alpha+\gamma)]\ p_t - \mu\ (\ \beta\ +\delta) p_t{}^2\} =$$

$$= \mu\ \ (\beta\ +\delta\ ) p_t - \left[\frac{\mu^2\ \ (\beta\ +\delta)^2}{[1+\mu\ (\alpha+\gamma)]}\right] p_t{}^2$$

On the other hand, using (7) and (8) we obtain:

$$z_{t+1} = \pi\ z_t\ (1 - z_t) = [1+\mu\ (\alpha+\gamma)]\ \left[\frac{\mu\ (\beta\ +\delta\ )}{1+\mu\ (\alpha+\gamma)}\right] p_t\ \left\{1 - \left[\frac{\mu\ (\beta\ +\delta\ )}{1+\mu\ (\alpha+\gamma)}\right] p_t\right\} =$$

$$= \mu\ \ (\beta\ +\delta\ ) p_t - \left[\frac{\mu^2\ \ (\beta\ +\delta)^2}{1+\mu\ (\alpha+\gamma)}\right] p_t{}^2$$

It is obtained that: (i) For parameter values $0 < \pi < 1$ all solutions will converge to $z = 0$; (ii) For $1 < \pi < 3{,}57$ there exist fixed points the number of which depends on π; and (iii) For $3{,}57 < \pi < 4$ the solution become "chaotic".

3. EMPIRICAL EVIDENCE

The main aim of this analysis is to present the producer price growth stability in USA, Russian Federation, Germany in the observed periods by using the logistic model (9). In this sense,

$$p_{t+1} = \pi p_t - \upsilon p_t^2, \quad \pi \in [0, 4] \tag{9}$$

where p – producer price of wheat, $\pi = [1+\mu(\alpha + \gamma)]$ and $\upsilon = \mu(\beta + \delta)$. Now, we estimate the model (9). The results are presented in Tables 1-3 (FAO, 2022).

Table 1. The estimated model (9): Wheat Producer price (USD/tons), 1991-2020, USA

R=0.82504 Variance explained 68.069 %	π	υ
Estimate	1.239126	0.348518
Std. Err.	0.124734	0.171399
t(27)	9.934113	2.033373
p-level	0.00000	0.051952

Source: FAO, 2022.

Because $\pi = 1.239126$, then producer price of wheat monotonically increased in the period 1991-2020, in the USA.

Table 2. The estimated model (9): Wheat Producer Price (USD/tons) Annual value, 1992-2020, Russian Federation

R=0.62878 variance explained 39.536%	π	υ
Estimate	1.437326	0.714277
Std. Err.	0.18665	0.251491
t(26)	7.700671	2.840163
p-level	0.000000	0.008644

Source: FAO, 2022.

Because π=1.437326, then producer price of wheat monotonically increased in the period 1992-2020, in Russian Federation.

Table 3. The estimated model (9): Wheat Producer Price (USD/tons) Annual value, 1991-2020, Germany

R=0.72285 Variance explained 52.851%	π	υ
Estimate	1.305768	0.451004
Std. Err.	0.14943	0.199413
t(27)	0.734643	2.261655
p-level	0.00000	0.31981

Source: FAO, 2022.

Because π=1.305768, then producer price of wheat monotonically increased in the period 1991-2020, in Germany.

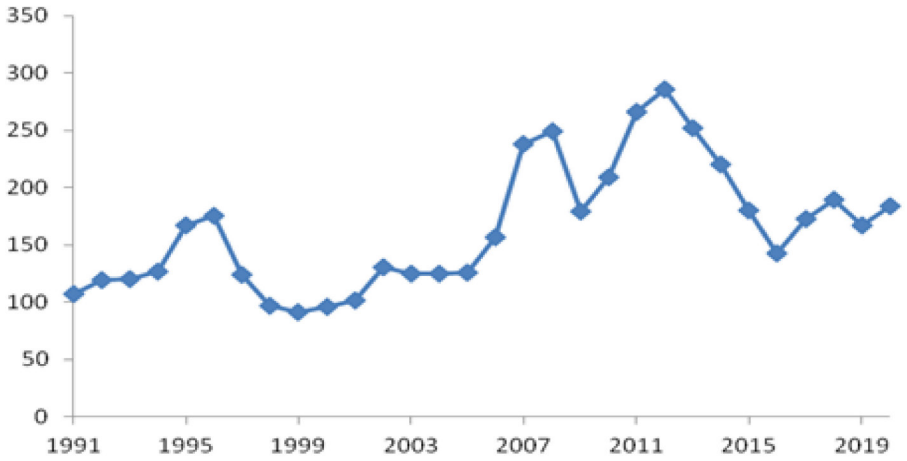

Figure 1. Wheat Producer Price (USD/tons), 1991-2020, USA
Source: FAO, 2022.

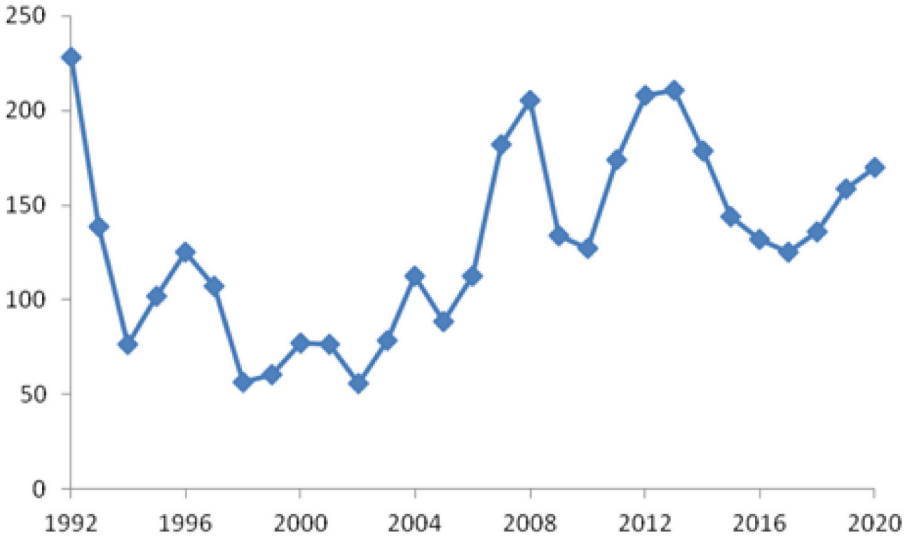

Figure 2. Wheat Producer Price (USD/tons) Annual value, 1992-2020, Russian Federation
Source: FAO, 2022.

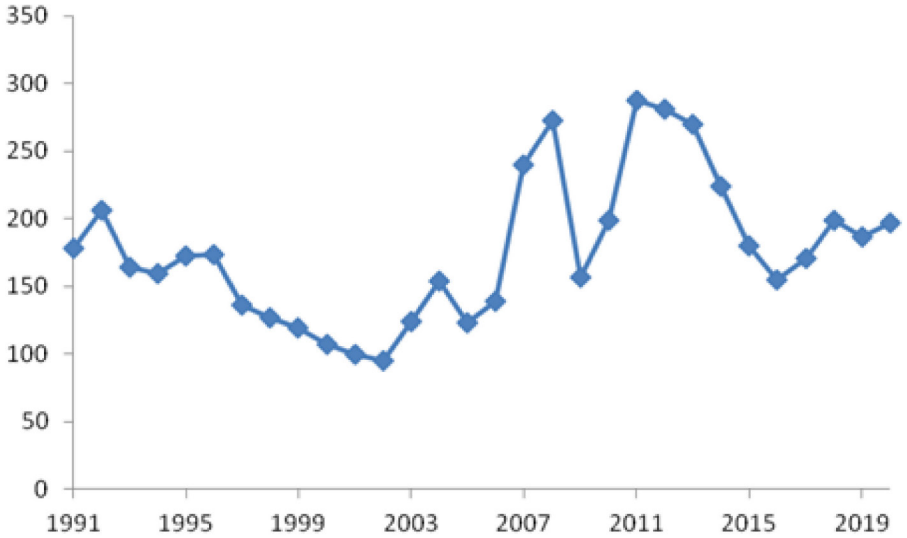

Figure 3. Wheat Producer Price (USD/tons) Annual value, 1991-2020, Germany
Source: FAO, 2022.

4. CONCLUSION

This paper creates the chaotic producer wheat price growth model. Also, this paper confirms that the coefficient $\pi = [1+\mu\ (\alpha+\gamma)]$ plays a crucial role in explaining the local stability of the producer wheat price, where, μ is the adjustment coefficient; α is the coefficient of the demand function for wheat, γ is the coefficient of the supply function of wheat. The estimated values of the coefficient π were between 1 and 2 in the USA, Russian Federation and Germany in the observed periods. These results confirm a stable growth of producer wheat price in those countries in the observed periods.

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Economic Assessment of Sea Buckthorn Cultivation and Processing in Conditions of Intensive Production

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Abstract: *The cultivation of medicinal plants is a current topic of growing importance. In Europe, but also the world, the demand for high-quality food is constantly growing. Sea buckthorn can be considered a functional food, which is an intermediate step between classic foods and medicines. Sea buckthorn contains a high content of vitamin C, which makes it an ideal helper in the treatment of flu or angina; thanks to the high content of vitamin B, it heals burns, has antiseptic effects, consumption of products from this medicinal plant ensures prevention in the treatment of cardiovascular diseases and cancer, supports digestion, detoxifies the body, purifies and supports the activity of the kidneys and urinary system, reduces high cholesterol, improves memory, has anti-inflammatory effects. In the contribution, we focus on the economic assessment of the cultivation and processing of this superfood in an intensive cultivation method. We modeled two alternatives: "Alternative A" - frozen fruits, "Alternative B" - 100% sea buckthorn juice. Based on the performed analysis, the second alternative is more economically efficient, given that the payback period is before the seventh vegetation year, the internal rate of return is at the level of 35.67% and the net present value reaches the level of 1,379,316 €. In the contribution, we also evaluated the intensity of production based on the resulting indicators (revenues, costs, management result per hectare, average profitability of revenues and costs) with conventional crops grown in the corn production area (wheat, barley, corn). We found that the values of all indicators were more favorable for sea buckthorn.*

1. INTRODUCTION

Sea buckthorn (*Hippophae rhamnoides* L., SBT) is being used as a folk medicine for its diverse medicinal properties. Flavonoids are generally considered the main bioactive and characteristic ingredients in SBT (Liu et al. 2021). Sea buckthorn (*Hippophae rhamnoides* L.), an ancient plant widely found in China, Mongolia, Russia, and northern Europe containing yellow or orange, fleshy, juicy, and soft berries, has gained increasing attention from scientists and consumers. It has a long history as a traditional Chinese herbal medicine, owing to its diverse phytochemical components and excellent antioxidant potential for improving the health of individuals suffering from chronic diseases (Ma et al., 2021). Sea buckthorn (*Hippophae rhamnoides* L., SBT) belongs to the Elaeagnaceae family and is a thorny, deciduous, dioecious shrub, which grows in cold-temp areas and arid regions, and is naturally distributed in Asia, Europe and North America. It has been used historically as a folk medicine to treat circulatory diseases, skin damage, metabolic disorders and digestive diseases in traditional Chinese medicinal prescriptions, being formally documented in the Chinese Pharmacopoeia in 1977 (Olas, 2018; Suryakumar & Gupta, 2011).

