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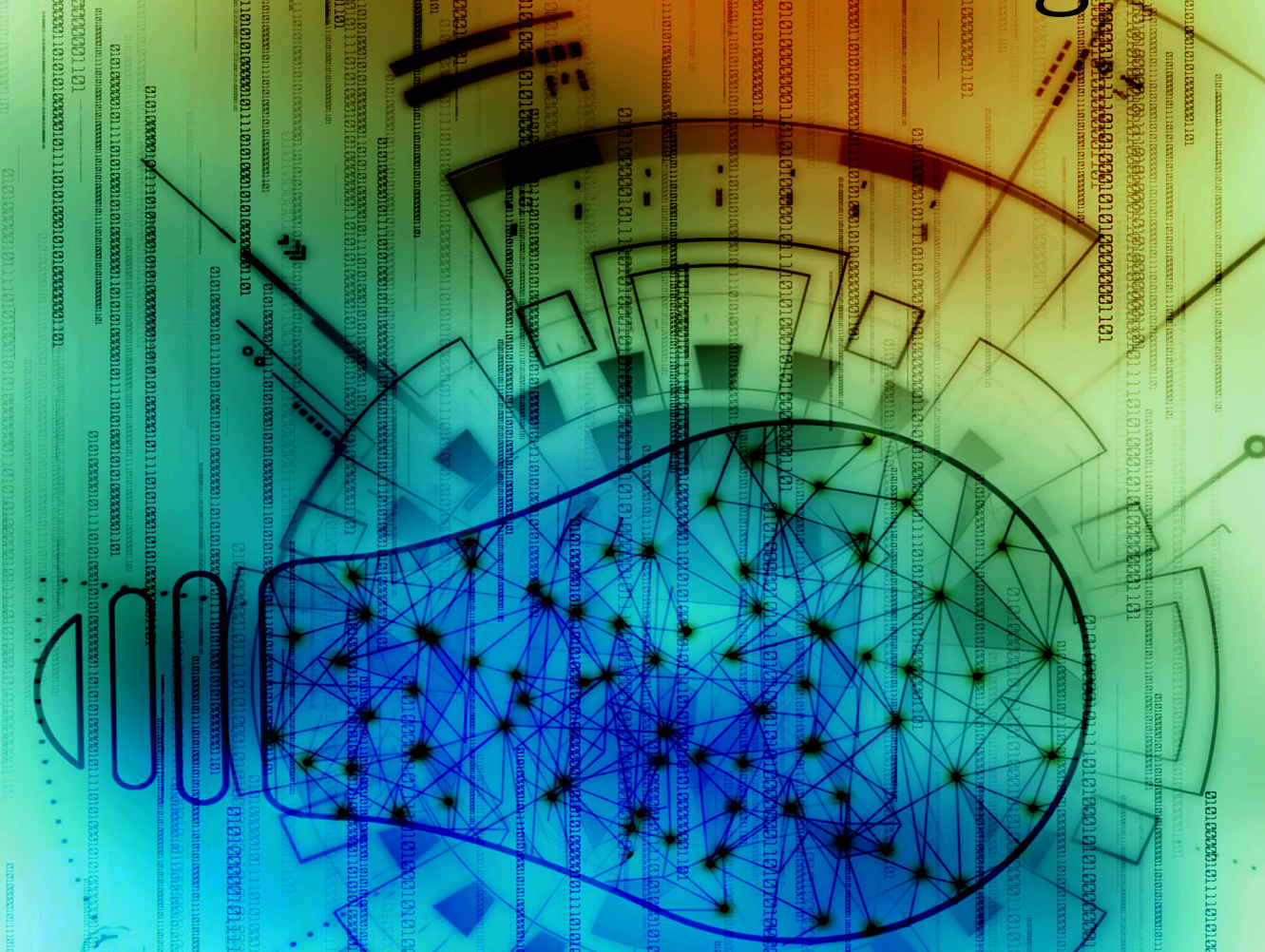
Book of Proceedings



7. MEĐUNARODNA NAUČNA KONFERENCIJA O DIGITALNOJ EKONOMIJI DIEC 2024

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Ivana Bestvina Bukvić, Ph. D., Assoc. Prof.[1] *Keynote paper*

ARTIFICIAL INTELLIGENCE (AI) IN MODERN FINANCIAL PRACTICES AND EDUCATION

Abstract

Artificial intelligence (AI) is a topic that infiltrated various areas and can therefore be considered a multidimensional and multidisciplinary field. It is inevitable that its application will soon be widespread and the major driver of job evolution. The importance of the topic of AI employability in finance lies in the fact that AI is already being applied in financial practice which is necessitating financial managers and students to acquire AI-related knowledge. As well, it is important for the education institutions to follow and analyse current research and reports in this field to keep their study programs up-to date with technological advancements. Using PRISMA protocol, a systematic literature review of 50 peer-reviewed articles published on this topic in the first half of 2024 and indexed in the WoS database was conducted. The review identified the main application areas (30) and challenges (10) in AI use in finance, prompting discussions on integrating AI into financial management education. Portfolio management and trading, predicting and forecasting future trends and business outcomes, detecting fraud and errors in various areas and credit scoring were the most emphasized were recognized by most authors as application areas. At the same time, a black box problem which leads to question of understanding and reliability of decisions based on AI-generated input, trust, user perception, unwillingness to use AI and the lack of a standardised legal framework for its use in finance were emphasized as a challenges of AI use in finance to be considered.

Key words: *Artificial Intelligence (AI), Financial Management, Education, Systematic Literature Review.*

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1. Introduction

Artificial intelligence (AI) has been an intriguing topic for some time now. Although it has been researched for decades, its development and implementation potentials are not still explored in full and therefore the topic of AI integration is very much current and more important than ever. The technological foundations, the ease of use, the possibilities of integration in everyday and business tasks, the impact on a change of the workplaces (job evolution), the questions of ethical use, safety issues, the regulatory framework and the need for the people to adopt - learn and deal with new technological advances, are the topics that numerous authors have been dealing with for some time (Siteanu, Frunzeti, & Coşereanu, 2017; Ernst, Merola & Samaan, 2019; Müller, 2020; De Felice, 2022, etc.).

As its technological properties develop, its application is spreading to different areas (Faud, 2019; Xu et al., 2021). Unlimited access and knowledge to utilize AI technology can determine economic and political dominance. For this reason, competition not only among industrial giants but also between countries for the supremacy of knowledge and the implementation of this technology is understandable. Organisations need to adopt AI technologies in different areas of their business to remain profitable and sustainable in a highly competitive environment (Kumari, Kaur & Swami, 2022). Therefore, it is inevitable that today's students and tomorrow's employees, officials and managers will need to adopt AI and utilise knowledge to be competitive in the business world.

As the topic of AI is too broad to discuss its implementation in general terms, a more focused approach must be taken. The aim of the study is to identify the activities in financial management where AI can be reliably applied in order to gradually introduce AI technologies into the training of financial management students. In this paper, the questions associated with the implementation of AI in financial management were analysed. The following general research questions were posed:

- How is AI used in financial management?
- What are the challenges of implementing AI in financial management?
- What are the opportunities for implementing AI in financial management education as education was found crucial for the acceptance of technological advancements (Liao et al., 2024)?

To find answers to these questions, a systematic literature review of papers published in the first half of 2024 and indexed in the Web of Science was conducted. As of the purpose of determining the application of AI in financial management and the possibilities of its implementing in financial management education at universities, the following research areas were considered:

- Definition of AI technologies in general
- Possibilities of applying AI in financial management (automated trading systems, fraud detection, risk management, personal financial management, customer service, etc.).
- Evaluation of its usability in financial management education.

The following chapter analyses the definition of artificial intelligence as well as its types and taxonomy. The third chapter presents the research methodology and the description of the examples, followed by a chapter with the research results. The fourth chapter discusses the research findings while the last one gives a conclusion as well as the limitations of the research and recommendations for future research.

2. Definition of Artificial Intelligence

Although it may seem that the issue of AI is a challenge only for policy makers and businesses, it will quickly become an issue for everyone due to its rapid integration into daily life, be it professional or personal. Therefore, its understanding is very important.

There are various definitions ranging from simple to complex, although there is not yet a standardised definition unified on the level of all institutions, most of them have emphasize same AI characteristics. For NASA, "Artificial intelligence refers to computer systems that can perform complex tasks normally done by human-reasoning, decision making, creating, etc.". ..."NASA follows the definition of AI found within EO 13960, which references Section 238(g) of the National Defense Authorization Act of 2019.:

- Any artificial system that performs tasks under varying and unpredictable circumstances without significant human oversight, or that can learn from experience and improve performance when exposed to data sets.
- An artificial system developed in computer software, physical hardware, or other context that solves tasks requiring human-like perception, cognition, planning, learning, communication, or physical action.
- An artificial system designed to think or act like a human, including cognitive architectures and neural networks.
- A set of techniques, including machine learning that is designed to approximate a cognitive task.
- An artificial system designed to act rationally, including an intelligent software agent or embodied robot that achieves goals using perception, planning, reasoning, learning, communicating, decision-making, and acting" (NASA, n.d.: n.p.).