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Sea buckthorn (SB) has been indicated to have hypoglycemic potential, but its effects on glucose in people with impaired glucose regulation (IGR) are still unclear (Ren et al., 2021). At present, increasing attention on the possible positive effects of SB berries for glycemic control was also noted. Several animal studies have shown the positive effects of SB protein/fruit oil extract on reducing blood glucose, as well as alleviating insulin resistance. (Gao et al., 2017; Yuan et. al., 2016; Zhang et al., 2010). In human trials, for example, compared with strawberries, SB decreased and delayed insulin response and improved glycemic profile following a sucrose-containing berry meal (Mortensen et al., 2018).

Sea buckthorn (*Hippophae rhamnoides* L.), which has been categorized as a "medicine food homology" fruit by China's National Health Commission for both nutritional and medicinal purposes, has nearly 200 kinds of nutritive and bioactive compounds such as polyunsaturated fatty acids, carotenoids, sugar alcohols, superoxide dismutase and phytosterols. Significant bioactivity, including cardiovascular improvement, antidiabetic and anti-obesity activity, have highlighted the application of sea buckthorn (Wang et al., 2021). Sea-buckthorn is an ancient plant with modern advantages, due to its nutritional and medicinal value. It is cold resistant, and native to Europe and Asia. All parts of sea-buckthorn, *e.g.* berries, leaves, and seed or pulp oils, contain many bioactive compounds. They are a rich source of natural antioxidants, such as tocopherols, carotenoids, flavonoids; they also contain proteins, vitamins, minerals, lipids (mainly unsaturated fatty acids), sugars, organic acids and phytosterols. Sea-buckthorn extracts have therefore many beneficial properties, mainly antioxidative, anticancer, anti-inflammatory, antibacterial and tissue protective (Cho et al., 2017; Guo et al., 2017; Suryakumar & Gupta 2011; Zhang et al., 2018; Zargar et al., 2020; Ji et. al., 2020). Recent clinical studies have also shown that consumption of extract from sea-buckthorn berries leads to an increase in the number of selected types of stem cells (progenitor, endothelial and lymphocytoid mesenchymal stem cells) in circulating blood. This, in turn, may affect the repair and regeneration processes in damaged tissues, as well as the suppression of inflammation (Drapeau et al., 2019).

Sea buckthorn and its derived products (oil; alcoholic extracts), rich in flavonoids and essential fatty acids, are among these healthcare products. Specifically, sea buckthorn and its derivatives are reported to have antioxidant and antitumor activity in dysplastic skin cells. (Dudau et al., 2021). Sea buckthorn (Elaeagnus rhamnoides L.) is a unique medicinal and aromatic plant, frequently used as part of various pharmaceutical treatments, some of which are related to skincare. Sea-buckthorn-derived alcoholic extracts and seed oil were tested for antioxidant, antitumor and regenerative properties (Gegotek et al., 2018; Olas et al., 2018).

The processing of sea buckthorn berries for juice extraction leads to a large amount of residues, accounting for 20% of the total fruit weight, consisting of pulp, seed and skin which are known to be rich in carotenoids, polyphenols, fatty acids and sterols (Rösch et al., 2004; Dulf et al., 2012; Radenkovs et al., 2018). To reduce waste, sea buckthorn pomace is generally utilized as animal feed or for the extraction of biologically active compounds, providing beneficial food constituents, antioxidants, and cosmetics products (Périno-Issartier et al., 2011). Other food applications targeted the addition of sea buckthorn pomace to bread and other bakery products in order to increase their nutritive value (Lougas et al., 2005; Kant et al., 2012) and the direct enrichment of edible oils with sea buckthorn carotenoids (Chemat et al., 2012).

2. MATERIAL AND METHODOLOGY

The goal of our research is an economic assessment of the simulation of operating inputs and outputs of a sea buckthorn plantation with an intensive cultivation method in the conditions of the Slovak Republic. The source of data for the simulation of the economic efficiency model of the cultivation of the medicinal plant selected by us was primary data from growers who are engaged in the cultivation of this medicinal plant. The missing data, especially of a production nature, which the growers were not willing to provide us, were obtained mainly from the professional literature by Valíček and Havelka (2008) and Bajer (2014).

Expected assumptions of research results:

1. The finalization of the total production in the form of sea buckthorn juice is more economically advantageous compared to the processing of the total harvest in the form of frozen fruits;
2. The resulting indicators evaluating the economic level of our model (total yields, costs, farming economic result per hectare, average profitability of costs and yields) will achieve more favorable economic results compared to the cultivation of conventional crops in the corn production area (wheat, barley, corn).

The plantation modeled by us has the character of an intensive cultivation method. Intensive agriculture is characterized by increasing the yield of the land using mechanization, chemical agents and the irrigation system. It does not require a large area of land, so it focuses on maximizing a specific, albeit smaller, area. In this method of cultivation, a whole range of preparations and modern methods are used to keep the soil as productive as possible. Compared to extensive agriculture, it represents a change in approach to crop cultivation, soil care, and thus to agriculture.

The reasons for choosing the mentioned medicinal plant are:

- the mentioned crop does not have sufficient economic evaluation (justification) in the Slovak Republic or in the world - in the scientific databases accessible to us, there is a minimum of contributions that would relate to the economy of medicinal plants in general, or specifically to sea buckthorn;
- with sea buckthorn, there are enough articles from an agrotechnical, production, medical or chemical point of view, but not from an economic point of view;
- it was not our intention to focus on the economic evaluation of plantation cultivation of conventional medicinal plants on arable land (echinacea, chamomile, calendula);
- almost the entire territory of the Slovak Republic has suitable conditions for growing this crop;
  it is a perennial medicinal plant;
- fruit tree or fruit bush;
- contains a large amount of substances beneficial to health;
- final products from this medicinal plant are increasingly popular among end consumers.

The sea buckthorn plantation fulfills the legal conditions for its inclusion in the category of long-term tangible assets. It will be depreciated in the fourth depreciation group with a depreciation period of 12 years.

2.1. Procedure for Determining Investment Expenses

Investment expenses will be determined in the amount of own costs for planting and tending the plantation until the first year of fertility, which is the fourth year after planting for sea buckthorn.

The economic evaluation was carried out through static and dynamic methods of evaluating investment projects:

1. Use of static methods:
   - **a.** **average profitability of revenues** – the indicator compares the average economic result of the project before taxation and the average revenues that will be produced during the lifetime of the project (Gurčík et al., 2012);
   - **b.** **average profitability of costs** – the indicator compares the average economic result from the project before taxation and the average operating costs incurred during the life of the project (Gurčík et al., 2012). We use the pre-tax farming result for subsequent comparison with conventional crops (wheat, barley, corn);
   - **c.** **return period of invested funds** – is the time during which the funds invested in the project will be returned. It is the period that elapses from the investment expenditure to the time when the accumulated revenues from the project cover this expenditure (Krištofík et al., 2009).
2. Use of dynamic methods:
   - **a.** **Net present value** – can be defined as the difference between the discounted cash income from the investment and the capital expenditure. An interpretation of the various possible net present value outcomes is as follows:
     - NPV > 0 – the discounted cash income exceeds the capital expenditure, the investment project is acceptable for the company,
     - NPV < 0 – the discounted cash income is less than the capital expenditure, the investment project is not acceptable for the company,
     - NPV = 0 – the investment project is indifferent from the point of view of the company (Bielik & Turčeková, 2013).
   - **b.** **Internal rate of return** – can be defined as the interest rate at which the present value of the cash income from the investment equals the capital expenditure. We can also define it as an interest rate at which the net present value is equal to zero (Bielik et al., 2018).
   - **c.** **Discounting as part of dynamic investment calculations** – the discount rate plays an important role in the calculation of dynamic indicators, the amount of which depends on the cost of own equity. This cost should evaluate the fact that the investor used the capital for a specific project and thereby got rid of the possibility to invest the free funds in other investment opportunities (Kislingerová, 2001). Over the last 15 years, the average return on government bonds is at the level of 3.5%. For projects with higher risk, the discount rate can be up to 5% higher than the average cost of own equity. Investments in agriculture are among the projects with a higher risk. Based on the above, the discount rate in our project was set at 8%.
   - **d.** **Analysis of sensitivity factors -** Sensitivity analysis consists of monitoring the impact of a change in some determinants on a change in the net present value (Krištofik et al., 2009). In the paper, we examine the impact of an increase in operating costs and a decrease in revenues on the net present value.

2.2. Break-Even Point Analysis

To determine the Break-even point represents for the enterprise the important information because it defines the minimum amount of products that the enterprise needs to produce to cover its fixed and variable costs. Knowing the Break-even point allows an enterprise to properly estimate the revenues necessary to ensure profits (Majerčáková & Majerčák, 2015).

3. RESULTS

The input parameters of our model are shown in Table 1. Cultivation of sea buckthorn in the Slovak Republic is rather an exception, it is not a widespread crop. Sea buckthorn is a unique cultural crop grown in Slovakia. Before we proceeded to the actual creation of the model, we personally visited several entities that are dedicated to the cultivation of this interesting crop, which contains a large number of substances beneficial to health, but in the mosaic of input data, we lacked data of a production nature, which either our respondents were not willing to provide us or provided them to us, and through subsequent cross-checking, we found that they are false or unreliable data. We sorted the collected data into data that is probably correct and data that is irrelevant. That's why we supplemented these missing data from the professional literature. We chose the varieties that are most planted under the conditions of the Slovak Republic. When growing this crop, it is necessary to consider its basic biological peculiarities. This includes a dioeciousness, demanding light, the need for sufficient air flow, water-protected land with enough organic matter and mineral substances.

Dioeciousness means that without the presence of a male, or a female plant does not pollinate the flower, which would prevent the harvest. In our model, we consider growing the Pollmix and Leikora varieties, which achieve the best production values in our conditions. On one hectare, approximately 90% of the female plants will be planted and the rest will be male plants. In the project, we calculate with the alternative that the business entity has the land at its disposal, i.e., j. without the cost of its procurement. The model compiled by us points to the individual work steps necessary for planting and tending the plantation, harvesting, and processing the crop, as well as the disposal of the plantation. Input prices of material assets, which are unavoidable during cultivation, or processing of this crop (mower, fencing, drip irrigation, freezer box, sorter) were determined based on consultation with potential suppliers of these capital inputs. We received information about the amount of labor costs directly from the growers. Personnel costs for harvesting were set at the level of 7 €/hour (net). Material costs (e.g., fertilization, electric shears needed for harvesting, etc.) were set based on a market survey carried out by us.

In the economic assessment, we assumed the finalization of the production in 2 forms:

- "Alternative A" - we plan to sell frozen sea buckthorn,
- "Alternative B" - 100% sea buckthorn juice.

The technological-economic project assumes 12 production years with an average annual yield of 9.50 kg per bush, i.e. j. 11 t/ha. The first production year is the fourth year after planting. This year we expect a yield of 0.60 kg per bush, while we assume that it will reach the maximum yield in the fifth to seventh production year (13.3 kg). After this period, the planned yield per hectare decreases slightly every year. The average annual yield in the eighth to twelfth production year per bush is 11.5 kg.