European Commission changed its definition of AI from one proposed in:

> "Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)" (European Commission, 2018: 1),

to updated definition:

> "Artificial intelligence (AI) refers to systems designed by humans that, given

a complex goal, act in the physical or digital world by perceiving their environment, interpreting the collected structured or unstructured data, reasoning on the knowledge derived from this data and deciding the best action(s) to take (according to pre-defined parameters) to achieve the given goal. AI systems can also be designed to learn to adapt their behaviour by analysing how the environment is affected by their previous actions." (High-Level Expert Group on Artificial Intelligence, 2018:7).

By OECD Artificial Intelligence (AI) System can, with certain level of autonomy, produce and output which can consist of predictions, recommendations and decisions by using the input given by humans or machines (OECD, 2021: 1).

Copeland (2024) in Encyclopedia Britannica summarizes the definition to the capability of computers or robots to conduct given task connected to intelligent beings, which has characteristic of humans in the way of its intellectual process which includes "ability to reason, discover meaning, generalize, or learn from past experience" (Copeland, 2024: n.p.). From these definitions few AI characteristics can be generated:

- Intelligent response in solving tasks and achieving goals set,
- A controlled degree of autonomy,
- Learning and improving ability,
- Adaptive behaviour, which can be defined as a human-like characteristic,
- Rational acting,
- Various possibilities of technological implementation and integration (whether software or hardware).

As it could be previously seen, AI includes several technologies used according to the defined problem and goals set, of which most important are presented in Figure 1.

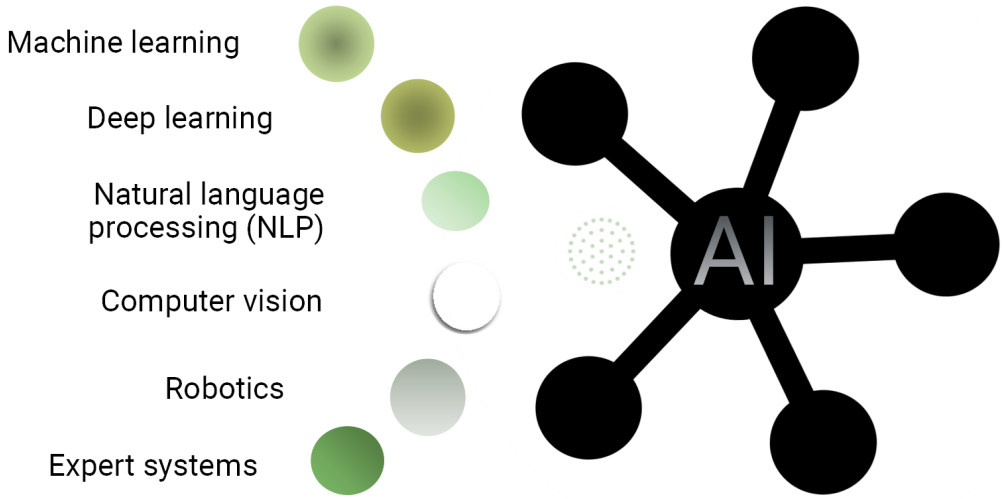


Figure 1. Types of AI based on technologies

Source: Authors' visualisation (according to Al-Ansi and Al-Ansi, 2023: 69; Ivošević, 2024: n.p.).

In their study of 65 relevant documents produced between 1955 and 2021, Samoili et al. (2020) analysed policy and institutional reports, research publications and market reports on AI. The result of the analysis was a taxonomy and, in total 185 keywords describing the basic structure of the AI field. They used the earlier definition of the EU's High-Level Expert Group on Artificial Intelligence (2018). The summary of their findings can be found in Table 1.

Table 1. AI domains and subdomains constituting part of the operational definition of AI by Samoili et al. (2020: 23)

	AI taxonomy	
	AI domain	**AI subdomain**
CORE	Reasoning	Knowledge representation
		Automated reasoning
		Common sense reasoning
	Planning	Planning and Scheduling
		Searching
		Optimisation
	Learning	Machine learning
	Communication	Natural language processing
	Perception	Computer vision
		Audio processing
TRANSVERSAL	Integration and Interaction	Multi-agent systems
		Robotics and Automation
		Connected and Automated vehicles
	Services	AI Services
	Ethics and Philosophy	AI Ethics
		Philosophy of AI

Source: Samoili et al. (2020: 23)

The EU has published the Artificial Intelligence Act (AI Act) with the aim of creating a legal framework. It was adopted by the European Parliament in March 2024, and it is proposing an assessment of new AI systems deployed in the EU and their categorisation according to the risk they could potentially pose to end users and citizens. The aim is to create a framework for human oversight of AI systems to prevent potentially harmful events. In this sense, AI systems operating on EU soil should be "safe, transparent, traceable, non-discriminatory and environmentally friendly" (European Parliament, 2024: n.p.).

The regulation defines 4 risk levels for AI systems (European Commission: 2024)

- Minimal risk
- Limited risk (for which there will be special transparency obligations)
- High risk
- Unacceptable risk.

IBM (n.d.) assesses AI technology differently and distinguishes between "weak" or "artificial narrow intelligence (ANI)", "artificial general intelligence (AGI)" and "artificial superintelligence (ASI)". AGI and ANI make up "strong" AI, which refers to the theoretical concept of an AI that would "surpass the intelligence and ability of the human brain" (International Business Machines Corporation - IBM, n.d.: n.p.). This AI would be much more advanced than the author of this concept, Searle (1980) predicted. Searle, who only considered the theoretical idea of a strong AI, thinking it to be impossible to occur at the level of simulating human intelligence with consciousness. On the other hand, IBM, as a developer of AI systems, explains the concept to a wider audience without claiming whether it could exist in the future.

For the AI systems operable on the EU soil, impacting citizens located in the EU, EU will set the procedure for monitoring and authorising AI technologies according to their risk levels. The results of the implementation of the procedures remain to be seen.

3. Methodology of the research

The research design used descriptive and analytical approach using secondary data and publications indexed in the Web of Science (WoS) database. The data were collected through literature review of publications from academic journals, and analysed by analytical methods including comparative analysis, thematic analysis, and content analysis of existing literature.

The WoS database was used to find scientific peer-reviewed articles published in the first half of 2024. The reason for narrowing down the research field to articles published in the last 6 months is the fact that AI is a rapidly evolving technology where information becomes outdated very quickly. In addition, the articles indexed in the Web of Science were considered for the identification of the rigorously reviewed articles. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol was used, including keywords, abstracts and content analysis of the publications. The keywords used were: Artificial intelligence + Financial Management. Articles from the fields of Management 394, Business Finance 314, Business 305, Automation Control Systems 240, Operations Research Management Science 234, Economics 230 were found (some of them correspond to several fields).

The research process is presented by Figure 2.

In first half of 2024, 578 publications were indexed in WoS. Through further analysis of the abstracts, 102 publications were filtered out as relevant to the