Table 1. Model input parameters

Item	Data
Area (ha)	10
Variety (types)	Leikora, Pollmix
No. of plants (ha)	1 281
No. of female plants (ha) – Leikora	1 159
No. of male plants (ha) – Pollmix	122
Mower	yes
Fencing	yes
Irrigation system	yes
Freezer box	yes
Sorter machine	yes
Building (for storage of unsold or unprocessed crops)	yes
Method of harvest	by hand using electric scissors
Sea buckthorn yield	52 %
Selling price of berries (frozen sea buckthorn)	7 €/kg
Selling price of juice	22 €/l

Source: Own processing

Our plantation model has an area of 10 hectares; to ensure the annual harvest, it is necessary to plan to plant 5 hectares in the first year, then 5 hectares in the following year. The reason for this is the fact that during harvesting, whole branches are cut, including the fruits (due to the sharp thorns on the branches), which will affect the productivity of the plant. The cut branches and the fruits are still in the field and placed in containers that go to the freezer box, where they are frozen for 48 hours at a temperature of -15 ^{0}C. Subsequently, the fruits frozen in this way are easily separated from the twigs. The fruits go to the sorting line, where they are separated from the leaves and in this condition, they can either be further stored in another freezer box at a temperature of -18 ^{o}C (like other small fruits) or they can be processed into a whole range of products. The yield of sea buckthorn is 52%, which means that we get approximately half a liter of juice from 1 kg of fruit. In the model, we assume the price of frozen fruit at the level of 7 €/kg, while we plan an annual price increase of 5% until the sixth year of production. This price increase was determined based on the current development of the price increase of this crop. The price of the juice was also determined based on market research. In the first year, we expect a price of 22 €/l, but the price of juice has grown significantly more slowly in the last period, and that is the reason why we expect only a 1% annual price increase.

Table 3 shows our planned operating costs that will arise during the production period of the sea buckthorn plantation, as well as the share of individual cost components in the total costs. Fixed costs include those whose volume does not change depending on the scale of production (mowing costs, fertilization costs, sorting machine maintenance costs, depreciation, operation of the freezer, liquidation of the plantation at the end of its life). During the life of the plantation, we will depreciate not only the plantation itself, but also the mower (reinvestment in the 4th production year), the fence, the irrigation system (reinvestment in the 4th production year) and the building (from the 1st production year) that will serve as a warehouse for storage not yet sold, or unprocessed crops from the plantation, a freezer box (from the first year of production) and a sorter (from the first year of production). Among the variable costs are the costs of manual harvest from the plantation, as well as other harvesting costs, among which we include the work of the tractor, the cost of transporting the fruit from the plantation, as well as the cost of procuring electric shears with which the crop is cut from the branches. Harvesting will be done by cutting branches. This alternative was chosen due to the

fact that mechanized harvesting with a harvester (adapted for cutting branches) would be disadvantageous due to high investment costs and poor utilization of the harvester considering that this harvester can cut 4-8 ha per day, and we calculate with harvesting in one year on an area of 5 hectares. There is also an alternative with vibrating mechanized technology. In Romania, they tested vibrating harvesters very successfully with the Moldova variety. The harvesting speed was 29-30 bushels per hour, which represented a harvest of approximately 800-900 kg of fruit (Bajer, 2014). However, this method does not seem to be effective due to the fact that there is a high loss of fruit, meaning that such a mechanized harvest would have to be followed by pruning of the branches as well. When we compare both alternatives, we find that the share of variable costs is higher in "Alternative B", which is related to the additional costs of pressing and packaging juices.

In Table 2 we see the quantification of investment expenses for the establishment of 10 hectares of sea buckthorn plantation within the first year of fertility, which in the case of this medicinal plant is the fourth year from the establishment of the plantation. At the beginning of the growing season, an investment in the procurement of a mower, fencing and an irrigation system is necessary. Together, these costs make up more than 50% of the total investment expenses. As for the plantation itself, the most expensive item is the planting itself, the share of which is almost 24% of the total investment expenses. Among other costs, we include the costs of preparing the plantation itself before planting, fertilizing the soil in the year of planting, as well as the costs of care until the first production year, which includes mowing, fertilizing and cutting bushes. Fertilization is ensured by both organic (manure) and inorganic (superphosphate, potassium sulphate, ammonium nitrate) fertilizers.

Table 2. Quantification of investment expenses up to the first production year (in Eur)

Item	Costs per 10 ha	Percentage share
Procurement of a mower	4 000	1.45
Procurement of fencing	19 200	6.94
Procurement of an irrigation system	127 500	46.06
Preparatory work	10 000	3.61
Soil fertilization	13 072	4.72
Planting a plantation	65 406	23.63
Treatment costs	37 633	13.60
Total	**276 811**	**100 %**

Source: Own processing

From the comparison of the alternatives modelled by us, it is clear that the implementation of "Alternative B" is more economically efficient (Table 4). The internal rate of return for this alternative is 35.67%, the payback period is before the seventh vegetation year, the net present value of the investment is at the level of 1,379,316 €. The average break-even point is at the level of 14,524 kg, or 9,481 l. Based on the above, the research assumption was confirmed that the finalization of the production in the form of 100% sea buckthorn juice is economically more interesting for the business entity compared to the finalization of the harvest in the form of frozen sea buckthorn.

Furthermore, we analyzed how an increase in operating costs by 10% or a decrease in revenues by 10% will influence the net present value (Table 5). The results of the analysis show that a more significant impact in the modeled alternatives is the decrease in revenues compared to the increase in operating costs. This impact is more significant with "Alternative B", in absolute terms we record a decrease of 261,056 € or 34%.

Table 3. The amount of total costs in € during the production period of the sea buckthorn plantation and their share in the total costs

Type of costs/Alternative	A (€)	A (%)	B (€)	B (%)
Fixed costs	**1 055 967**	**28.74**	**1 055 967**	**22.7**
Mowing costs	46 484	1.27	46 484	1
Costs of fertilization	29 078	0.79	29 078	0.63
Maintenance costs	12 400	0.34	12 400	0.27
Depreciation	392 761	10.69	292 761	8.44
Freezer operation	563 308	15.33	563 308	12.11
Disposal of plantation	11 936	0.32	11 936	0.26
Variable costs	**2 617 806**	**71.26**	**3 595 281**	**77.3**
Personnel costs for annual fruit collection	378 514	10.30	378 514	8.14
Other costs of harvest	2 051 315	55.84	2 051 315	44,1
Cleaning	187 977	5.12	187 977	4.04
Cost for pressing juices	0	0	195 496	4.2
Cost per bottle	0	0	781 979	16.81
Costs	**3 673 772**	**100**	**4 651 247**	**100**

Source: Own processing

Table 4. Resulting indicators of the economic efficiency of the investment - sea buckthorn (intensive cultivation method)

Indicator/alternatives	A	B
Payback period (in years)	7,59	6,75
Average profitability of revenues (%)	36,19	42,31
Average cost profitability (%)	56,72	73,35
Net present values (€)	767 080	1 379 316
Internal rate of return (%)	26.41	35.67
Break-even point	14 524 kg	9 481 l

Source: Own processing

Table 5. Analysis of the sensitivity of factors to changes in the net present value - sea buckthorn (intensive cultivation method)

Alternatives	A		B	
10% increase in operating costs	-184 348 €	-24%	-228 525 €	-17%
10% decrease in revenue	-261 056 €	-34%	-366 457 €	-27%

Source: Own processing

When performing any business activity, the primary goal is to achieve profit, maximize production and increase competitiveness in the market. Agricultural production, which tries to generate a positive economic result, is no exception. In general, the operating result represents the difference between revenues and costs. The amount of total revenues is also affected by subsidies that are paid in Slovakia through the Agricultural Payment Agency. Since we were unable to obtain information on the amount of subsidies provided to sea buckthorn growers, in Table 6 we present a comparison of selected economic indicators without taking into account subsidies. The source of data for conventional crops was the publication Cost of Agricultural Products published by the National Agricultural and Food Centre of the Slovak Republic. When comparing individual crops, we can see that of the conventional crops, corn achieves the most economically favorable values. The result of wheat management reached the value of -26 €, which was reflected in the negative profitability of revenues as well as costs. With sea buckthorn, we see much more interesting economic values compared to commonly grown crops. When comparing the economic indicators between the alternatives modelled by us, we again see more interesting values for "Alternative B".

Table 6. Comparison of selected economic indicators between sea buckthorn and selected conventional crops (intensive cultivation method vs. corn production area)

Alternative	Wheat	Maize	Barley	Sea buckthorn	
				A	B
Revenues per hectare (€)	804	995	770	95 959	134 379
Costs per hectare (€)	831	971	757	64 230	77 521
Profit per hectare (€)	-26	24	13	34 730	56 858
Return on costs (%)	-3.18	2.47	1.78	56.72	73.35
Return on revenues (%)	-3.28	4.41	1.75	36.19	42.31

Source: Own processing

From the data presented in Table 6, it is clear that the first research assumption has been confirmed, which means that the cultivation of sea buckthorn with an intensive cultivation method is economically more interesting compared to the cultivation of conventional crops selected by us in the corn production area.

4. FUTURE RESEARCH DIRECTIONS

International trade with sea buckthorn has developed within the last ten years with great success. More and more not only berries but also semi-products are marketed, and trade channels become more complex. There is a great demand for assuring quality and defining distinct parameters for products from sea buckthorn. In 2013 International Sea Buckthorn Association (ISA) launched a working group to propose sea buckthorn standards. The first draft documents presented in 2014 indicate that there are tremendous differences in understanding what standardization means. In general, standardization means the unification of dimensions, types and procedures. In production, it is used to unify products (typification) or/and define common sets of parameters (properties) (Morsel, 2015).

Sea buckthorn is a plant-producing fruit containing high levels of complex nutrients that competes within a developed market of internationally traded natural nutraceutical products. It has been grown as an agricultural crop in Europe since the 1970s. This is part of a global production that is largely Asian-centered, where investment in processing development and facilities has grown significantly since the year 2000. Health-conscious consumers in Europe spend €9 billion a year on nutritional supplements. Sea buckthorn as a crop is expanding in some EU member states, but cost structures and technical difficulties relating to harvesting need to be answered for production to grow (Eagle, 2015).

Erdos and Szollosi (2018) focus on the business management-related advantages and disadvantages of sea buckthorn production and processing based on economic analyses. It is the main objective of the authors to identify the expected economic findings in a high-standard plantation with different average yields. A deterministic model calculation was performed based on technological processes, using the primary data collected from enterprises dealing with sea buckthorn production. The calculation is based on the assumption of a 10-hectare plantation with intensive production technology (high soil quality (golden crown value: 32 GC per ha), irrigation, high plant density per hectare). The cost and income relations and the long-term return of the plantation were examined in the case of different average yields (12 t/ha, 18 t/ha and 24 t/ha). Under the economic circumstances of 2016, the planting cost of an intensive plantation is around 4-4.1 million HUF/ha. In the years following the fruit-bearing stage, direct production costs are between 2.5-3.9 million HUF/ha, depending on the given average yield. On the

contrary, 5.6-11.1 million HUF/ha revenue can be reached based on the current market prices, resulting in a gross margin of 3.1-7.1 million HUF/ha. Under the modelled circumstances, return is realized on the plantation's costs in 6-8 years. The net present value (NPVr=3.24%) calculated for the 15-year-long life cycle of the 10-hectare plantation is between 151-466 million HUF, while the internal rate of return (IRR) is between 23-45%. From the business management aspect, the advantage of sea buckthorn production is that it provides better income and return at a planting cost that is similar to that of other small fruits and berries. At the same time, the disadvantage of sea buckthorn production is the fact that yields are harvested every two years due to the technological characteristics of harvesting. The negative impact of this bi-yearly yield on liquidity can be eliminated with the so-called delayed planting.

In the economic evaluation of the cultivation of sea buckthorn, we started with the authentic documents of a specific farm operating in the territory of Slovakia. In the work, we evaluated basic economic indicators such as sales, costs, profit as well as selected ratio indicators of economic efficiency for the period 2012-2016. The profit from a hectare of plantation for the period 2012-2016 ranges from 600 € to 9,584 €, depending on harvest and realization price of production. It is assumed that at the time of full productivity of the plantation, an average yield of 15 kg per bush will be achieved and it is realistic that the profit from 1 hectare will be at a level exceeding the value of 30,000 €. When comparing the economic results of growing conventional crops such as cereals, root crops, but also oilseeds, the profit achieved when growing sea buckthorn is commercially interesting. And this even though building a plantation requires considerable investment expenses. The economic effect can also be increased by finalizing sea buckthorn fruits under farm conditions (Gurčík et al., 2019). A topic for further research can be the economic evaluation of the cultivation and processing of sea buckthorn using other varieties, given that we have several dozen varieties of this medicinal plant, or the economic evaluation of the plantation cultivation and processing of other medicinal plants that are interesting for the consumer in terms of health benefits (arrow rose, goji).

5. CONCLUSION

The scientific contribution aimed to evaluate the economic efficiency model of growing and processing sea buckthorn using an intensive cultivation method. In the paper, we present the finalization of the production in two forms: "Alternative A" - frozen fruits, "Alternative B" - 100% sea buckthorn juice. Based on the performed analysis, the most economically acceptable option for the grower is the implementation of "Alternative B". With this alternative, the payback period was before the seventh growing year, the internal rate of return was 35.67% and the net present value was 1,379,316 €. The results of the sensitivity analysis showed that in both modeled alternatives, the net present value was more affected by the decrease in yields, which are affected by the variability of the harvest and the unit price per kilogram, respectively.

Both formulated research assumptions were confirmed:

1. The finalization of the total production in the form of sea buckthorn juice is more economically advantageous in comparison with the processing of the total harvest in the form of frozen fruits;
2. The economic indicators chosen by us (total revenues, costs, farming result per hectare, average profitability of costs and revenues) will achieve economically more interesting values compared to conventional crops grown in the corn production area (wheat, barley, corn).

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Introducing Green Infrastructure into Urban Policy Documents – The Case of Croatian Cities

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Abstract: *More and more cities are coping with the challenges of unsustainable urbanization, degradation, loss of natural capital, climate change, and increased risk of natural disasters. Green infrastructure (GI) and especially urban green infrastructure (UGI) could have a key role in dealing with these development issues.*

The main goal of the paper is to evaluate the role of GI in development strategies, both on national and local levels. The role of GI as a policy tool is analyzed. In addition to national development strategies, the paper reviews the development strategies of several Croatian cities. The four biggest and most developed cities are selected: Zagreb, Split, Rijeka, and Osijek. As the most developed cities in economic terms, they are expected to base their development on new development patterns, including GI.

The paper is structured as follows. After presenting GI and the literature review, the third section discusses national regulation and urban policy documents related to GI. The final section presents some conclusions and some proposals for future research agenda.

1. INTRODUCTION

Urban areas, primarily cities, are the main drivers of economic growth, but at the same time, they also have the greatest impact on sustainable development. Since 75 percent of the European and 58 percent of the Croatian population live in urban areas it is important to improve the sustainability of urban areas, improve the environment, and increase the quality of life in cities.

More and more cities are coping with the challenges of unsustainable urbanization, degradation, loss of natural capital, climate change, and increased risk of natural disasters. Green infrastructure (GI) and especially urban green infrastructure (UGI) could have a key role in dealing with these development issues.

The main goal of the paper is to evaluate the role of GI in development strategies, both on national and local levels. The role of GI as a policy tool is analyzed. In addition to national development strategies, the paper reviews the development strategies of several Croatian cities. We select the biggest and the most developed cities: Zagreb (790.017 inhabitants), Split (178.102), Rijeka (128.624), and Osijek (108.048). As the most developed cities in economic terms, they are expected to base their development on new development patterns, including green infrastructure. Besides, these cities also formulate development strategies for urban agglomeration. The existence of specific strategies for GI development for Croatian cities is rare, so general development strategies are used.

The paper is structured as follows. After presenting GI and the literature review, the third section discusses national regulation and urban policy documents related to GI. The final section presents conclusions and some proposals for future research agenda.

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2. INTRODUCING GREEN INFRASTRUCTURE

There are different conceptual approaches to green infrastructure as well as its numerous classifications, while the concept is still evolving. GI is a very broad concept that can be interpreted in different ways. According to Sandström (2002), the concept of GI was introduced in the 1990s in the USA, but its implementation in Europe is growing, especially with the introduction of the EU's Green Infrastructure strategy (EC, 2013). GI plays a social, structural, and environmental role (function) in urban spaces. Therefore, Maruani and Amit-Cohen (2007) propose that definitions can be divided into two groups, those dealing with human needs and those dealing with environmental values.

The complexity of the concept was mentioned in academic literature and in policy papers formulated by different agencies and organizations, including companies and community groups (Pauleit et al., 2011). Naumann et al. (2011) analyzed green infrastructure predominantly from a policy perspective. It can be used as a tool or strategy to achieve sustainable development and smart growth (Demuzere et al., 2014). Therefore, the role of GI is especially emphasized in spatial planning while it encompasses multi-functional zones and includes different measures in land-use policies (EC, 2012; EU, 2013; Sandstrom, 2002).

The role of GI in planning development policy in Croatia is the focus of this paper. Hence, the insights of Wang and Bazhaf (2018) are the most valuable here. They highlight three main interpretations of GI based on "transferring or translation processes" (Wang and Bazhaf, 2018: 760). First, the link between humans and natural systems is to reach the balance of anthropocentric and eco-centric approaches. The second is a translation from the theory approach to the practical policy measure, and the third is the translation of the GI definition to understand its multifunctionality on different scales (local, urban, regional, and national). Wang and Banzhaf (2018) review six principles of green infrastructure, where multifunctionality is considered the most crucial one. The integral approach to green infrastructure functions, including environmental, social, and economic benefits, has to be applied to different scales and levels. According to Sternlieb et al. (2013) conceptual developments of green infrastructure should be related to the proper level of decision-making. Garmendia et al. (2016) emphasize the role of GI in spatial planning and argue that the concept of multifunctionality is more convenient for operationalization than the concept of sustainability. In addition, Garmendia et al. (2016) stress the importance of functional connectivity among policy planners, developers, and different disciplines.

The other concept which is closely related to green infrastructure is the urban green infrastructure (UGI) which was introduced to position green areas in urban environments using processes, approaches, and selected policy themes (Davies & Lafortezza, 2017: 94). Notions of UGI as a planning process are strategic, inter-and transdisciplinary, and socially inclusive planning. Concepts of UGI as a planning approach are connectivity (creating networked geographical areas), multifunctionality (different functions including ecosystem services), integration, and multi-scale. UGI policy themes are climate change adaptation, green economy, human health, social cohesion, biodiversity, and ecosystem services (Davies & Lafortezza, 2017: 94).

Recently, the concept of GI is associated with the term blue infrastructure (rivers, streams, ponds, lakes, etc.) which today is considered the pillar of UGI.

The benefits of GI are numerous and diverse. They are presented in Table 1.

Table 1. Potential benefits of the GI

Environmental benefits	• Provision of clean water • Removal of air pollutants • Protection of soil erosion • Rainwater retention • Increased pest control • Mitigation of land take and soil sealing
Social benefits	• Better health and human well-being • Creation of jobs • Diversification of the local economy • More attractive, greener cities • Higher property values and local distinctiveness • More integrated transport and energy solutions • Enhanced tourism and recreation opportunities
Climate change adaptation	• Food alleviation • Strengthening ecosystems resilience • Carbon storage and sequestration • Mitigation of urban heat island effects • Disaster prevention (storms, fires, landslides)
Biodiversity benefits	• Improved habitats for wildlife • Ecological corridors • Landscape permeability

Source: EC, 2013.

Environmental benefits encompass improving the functions and resilience of ecosystems, conservation of biodiversity by connecting existing natural areas, and preservation of natural habitats by preventing their fragmentation (Schäffler & Swilling, 2013). Providing multifunctional outdoor spaces and creating safe spaces that encourage activity are the principal social benefits. Protection of significant landscapes and natural heritage that affect the local identity in combination with fostering the inclusion of the community's environmental action are significant.

Economic benefits entail the creation of favorable conditions for the sustainable development of agriculture, tourism, and leisure industries. Well-planned and high-quality urban spaces increase land and real estate values. All of that can result in creating new jobs (Rutt & Gulsrud, 2016).

The most perceived barriers to the development of GI are conflicting interests of different stakeholders, physical barriers in the case of private areas, and institutional barriers. Among the major barriers, institutional barriers must be emphasized. According to Biernacka and Kronenberg (2018) institutional barriers affect the availability, accessibility, and attractiveness of GI. Implementation barriers range from legislation to a lack of cooperation, knowledge, and awareness, including a lack of communication between different stakeholders.

3. CROATIAN GREENSPACE PLANNING AND POLICY DOCUMENTS ANALYSIS

3.1. National Regulation and Policy Documents

A policy document analysis and a desk study were the main methods used for this article. The desk study of relevant literature and documents (development strategies for cities, and urban agglomerations) had been conducted to provide insight into whether or how different approaches and policy themes were considered in planning.

GI is defined in Croatian legislation. The term GI is defined by the *Law on Spatial planning*, which states that "green infrastructure is planned green and water surfaces and other nature-based spatial solutions applied within cities and municipalities that contribute to the conservation, improvement and restoration of nature, natural functions and processes in order to achieve the environmental, economic and social benefits of sustainable development".

The Construction Act stipulates the need for the formulation of The *Program for the Development of GI in urban areas*. The Program for the Development of GI in Urban Areas for the period 2021-2030 was prepared by the Ministry of Physical Planning, Construction, and State Property and adopted by the Government of the Republic of Croatia in December 2021. According to the EU documents, the Program defines objectives and measures for the development of green infrastructure in urban areas to establish sustainable, safe, and resilient cities and settlements through increasing the energy efficiency of buildings and construction areas, developing green infrastructure in buildings and urban transformation, and urban rehabilitation. It is in accordance with the *National Development Strategy of the Republic of Croatia until 2030*, which is an overall strategic document that defines the national development vision, strategic objectives, and priority areas. *Strategy for Adaptation to Climate Change* in the Republic of Croatia for the period up to 2040 with a view to 2070 and *Integrated National Energy and Climate Plan* for the Republic of Croatia 2021-2030 highlight the importance and role of GI in achieving the objectives of sustainable development with the nature-based solutions. GI Development Program is also essential for the reduction of energy consumption and therefore it is related to the Long-term Strategy for the renovation of the national building stock by 2050 and to the *Strategy for Low-Carbon Development of the Republic of Croatia by 2030* with a view to 2050. The GI Development Program is in accordance with *The Spatial Development Strategy*[2] which is a guiding document implemented on the national, regional, and local levels. One of the priorities stated in the Strategy emphasizes the importance of strengthening natural capital by planning the development of GI.

Reviewing the national strategy documents reveals that the importance of GI in the planning and development of urban areas has already been recognized. This paper questions the presence of GI approach in lower spatial scales. The urban development strategies for the four biggest cities (Zagreb, Split, Rijeka, and Osijek) are selected and analyzed.

3.2. Urban Development Strategies

For the purpose of this article the following urban strategies are analyzed: Zagreb development strategy for the period up to 2020 (ZAGREBPLAN), Zagreb urban agglomeration development strategy for the period up to 2020[3], City of Rijeka development plan 2021-2027[4], Osijek development strategy – from industrial to intelligent city 2016-2020[5], Osijek urban agglomeration

[2] Croatian system of physical planning could be classified as the continental style of planning in combination with a comprehensive integrated approach (Katurić et al., 2018).