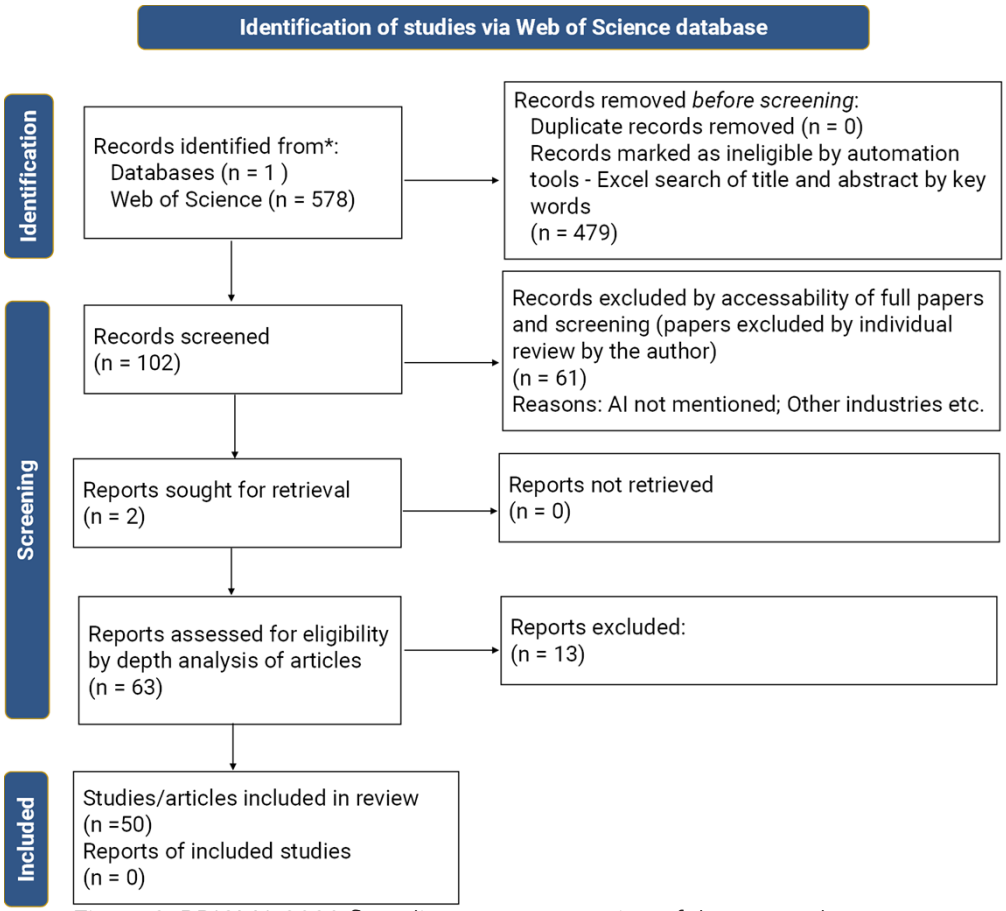


Figure 2. PRISMA 2020 flow diagram presentation of the research process

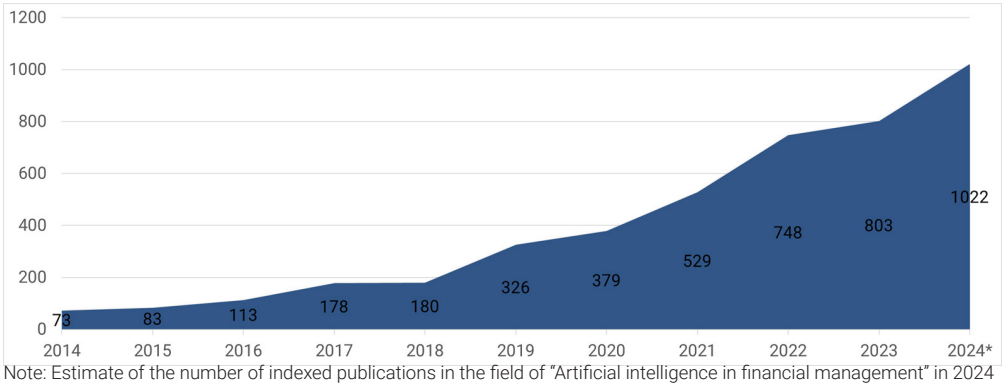
Source: Authors' work (based on methodology set by Page et al., 2021; Page et al. (n.d))

field of this research. Of these, 63 were open source or available via licences that were accessible to researchers at the Josip Juraj Strossmayer University of Osijek and were included in the further analysis and relevant according to author's first screening. For the final review, after in-depth analysis, 50 articles were used. Table 2 presents the structure of the sample according to type of the research, systematic literature review or primary research used.

Table 2. Structure of the sample (articles included in research)

Research model description	Number	Share
Systematic literature review	14	28,0%
Primary research (case studies, interviews, AI new models testing, AI performance analysis)	36	72,0%
Total	**50**	

Source: Author's work



Note: Estimate of the number of indexed publications in the field of "Artificial intelligence in financial management" in 2024 based on 578 indexed articles up to 25 July 2024.

Figure 3. Illustration of the number of articles indexed in the WoS in the field of AI in financial management from 2021 to 2023 and forecast for 2024.

Source: Authors' work based on Web of Science

Figure 3 gives illustration of the rise of the scientific interest and the number of publications in this field.

The topic of intelligent machines of any kind has intrigued the public and researchers for decades, but the huge rise in interest is linked to the emergence of open-source AI technologies.

Table 3. Results of the literature review on the use of AI in financial management

AI Application in Finance	Author(s) (Year of Publication)	Number of papers
Portfolio management / trading	Sutiene et al. (2024); Shkalenko, Navareno (2024); Gedikli et al. (2024); Pelster, Val (2024); Li et al. (2024a); Almeida, Gonçalves, (2024); Zheng et al. (2024); Hung, Chen, Yu (2024);	8
Frauds and errors detection	Kureljusic & Karger (2024); Das et al. (2024); Shkalenko, Nazarenko (2024); Desyatnyuk et al. (2024); Ming, Mohamad, Innab, Hanafy (2024); Zheng et al. (2024); Xia et al. (2024)	7
Forecasting/prediction	Henriques, Pereira (2024); Kureljusic, Karger (2024); Pustokhina et al. (2024); Tkachenko (2024); Zheng et al. (2024); Li M et. al (2024b)	6
Credit scoring	Das et al. (2024); Tigges et al. (2024); Ali et al. (2024); Giudici et al. (2024); Jena et al. (2024); Tian et al. (2024)	6
Customer service enhancements	Kshetri (2024); Das et al. (2024); Desyatnyuk et al. (2024); Jena et al. (2024)	4
Risk management and analysis	Kshetri (2024); Das et al. (2024); Tian et al. (2024); Nakashima, Mantovani, Machado (2024); Pattnaik, Ray, Raman (2024)	5