[3] Zagreb Urban Agglomeration contains 7 cities and 20 municipalities (within Zagreb County, Krapina-Zagorje County, Karlovac, and Sisak-Moslavina County). They have common interests related to environmental and natural protection, as well as cultural resources and heritage. In April 2022 the development of the new Zagreb Urban Agglomeration Development Strategy for the period up to 2027 has begun.

[4] Strategic objectives are harmonized with the five objectives of the new regional and cohesion policy of the European Union for the period 2021-2027 (Smarter Europe, Carbon-free Green Europe, A more connected Europe, A more social Europe, and Europe closer to citizens). A Green infrastructure strategy for the City of Rijeka was adopted in 2020.

[5] The City of Osijek is a member of the Intelligent Cities Forum.

development strategy for the period up to 2020[6], Split development strategy for the period up to 2020, and Split urban agglomeration development strategy for the period up to 2020[7].

These are fundamental strategic documents of regional development policy for selected cities. Documents were developed in accordance with the Law on Regional Development of the Republic of Croatia (Official Gazette, OG 147/14) and the Guidelines of the Ministry of Regional Development and EU funds for the development of county development strategies, monitoring, and evaluation of their implementation from September 2015. The development strategies are also aligned with the Regional Development Strategy of the Republic of Croatia until the end of 2020 (OG 75/17) and the spatial planning documentation for selected cities. All development documents, except the strategic document for the City of Rijeka, expired in 2020. And that's one of the limiting factors of analysis.

In reviewing documents, the focus was on the *selected green areas approach*, *objectives* related to green areas, *actions* for achieving these objectives (strategy), and *indicators*.

The *green areas approach* is questioned by the presence of GI in urban strategies. The first finding was that green areas are rarely present as a stand-alone chapter (section) in the strategies of selected cities and most commonly they are included within broader environmental sections. The exception is the development strategy for the City of Rijeka. In analyzed documents, there is no definition of GI concept, and there is a lack of theoretical characteristics associated with UGI. The most prevalent occurrence of GI is its description. All selected strategies include so-called flagship categories of GI such as parks, forests, gardens, cemeteries, and street greenery which are managed by urban authorities and located on public land. In addition, there is no sufficient planning of public green spaces within the new settlements. Roof terraces and vertical gardens are recognized as a great potential for improving the quality of housing and life. Urban Strategies of Rijeka and Split pay more attention to blue infrastructure, compared to Zagreb and Osijek. In the development document of Rijeka, the broader context of GI is applied, and concepts of green growth (including green jobs) and green public procurement are introduced. The idea of a circular economy as well as the principles of the doughnut economy are mentioned (Raworth, 2017). The urban strategy of Rijeka is the most ambitious one and the goal is to become a regional hub for Southeast Europe for developing and implementing smart solutions in urban management.

The *benefits* of GI, the associated *problems*, and potential *barriers* to future development for GI are elaborated on in all selected urban documents. All development strategies for selected urban agglomeration consider the benefits of functional and physical networks. These benefits were generally referred to as either environmental (biodiversity) or social (recreation). All urban agglomeration documents emphasize the importance of connectivity and multifunctionality (provision of multiple functions and services) which are the essence of GI.

Urban strategies are seen as an umbrella concept for reviewing future development plans in terms of *objectives*, *actions* to achieve them, and *indicators* for monitoring. The general objectives identified in the analyzed document are increasing the surface of green areas, protection and conservation, and better management of existing GI.

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[6] Out of 19 local self-government units that make up the Osijek Urban Agglomeration, 18 of them are in Osijek-Baranja County and one in Vukovar-Srijem County.

[7] It consists of 12 local self-government units within Split-Dalmatia County. In October 2020 Split began the formulation of the Action plan for the green city according to EBRD and OECD methodology.

Specific Croatian development issues presented in urban strategies are the unresolved property status of green spaces, illegal construction, and expansion of other objects into the greening area, inconsistent standards for the design, regulation, and protection of GI components, as well as management and detachment of competent authorities in the planning and implementation of GI process. As the most urgent challenges, cities identified design of an appropriate model of a multifunctional network of GI, mapping, and inclusion of GI in other planning acts and spatial planning documents, just to name a few[8]. Urban agglomerations stress the lack of communication between competent authorities and inadequate vertical coordination among the members of agglomeration. The cities within urban agglomerations are preparing for a new generation of programs funded as integrated territorial investments for urban agglomerations, and a stronger emphasis on joint and big strategic projects.

Sound policies and strategies should be based on quantitative data describing UGI showing the availability and accessibility of GI, including their values and costs of management. A green atlas of the City of Zagreb is prepared, including the indicator of green area per inhabitant. More detailed data on green areas for the City of Zagreb are under construction, including the number of square meters per capita. Rijeka formulated indicators for monitoring the achievements of key strategic goals, including the surface of parks and other green areas till 2030. Although, there is no data on green area surface per inhabitant. Osijek prepared a Green cadaster and is expected to prepare it for agglomeration. In the Split urban strategy, quantitative indicators for planning and building new public green areas are presented. The creation of green cadaster is also planned.

To conclude this section, it is necessary to point out that all selected documents emphasize the sustainable spatial development of the urban agglomeration as one of the development priorities. To achieve this goal, integral spatial planning is one of the most important activities. It includes establishing the appropriate model of the multifunctional network of GI of the agglomeration, with mapping and valorization of the area, the inclusion of green determinants infrastructure into spatial plans, and other planning development documents. Participation of key stakeholders is a prerequisite for sustainable spatial development, and it assumes the involvement of key stakeholders (at all levels) and the public in the planning and implementation of development plans (spatial plans, green infrastructure plans).

4. CONCLUSION

GI is a significant and influential concept, but it is not fully recognized in Croatian urban planning. By reviewing selected urban development strategies, it is evident that implementing the GI concept has many challenges, including its integration into the physical planning process.

It can be concluded that Croatian cities show moderate commitment to GI development. The most demanding task is to find an appropriate mix of solutions for urban specificities which is also in line with previous European research (Andersson, 2016; Wagner, 2016; Garcia, 2017).

Why Croatian cities are not greener? Authorities are predominantly focused on a part of green areas for which they are responsible, and still, there is a lack of a coherent basis for GI research.

[8] The need for the participation of key stakeholders in the processes, educational programs related to GI, and effective use of ESI funds in the next period are also highlighted.

An effective policy requires data on GI, and a database of existing public green spaces established in the GIS environment will improve the management of public green spaces.

The future research agenda includes the following issues - is green infrastructure viewed differently by different user groups; what are the future opportunities for GI development; how to quantify intangible benefits of GI, etc.

In addition to further research, the implementation of information campaigns and educational programs are required.

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Priority Substances in Waters of Albanian Ports

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BTEX;
Water analyze;
GC/ECD/FID

Abstract: *This study was to determine the concentration of organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and BTEX (benzene, toluene, ethylbenzene and o-, m- p-xylenes) in water samples of Adriatic Sea on the Albanian coastline. These pollutants are classified as priority substances because of their stability and toxicity. Stations near the ports of Durres and Vlora were selected for this study. Durres and Vlora ports are the largest ports in Albania which are processing more than 90% of shipping transport for people and commerce in Albania. Intense ship transport and commercial processing are the main reasons for water pollution in port areas. Water currents and new arrivals from Albanian rivers can influence their pollution. Marine water samples from the ports of Durres and Vlora were taken in for the same stations in two periods, May and July 2022. Liquid-liquid extraction (LLE) and hexane as extracting solvents were used to isolate organochlorine pesticides and PCBs by water samples. PAHs were extracted using two steps LLE technique. Firstly, by using dichloromethane and after that hexane as extracting solvent. Organic phases were dried by using Na2SO4 anhidrous. Clean-up procedures were performed by using SPE techniques. After the concentration, the samples were injected in Varian 450 GC equipped with ECD and FID detectors. BTEX was analyzed using HS/SPME technique followed by GC/FID technique. Organochlorine pesticides (mostly their metabolites) were detected almost in all analyzed water for both periods of sampling. The main factors can be their previous use, new arrivals from rivers, and the water currents of the Adriatic Sea. PCBs, PAHs and BTEX were found almost for all analyzed samples. Their presence could be because of anthropogenic factors (intense activity and ship transport) in the port area. The higher level of all pollutants was in July because of the intense ship transport in this period of the year. The higher levels were found inside port areas for both periods. Priority substance levels in water samples of Durres and Vlora ports were higher/comparable with reported levels of them from other stations of the Adriatic Sea (Albania coast).*

1. INTRODUCTION

This study determined priority substance concentrations in water samples for the ports of Durres and Vlora which are the main ports of Albania. These ports are located respectively in the central and south Adriatic Sea, Albanian coastline. Both ports are processed more than 90% of shipping for people and commerce in Albania. The port of Durres is the largest seaport in Albania. It is an artificial basin that is formed between two moles. The Port is located at the north end of the Bay of Durres, located in the central Adriatic Sea. Part of the port of Durres is a fishing harbor that lies at the north end of the East Mole. From 2014, the port ranks as the largest passenger port in Albania and one of the largest passenger ports in the Adriatic Sea. In the north of Durres port (5 km distance) is located the hydrocarbon ports of Porto-Romano.

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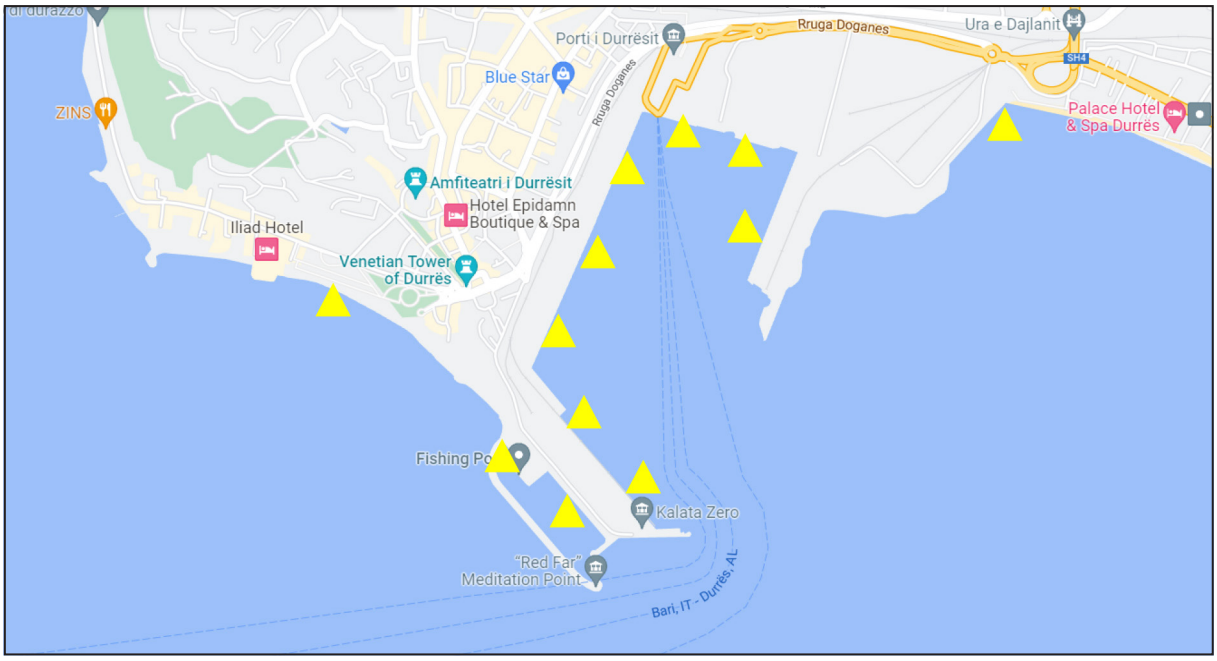
Shortly, it is thought that the port area will be re-conceptualized and expanded as one of the largest ports of the Mediterranean Sea. The port of Vlora is the second port of Albania. It is located in Vlora bay, near the city of Vlora, south Albania. The port is considered part of the Lungomare Master Plan of Vlora. Part of this project is the construction of a yacht port, and some new roads to make the port area most accessible. Until now, Vlora's port is the main function of passengers and commercial shipping. In fact, beside Vlora port in the area of Vlora bay are located other ports such as a petroleum port (Petrolifera near Zverneci), Marina port for Delta Force (near Radhima), Military Base of Orikumi and a fishing harbor (near Zverneci). In the area of Vlora bay operates some tourist ships and many small boats (motorized one) that serve as tourist transportation to visit beautiful areas of Sazani Island and the Karaburuni peninsula. Vlora bay (and Vlora's port) has intense ship transport and except this, the geographical position of the bay favors the concentration of pollutants inside of it. The negative impact of Vjosa and Semani rivermouth that bring new arrivals of pollutants (pesticide, hydrocarbons, detergents, etc.) as well as the internal/external water currents are not excluded as factors that affect pollution of Vlora bay. Vlora's port is affected by this pollution adding the pollution to this area by ships, automobile transport and commercial import/export that operate on it.

Organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons and benzene are classified as Persistent Organic Pollutants (POP) because they are persistent for many years after their application (Shayler et al., 2009). Great concern was caused by chlorinated compounds, which proved to be extremely persistent in the environment and after that in the food chain (Penttila & Siivinen, 1996; WHO & FAO 1983; Wilhelm et al., 2002). For more than 50 years (after the Second World War to 90') organochlorine pesticides were used widely in Albania for agricultural purposes. The main agricultural areas are located in the western of the country near the Adriatic Sea. The use of pesticides in Albania after 1990 decreased rapidly due to migration and the immigration of the population. PCBs were not in use in Albania until 90'. They can be found only in some electrical transformers that were used in the early 1990s, but they were reported in many water ecosystems of our country because of their atmospheric depositions. PAHs and BTEX are pollutants generated by automobile transport, extracting/processing of the oil industry, coal mine, and other industries. These hydrocarbons could be found in marine water because of ship transport or some accidental spills of hydrocarbons. Forest burning and their natural background make them very often in the environment. These pollutants have high stability, high bioaccumulation capacity, and the ability to spread out far away from the application site. Generally, these compounds are difficult to degrade and can persist for many years in particular in water ecosystems (Corsi et al., 2010; Nuro et al., 2012).

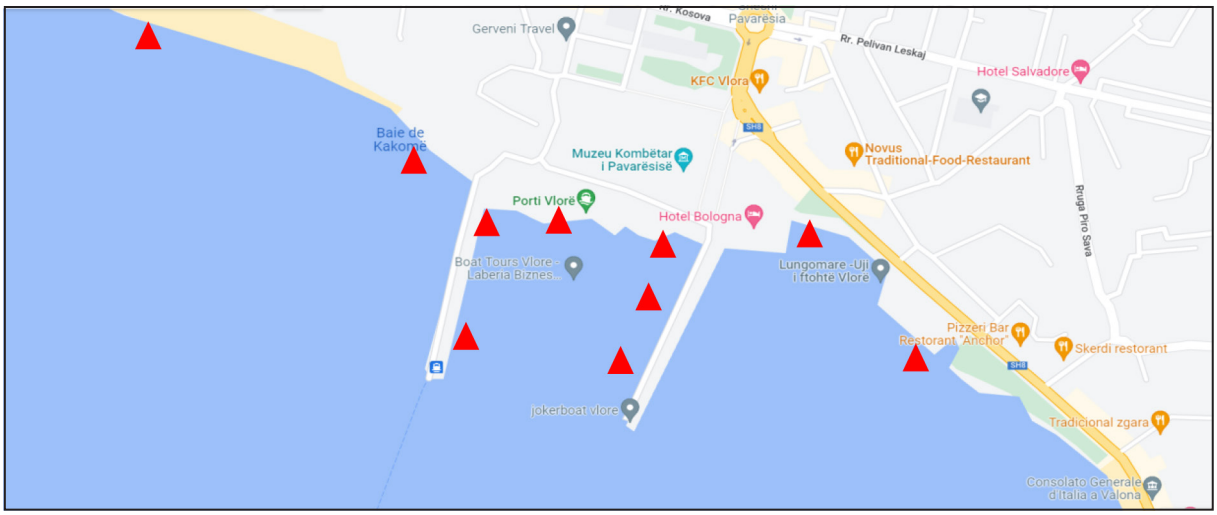
2. MATERIAL AND METHODS

2.1. Water Sampling in the Adriatic Sea

Water samples were taken in 12 different stations of the port of Durres (8 inside and 4 outside its area) and 10 stations of Vlora's port (6 inside and 4 outside port area) for two periods May and July 2022. Sampling periods were chosen for these months because May is a normal working period for both ports while July is the intense period (two to three times higher than the normal period). The sampling stations for Durres and Vlora ports are presented in Figure 1. A quantity of 2,5 litre of marine water was taken from each station in Teflon bottles. The sampling method was based on ISO 5667-3:2018. Water samples were transported and conserved at +4°C before their analysis.



a) Port of Durres sampling site, D1 (left) – D12 (right)



b) Port of Vlora sampling site, V1 (left) – V2 (right)

Figure 1. Sampling stations in the port of Durres and port of Vlora, May and July 2022.

2.2. Treatment of Water Samples for Pesticide and Pcb Analyzes

Liquid-liquid extraction was used for the extraction of organochlorine pesticide and polychlorinated biphenyls from marine water samples. One liter of water and 50 ml n-hexane as extracting solvent were added in a separatory funnel. After extraction, the organic phase was dried with 5 g of anhydrous Na_2SO_4 for water removal. A florisil column was used for the sample clean-up. 20 ml n-hexane/dichloromethane (4/1) was used for elution. After concentration to 1 ml hexane, the samples were injected in GC/ECD (Lekkas et al., 2004; Vryzas et al., 2009; Nuro et al., 2012).

2.3. Gas Chromatography Analysis of Pesticides and PCBs

Organochlorine pesticides and PCBs were analyzed simultaneously using capillary column type Rtx-5 (30 m long x 0.25 mm i.d. x 0.25 μm film thicknesses) on a gas chromatograph Varian 450

GC with ECD detector. Helium was used as carrier gas (1 ml/min) while nitrogen as make-up gas (24 ml/min). The manual injection was done in splitless mode at 280°C. The organochlorine pesticides detected were DDT-related chemicals (o,p-DDE, p,p-DDE, p,p-DDD, p,p-DDT), HCHs (a-, b-, γ- and d-isomers), Heptachlor's (Heptachlor and Heptachlorepoxide); Aldrin's (Aldrine, Dieldrine and Endrin) and Endosulfanes (Endosulfan alpha, Endosulfan beta and Endosulfan sulfat). Analysis of PCBs was based on the determination of the seven PCB markers (IUPAC Nr. 28, 52, 101, 118, 138, 153 and 180). Quantification of OCPs and PCBs was based on an external standard method (Vryzas et al., 2009; Lekkas et al., 2004; Nuro et al., 2014).

2.4. Treatment of Water Samples for PAH Analyzes

Two steps liquid-liquid extraction (LLE) was used for extracting PAHs from marine water samples. One liter of water with firstly 30 ml dichloromethane (first step LLE) and after that 30 ml hexane (second step LLE) as extracting solvent was added in a separator funnel. After extraction, the organic phase was dried with 5 g of anhydrous Na_2SO_4 for water removal. Extracts were concentrated to 1 ml hexane using Kuderna-Danish and then were injected in GC/FID for qualification/quantification of PAHs (Nuro et al., 2014; Wang et al., 2009; Lekkas et al., 2004).

2.5. GC/FID Determination of PAH in Water Samples

Gas chromatographic analyses of PAHs in water samples were realized with a Varian 450 GC instrument equipped with a flame ionization detector and PTV injector. VF-1 ms capillary column (30 m x 0.33 mm x 0.25 μm) was used for the qualification and quantification of 13 PAHs according to EPA 525 Method. Helium was used as carrier gas with 1 ml/min. FID temperature was held at 280°C. Nitrogen was used as the make-up gas (25 ml/min). Hydrogen and air were flame detector gases with 30 ml/min and 300 ml/min, respectively. EPA 525 Standard Mixture was used for qualitative and quantitative analysis of PAHs. Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Pyrene, Benzo [a] anthracene, Chrysene, Perilene, Benzo [b] fluoranthene, Benzo [k] fluoranthene, Indeo [1,2,3-cd] pyrene, Dibenzo [a, b] anthracene and Benzo [g, h, i] perylene were determined in seawater samples. Quantification of PAHs was based on an external standard method (Nuro et al., 2014; Wang et al., 2009; Lekkas et al., 2004).

2.6. HS-SPME Technique for Determination of BTEX in Water Samples

Determination of BTEX in water samples was realized using solid phase micro-extraction in static headspace mode (HS/SPME) followed by GC/FID technique. 5 ml of water sample was put in a 10 ml headspace vial. 100 um PDMS fiber was used to extract BTEX from water samples. The adsorption process was realized at 50°C (using a water bath) for 45 minutes. The desorption process (30 seconds in 280°C) was realized in a PTV injector (HS mode was selected) of a Varian 450 GC instrument. VF-1 ms capillary column (30 m x 0.33 mm x 0.25 μm) was used for the separation of Benzene, Toluene, Ethyl benzene and Xylene isomers. Helium was used as carrier gas with 1 ml/min. FID temperature was held at 280°C. Nitrogen was used as the make-up gas (25 ml/min). BTEX Mixture was used for their qualitative and quantitative analysis based on an external standard method (Nuro et al., 2014).

3. RESULTS AND DISCUSSION

In this study were analyzed organochlorinated pesticides, PCBs, PAHs and BTEX were in marine water samples from the ports of Durres and Vlora, Adriatic Sea. These are the main ports of Albania for passengers and commercial shipping. Samples were taken in May and July 2022. Organochlorine pesticides, their degradation products and PCB markers were analyzed using GC/ECD techniques. The analysis of pesticides is based on the EPA 8081B standard, in which Lindane and its isomers, Heptachlors, Aldrins, Chlordanes, DDTs and Endosulfanes are analyzed. Analysis of PCBs in water samples was based on determination of seven PCB markers. Polycyclic aromatic and volatile hydrocarbons were analyzed using GC/FID techniques. OCPs, PCBs, PAHs and BTEX were classified as priority substances because of their stability and toxicity.

Organochlorine pesticides were detected in all water samples analyzed from the ports of Durres and Vlora, for both periods (May and July 2022). The higher average value of pesticides was found in Vlora port (July 2022) with 8.2 ng/l. Vlora samples were the most polluted for both periods. The presence of pesticides in the marine water of the Adriatic Sea must be due to their previous uses in agricultural areas near the ports, river discharges (new arrival because of soil rinsing), water currents, punctual sources near the port, etc. The total of pesticides for each station was higher for water samples in July 2022 (Figure 2). Agricultural activity and new arrivals from the rivers could be the main factors. Momentum values are not excluded. It was noted that levels of pesticides for Vlora stations were higher than for Durres because of the geographic position of Vlora Bay. It favors the concentration of pollutants inside the bay. The most polluted stations for Durres were D11 in May and D10 station in July while for Vlora were V4 in May and V6 in July (Figure 3). All these stations are inside the ports of Durres and Vlora. Semi-closed areas of ports influence their concentration. Distribution and profile of organochlorine pesticides (Figure 4) were found to be different for the ports of Durres and Vlora, for both periods (May and July 2022). Their presence is based mainly on the individual concentration of some pesticides. Endrine ketone was found higher for both ports in May but Endosulfane I, Heptachlor and d-HCH were found higher in July. This fact could be connected mainly with the momentum values of these pollutants in water samples. OCP levels in water samples of Albanian ports were comparable with the reported data in previous studies on the Adriatic Sea, Albanian part (Murtaj et al., 2014; Como et al., 2013, Nuro et al., 2017).