Investment Robo-Advisory Services	Fatima, Chakraborty (2024); Nain, Rajan (2024); Adji, Karmawan, Lusianah (2024); Orzeszko, Piotrowski (2024)	4
Cybersecurity in Financial Services / Operational Risk Management	Thanathamathee, Sawangarreerak, Nizam (2024); Lavanya, Mangayarkarasi (2024); Elhoseny et al., (2024);	4
Anti-money laundering	Pattnaik, Ray, Raman (2024); Desyatnyuk et al. (2024); Giudici et al. (2024)	3
Environmental Social and Governance (ESG); Corporate Social Responsibility (CSR)	Lim (2024); Tkachenko (2024); Shkalenko, Nazarenko (2024)	3
Accounting and Auditory	Smith, Lamprecht (2024); Kureljusic and Karger (2024); Liao et al. (2024)	3
Bankruptcy Prediction	Letkovsky, Jencová, Vasanicová (2024); Kureljusic & Karger (2024)	2
Financial Analysis	Kureljusic & Karger (2024); Nica, Delcea, Chirita (2024)	2
Algorithmic Trading	Das et al. (2024); Majidi, Shamsi, Marvasti (2024);	2
Extreme Scenario Analysis	Shkalenko, Nazarenko (2024); Zheng et al. (2024);	2
Policy Analysis	Shkalenko, Nazarenko (2024); Zheng et al. (2024)	2
Insurtech	Cosma, Rimo (2024); Ming, Mohamad, Innab, Hanafy (2024)	2
Sentiment Analysis / Sentiment Trading	Nair, Abd-Elmegid, Marie (2024); Kirtac, Germano (2024)	2
Corporate Governance	Albalawee, Fahoum (2024)	1
Improving the Quality of Financial Reporting	Mbaidin et al. (2024)	1
AI-Generated Financial Text	Arshed et al. (2024)	1
Rating Agencies	Davidescu et al (2024)	1
Fintech	Pattnaik, Ray, Raman (2024)	1
Banking Industry in general	Pattnaik, Ray, Raman (2024)	1
Card Default prediction	Talaat et al. (2024)	1
Cost Reduction / Optimization	Lytvyn et al. (2024)	1
Mergers and Acquisition (M&A) performance	Ding et al. (2024)	1
Financial Security	Desyatnyuk et al. (2024)	1
Startup Investing	Setty, Elovici, Schwartz (2024)	1
Internet Personal Finance Risk Management	Tian et al. (2024)	1

Source: Author's work

Although expected contrary, most of the papers were written on the basis of primary research results (72%), presenting results of research of AI implementation in different subfields in finance.

4. Results of the Research

Using the PRISMA 2020 flow method, 50 WoS-indexed articles were identified that were published in the first half of 2024 and deal with the narrow topic of the use of AI in financial management. The results of the systematic literature review are presented in Table 3.

A total of 30 different areas of application were identified, with some of the authors analysing more than one area. All the papers analysed show that there is great potential for the use of AI in different fields. Most of the recently published papers dealt with portfolio management/trading (8), fraud and error detection in general (6) and in accounting (1), forecasting/prediction (6) and credit scoring (6). On the other hand, money laundering (3) can also be considered as a subset of "fraud" giving it more emphasis.

At the same time, the authors pointed out some barriers and potential challenges in implementing AI in different areas of financial management. The systematic literature review identified the following 10 main concerns, with most authors emphasising the (non)understanding of the AI concept (black box model) (Table 4).

Table 3 presents a number of challenges, from the black box problem that affects the understanding of artificial intelligence as a concept and tool to upgrade work efficiency and precision to acceptance of use. The black-box problem and the acceptance of AI technologies for use (by financial services, managers and employees) are as well interconnected and could be influenced by various behavioral factors (Adji, Karmawan and Lusianah, 2024; Mbaidin et al., 2024).

The findings highlight the need educators to incorporate AI tools by enhancing students' IT knowledge to mitigate the black-box problem and improve AI adoption.

5. Discussion

The analysis of the literature shows that the new technologies in financial practise and industry bring efficiency gains, increased accuracy and cost reductions. At the same time, however, certain concerns were also expressed. The following word cloud shows the most important areas of the analysed literature on AI applications in finance.