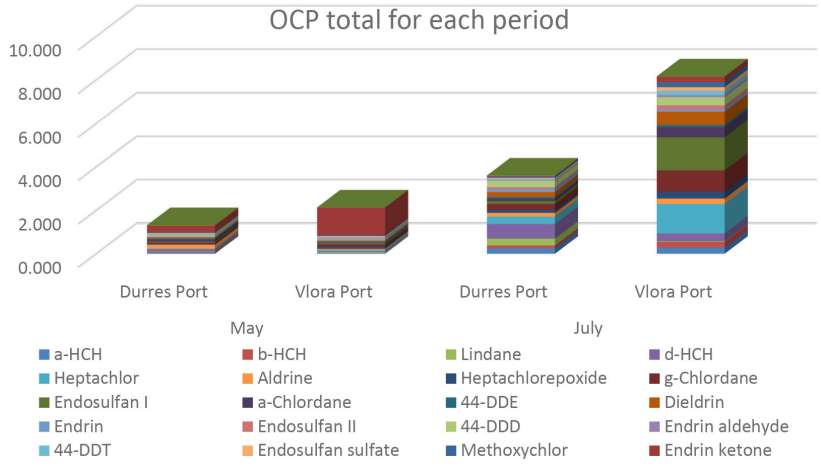


Figure 2. Total of organochlorine pesticides (ng/l) for both periods (May and July 2022) in water samples of Durres and Vlora ports, Adriatic Sea

Source: Own research

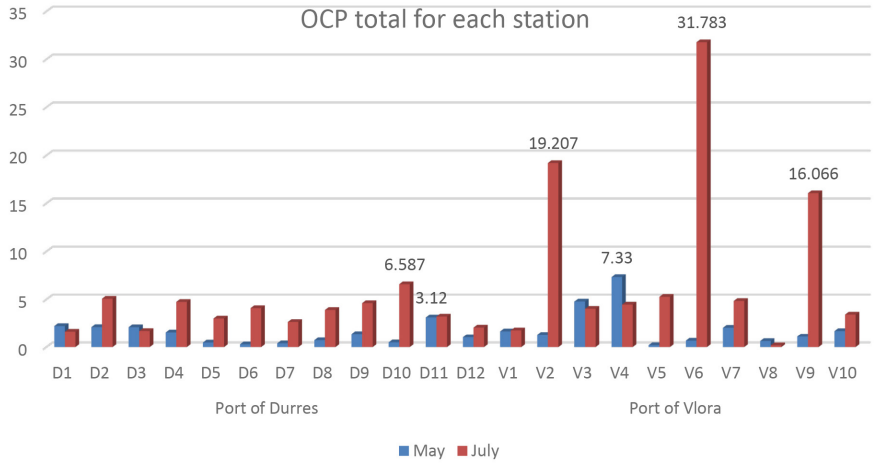


Figure 3. Total of pesticides (ng/l) for each station of Durres and Vlora ports

Source: Own research

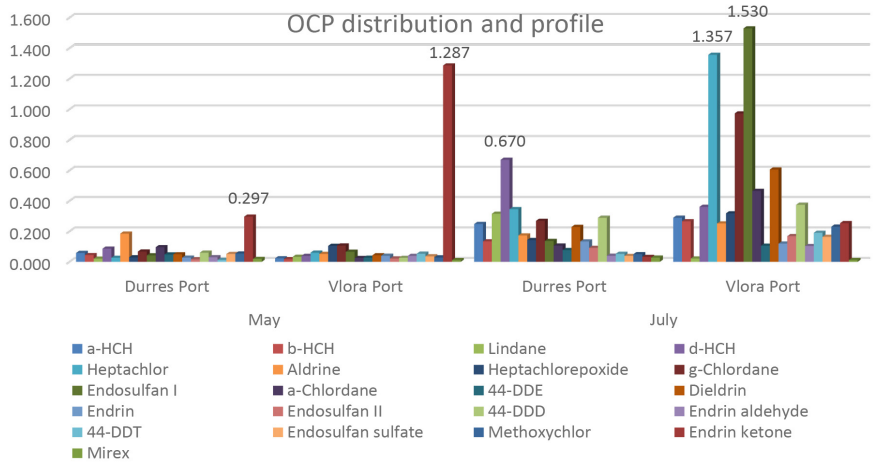


Figure 4. Distribution and profile of pesticides (ng/l) in water samples of Durres and Vlora ports

Source: Own research

PCB markers were detected in all water samples analyzed from the ports of Durres and Vlora, for both periods (May and July 2022). Also for PCBs, the higher average value was found in the port of Vlora (July 2022) at 5.4 ng/l (Figure 5). Again, Vlora samples were the most polluted for both periods. Their presence can be related to the elevated industrial activity near the ports of Durres and Vlora. Punctual sources and momentum values are not excluded. Again, the total of PCBs for each station was found in higher concentrations for water samples in July 2022. Also, levels of pesticides for Vlora stations were higher than Durres, because of the geographic position of Vlora Bay (Figure 6). It favors the concentration of pollutants inside the bay. The most polluted stations for Durres were D1 in May and D1 station in July while for Vlora were V2 in May and V7 in July. D1 and V2 stations are located outside the port areas while D11 and V7 stations are inside the ports of Durres and Vlora. Terrestrial sources and industrial activity are the main reasons for PAC's presence. The distribution and profile of PCB markers (Figure 7) were found to be different for the ports of Durres and Vlora and for both periods (May and July 2022). Their presence is based mainly on the individual concentration of PCB congeners. PCB 52 was found higher for both ports in May and PCB118 was found higher in July. This fact could be connected with different pollution origins of PCBs in these areas of the Adriatic Sea. It's a combination of atmospheric deposition of volatile congeners (PCB 28 and PCB 52) and terrestrial sources of heavy PCBs (PCB

118 – PCB 180) that are the main factors. Water currents and momentum values can influence their profile. PCB levels in water samples of Durres and Vlora ports were higher/comparable with the reported data in previous studies on the Adriatic Sea, Albanian part (Murtaj et al., 2014; Como et al., 2013, Nuro et al., 2017).

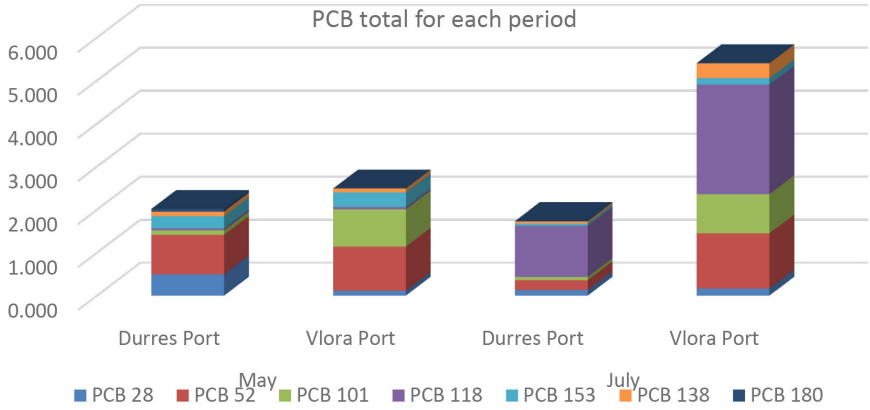


Figure 5. Total of PCB markers (ng/l) for each period of sampling (May and July 2022) in Durres and Vlora ports

Source: Own research

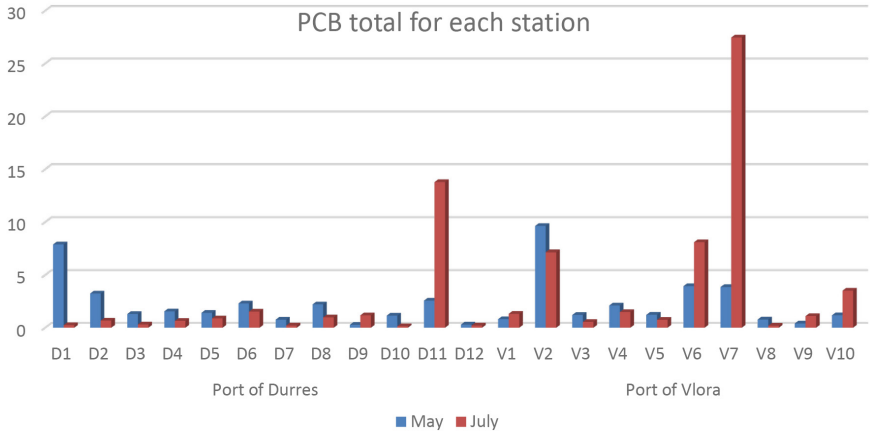


Figure 6. PCB markers (ng/l) for each station of Durres and Vlora ports

Source: Own research

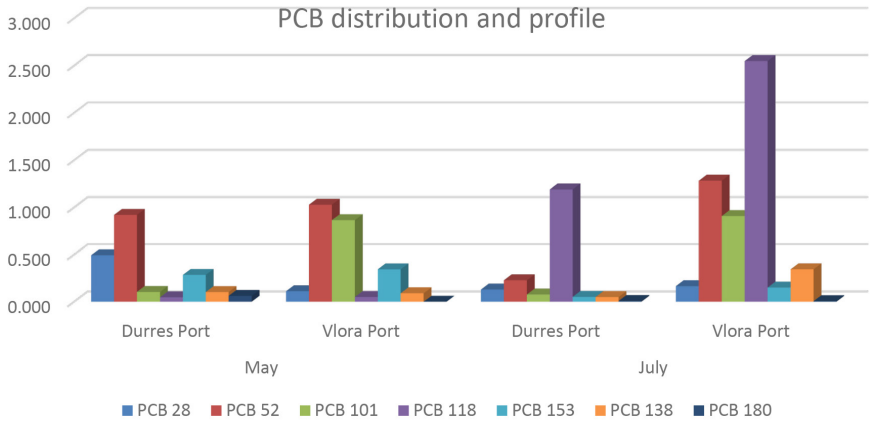


Figure 7. Distribution and profile of PCBs (ng/l) in water samples of Durres and Vlora ports

Source: Own research

Polycyclic aromatic hydrocarbons were detected in all water samples analyzed from the ports of Durres and Vlora, for both periods (May and July 2022). The higher average value of PAHs was found in the port of Durres (1.2 ug/l) in May and Vlora port in July 2022 (5.5 ug/l). PAH levels in water samples found in July were higher in July. Their presence could be because of elevated ship transport in this period 2-3 times higher than normal. Automobilist transport and any possible accident spillage could be another source of PAH pollution in marine water samples of Durres and Vlora ports. The total of PAHs for each station was higher for water samples of July 2022 (Figure 8). The presence of PAHs is mainly because of the intense ship and automobilist transport in this period. Momentum values are not excluded. Again, levels of PAHs for Vlora stations were higher than Durres because Vlora Bay favors the concentration of pollutants inside the bay as well as in Vlora port. The most polluted stations for Durres were D8 in May and D3 station in July while for Vlora were V8 in May and V4 in July (Figure 9). All these stations are inside the ports of Durres and Vlora. Ship transport and semi-closed areas of ports influence their concentration. Distribution and profile of PAHs (Figure 10) were found to be different for the ports of Durres and Vlora in May but it was almost the same for both ports in July. Their presence is based mainly on the individual concentration of some PAHs. Fluorene and Acenaftilene were found higher in May while Benzo[k]fluoranthrene and Anthracene were at a higher level in July respectively for Durres and Vlora samples. This fact could be connected mainly with the momentum values of these pollutants in water samples. PAH levels in seawater samples of Albanian ports were in the same range/higher than the reported levels for other stations of the Adriatic Sea, Albania (Magi et al., 2002; Marini & Frapiccini, 2013; Mandić & Vrančić, 2017). The concentration of PAH individuals (Anthracene) was higher than the permitted level according to Albanian and EU norms (Directive 2008/105/EC).