When analysing the publications published during first half of 2024, the main areas in which the use of AI was investigated were portfolio management and trading in general (Sutiene et al. 2024; Shkalenko, Navareno 2024; Gedikli et al. 2024; Pelster, Val 2024; Li et al. 2024a; Almeida, Gonçalves, 2024; Zheng et al, 2024; Hung, Chen, Yu, 2024); forecasting and prediction of future financial trends (Henriques, Pereira 2024; Kureljusic, Karger 2024; Pustokhina et al. 2024;

Tkachenko 2024; Zheng et al. 2024; Li et. al 2024b), fraud and error detection in finance and accounting (Kureljusic & Karger 2024; Das et al. 2024; Shkalenko, Nazarenko 2024; Desyatnyuk et al. 2024; Ming, Mohamad, Innab, Hanafy 2024; Zheng et al. 2024) and credit scoring in the financial industry and market analysis (Das et al. 2024; Tigges et al. 2024; Ali et al. 2024; Giudici et al. 2024; Jena et al. 2024; Tian et al. 2024).

Table 4. Results of the literature review on the challenges of AI application in financial management

Challenges of AI Application in Finance	Author(s) (Year of Publication)
Influence of black-box model on **reliability of the reasoning** behind a recommendation of the AI model for the user's decision and for the purpose of risk management.	Talaat et al. 2024; Sachan, Liu, 2024; Martins et al. 2024; Sutiene et al., 2024; Almeida; Gonçalves, 2024; Kureljusic & Karger, 2024
Absence of a **unified regulatory framework** in finance.	Lytvyn et al., 2024; Cosma; Rimo 2024; Ali et al., 2024
Influence of the complexity (black-box model) **on trust and users' perceptions**	Nakashima, Mantovani, Machado; 2024; Davidescu et al., 2024
Challenges of **acceptance by employees** to use AI models and their computational expertise.	Henriques; Pereira, 2024; Kureljusic & Karger, 2024
Problem of **identification of AI-generated contents** (texts and datasets) in financial sector, but politics, media and law as well emphasizing reliability of insights derived from these sources.	Arshed et al. 2024; Tkachenko; 2024
Challenges of available **data quality.**	Henriques; Pereira, 2024
Question of **responsible and transparent use.**	Davidescu et al., 2024
Loss of potential gains by decision-making based on AI input per example in startup investments.	Setty; Elovici; Schwartz: 2024
Necessity for development of machine learning models and algorithms for every company which **implicates high costs.**	Tian et al., 2024
Resistance of traditional players.	Lytvyn et al., 2024

Source: Author's work

The most frequently expressed concerns related to AI implementation were: black box problem, which raises the question of the understanding and reliability of decisions based on AI-generated input, as well as user trust (Talaat et

Figure 4. Word cloud showing the frequency of use of AI in certain areas and the associated issues

Source: Author's work (created in online application Flourish)

al. 2024; Sachan, Liu, 2024; Martins et al. 2024; Sutiene et al, 2024; Almeida; Gonçalves, 2024; Kureljusic & Karger, 2024; Nakashima, Mantovani, Machado; 2024; Davidescu et al, 2024), the rejection of the use of AI by potential users (e.g. employees or managers) (Henriques; Pereira, 2024; Kureljusic & Karger, 2024; Lytvyn et al, 2024) and the lack of a standardised legal framework in the financial sector (Lytvyn et al, 2024; Cosma; Rimo 2024; Ali et al, 2024).

The issue of the conscientious use of AI technologies is one of the main concerns raised in almost all contributions. For this reason, some of the authors have proposed policy recommendations and risk assessment methods. For example, Giudici, Centurelli and Turchetta (2024) have proposed the AI SAFEty (Sustainability, Accuracy, Fairness, Explainability) methodology – an integrated AI risk management framework for the financial industry (credit scoring, anti-money laundering, IT systems monitoring and anomaly detection) to assess compliance with increasingly complex AI regulations. In addition, Kumary, Kuar and Swami (2024) provide policy recommendations for the industry and government to support the process of AI adoption in the financial industry.

There is a "need to rigorously and critically ethically consider important challenges such as the question of consent, algorithmic transparency, data quality, data misuse, representativeness, traceability, accountability, bias and discrimination" (Tigges et al., 2024: n.p.). Therefore, the EU and national procedures for dealing with the various AI technologies must be accepted at the level of the individual institutions.

6. Conclusion

It is now clear that AI technology itself cannot be treated as a new product of the technology sector, helping to operationalise and increase productivity and efficiency, but is increasingly becoming the individual industry itself, due to its wide application not only in the formal and social sciences, but also increasingly with great results in the natural sciences. It is therefore inherently multidisciplinary and taking its complexity and controversy in some aspects, deserves an approach recognising this.