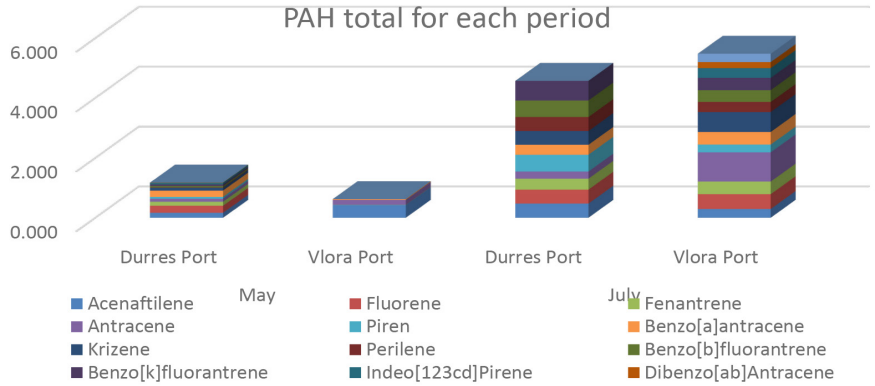


Figure 8. Total of PAHs in water samples of Durres and Vlora ports for both periods (May and July 2022)

Source: Own research

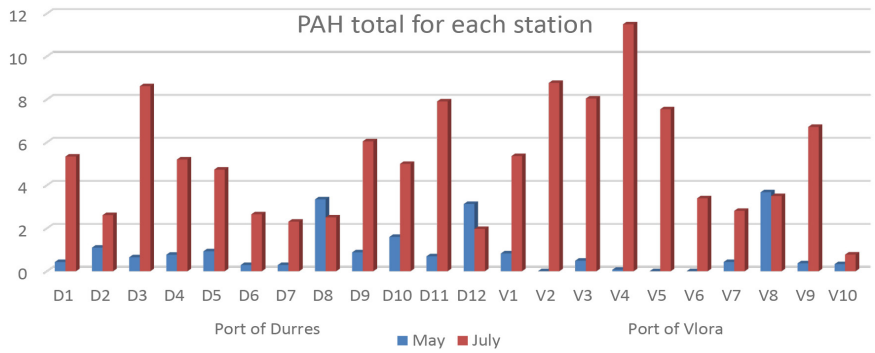


Figure 9. Total of PAH for each station of Durres and Vlora ports

Source: Own research

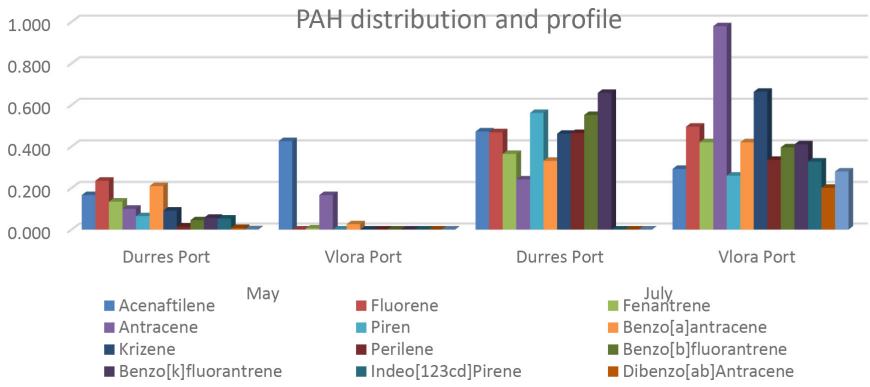


Figure 10. Distribution and profile of PAHs in water samples of Durres and Vlora ports

Source: Own research

BTEX was detected in all water samples analyzed from the ports of Durres and Vlora, for both periods (May and July 2022). The higher average value of BTEX was found for Durres port (July 2022) with 2.7 ug/l. Durres samples were most polluted for both periods. The presence of BTEX could be because of elevated ship transport, automobilist transport and any possible accident spillage of hydrocarbons near the areas of Durres and Vlora ports. Momentum values of BTEX are not excluded. The total BTEX for each station was higher for water samples in July 2022 (Figure 11). The presence of PAHs is mainly because of the intense ship and automobilists transport in this period. Momentum values are not excluded. BTEX levels in Durres stations were higher than in Vlora because of the elevated ship transport in the port of Durres. The most polluted stations for Durres were D9 in May and D3 station in July while for Vlora were V8 in May and V4 in July (Figure 12). All these stations are inside the ports of Durres and Vlora. Ship transport and semi-closed areas of ports influence their concentration. The distribution and profile of BTEX (Figure 13) were found to be different for the ports of Durres and Vlora and for both periods (May and July 2022). Their presence is based mainly on the individual concentration of volatile hydrocarbons. In the May sampling period: Benzene was found higher in the port of Durres while Ethylbenzene was in the port of Vlora. In July: Toluene was higher in Durres while Benzene in Vlora samples. BTEX origin could be the same (ship transport, automobile transport, hydrocarbon spillage, etc.) but momentum values of these pollutants influence their level in water samples. Benzene concentrations were found in higher/comparable concentrations than reported levels for other stations of the Adriatic Sea, Albania (Nuro et al., 2014). Benzene level was higher than the permitted level according to Albanian and EU norms (Directive 2008/105/EC).

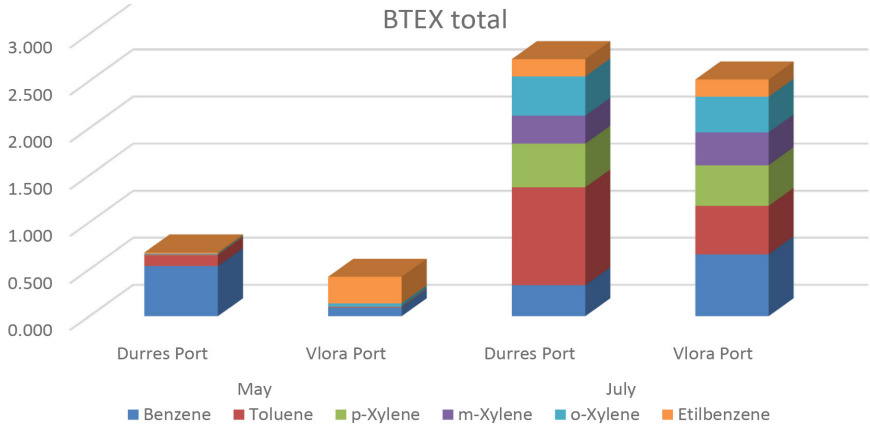


Figure 11. Total of BTEX in water samples of Durres and Vlora ports

Source: Own research

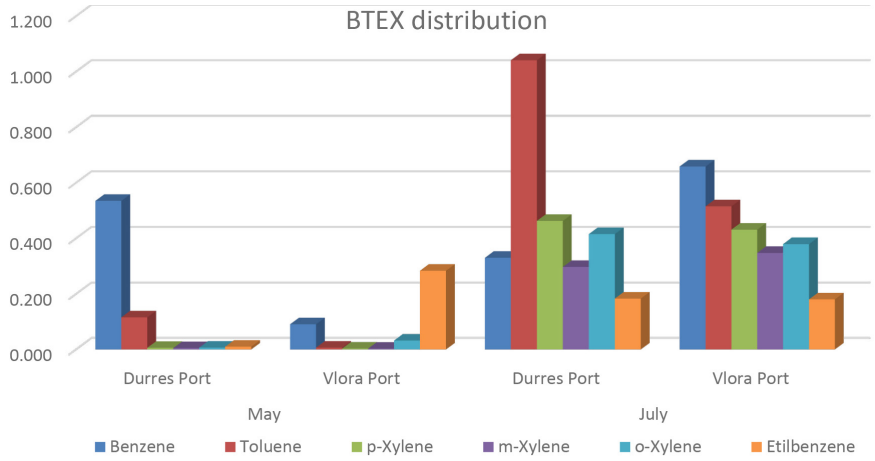


Figure 12. Total of PAHs in water samples of Durres and Vlora ports

Source: Own research

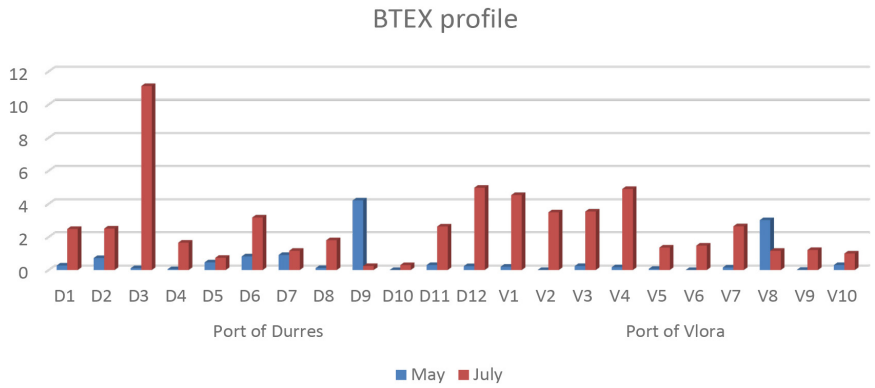


Figure 13. Profile of BTEX in water samples of Durres and Vlora ports

Source: Own research

4. CONCLUSION

Organic pollutants (Pesticides, PCBs, PAHs and BTEX) were found in all water samples of Durres and Vlora ports for both periods, May and July 2022. The higher levels for all pollutants were found in July because of the intense activity in this period (2-3 times higher than normal). Organochlorine pollutants (OCPs and PCBs) were found at a higher level for the samples of the Vlora port. It was noted the presence of degradation products of pesticides at higher levels compared to their active products. This fact is connected with the previous use of pesticides in Albania and their degradation process. PCBs volatile were found at high levels for all seawater samples. Their presence could be because of their atmospheric deposition. In some water samples, heavy PCBs were detected. This could be connected with terrestrial. Momentum values of them are not excluded. The presence of PAHs and BTEX could be because of elevated ship transport, automobilistic transport, and any possible accident spillage of hydrocarbons near the areas of Durres and Vlora ports. Concentrations of some individuals (Endrin ketone, Heptachlor, PCB52, PCB 118, Acenaftilene and Benzene) were found relatively in higher concentrations than others. Punctual sources and water currents can affect this. Generally, priority substance concentrations in the water of Durres and Vlora ports were lower than permitted levels for surface waters according to EU Directive 2013/39 and Albanian norms. Exclude was for some individual pollutants (Acenaftilene and Benzene were found at a higher level than the permitted level). Monitoring of organic pollutants in the water of Albanian ports and the Adriatic Sea should be continuous because of their presence.

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