It is clear that access to AI technology can be the decisive factor for economic and political supremacy. For this reason, the competition not only between industrial giants but also between countries for the supremacy of knowledge and the widespread implementation of this technology is understandable. Access to knowledge could be a problem for economies lagging in implementation technological advances. To keep up, teachers and students need to improve their engagement to keep the knowledge up to date. Therefore, educational institutions and teachers need to adapt to these changes, acquire the necessary knowledge to develop financial study programmes that equip students for the future permeated with artificial intelligence and make the knowledge accessible.

This paper presented the results of systematic literature review by PRISMA 2020 flow method, of 50 WoS-indexed articles that were published in the first half of 2024 in the topic of AI in financial management. The results of the research show that most researchers find portfolio management and trading as most interesting field of AI implementation, followed by frauds and errors detection, forecasting and prediction of future trends and credit scoring. Therefore, it is necessary for the teachers to gain the knowledge which will enable them to present the students the possibilities of its use in these fields. Financial management study programmes would benefit from strengthening students' IT knowledge to increase their understanding of the technological characteristics of the AI systems they use. In this way, the black-box problem, which was highlighted as significant by numerous authors, would be reduced. In the future, AI could be used to develop personalised learning models and intelligent tutoring systems that deal with concrete case studies from the financial sector, enabling future generations to critically evaluate the possibilities and outcomes of AI use.

In general, the development of curricula that incorporate AI tools, the training of teachers and seminars on the use of AI technologies in financial management to enable future generations to deal with the challenges of more powerful AI, and the development of strong collaboration between practise and education with the aim of trialling, understanding the impact and proper application with critical reflection and reassessment of the AI results are necessary. In the coming years, guidelines for the implementation of AI and privacy considerations, the development of training programmes for financial professionals, and ethical guidelines by financial associations, all for the use of AI in financial practice need to be developed.

By all this, it is clear that the concept of Artificial Intelligence (AI) is very complex in terms of technology, implementation, impact and therefore regulation. It will have a far-reaching impact on various areas of life, including societal, ethical, safety, economic and environmental aspects (Davidescu et al., 2024). Therefore, there is a need to explore, scrutinise and carefully examine before widespread implementation.

Research limitations: The search focussed exclusively on the WoS database, which excluded high quality papers indexed in other databases or published in non-indexed journals, conference proceedings or reports. Although only recent studies were purposely considered in this work, it must be acknowledged that the narrow time frame (first half of 2024) excludes many papers published before or after this period. In addition, only papers published in English were considered.

Recommendations for future research: In future studies, more comprehensive statistical analyses could be conducted, analysing a larger number of papers from a broader time frame. In addition, the cross-sectoral benefits and challenges as well as the potential for integrated AI applications could be investigated. In the context of acceptance of new AI technologies, the acceptance of experts, teachers and students of financial management could investigate theories relevant to AI, such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) and others.

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Professional paper

INFORMATION SECURITY COMPLIANCE MANAGEMENT

Abstract

Compliance is an important concept for information security managers to understand. Compliance means adhering to a rule or set of rules. In the case of information security, compliance refers to the rules to which people, systems, and processes are expected to comply - these are typically laws, regulations, policies, standards, guidance or specifications. Effective compliance management requires a disciplined, repeatable approach to enterprise security management that, among other things, should include development of baseline enterprise security standards - the identification of all the security categories and controls applicable to the organization. In this paper, we talk about the approach that, based on good industry practices, information security managers in Bosnia and Herzegovina can use to develop a baseline enterprise security standard for effective compliance management.

Key words: *Information Security, Risk, Compliance, Enterprise Security Standard.*

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1. Introduction

Many business organizations today use the cyber domain to interact with vendors, suppliers, partners, employees and customers. Acting within the cyber domain becomes crucial for the survival and progress of business, and therefore the continuous analysis of threats, vulnerabilities and risks related to the cyber domain in a business sense represents a good business practice. However, identification and resolution of cyber domain risks, in addition to being a good business practice, can also be an obligation to comply with legislation. ((ISC)² Corporate, 2015)

Compliance is an important concept that information security managers need to understand. Compliance means following a rule or set of rules. In the case of information security, compliance refers to the rules that people, systems and processes are expected to adhere to, usually laws, regulations, policies, standards, guidelines or specifications.

Different industries and organizations have prescribed security compliance obligations established by laws, regulations or industry rules. For example, in Bosnia and Herzegovina:

- Business entities that process personal data are obliged to take measures against unauthorized or accidental access to personal data, alteration, destruction or loss of data, unauthorized transfer, other forms of illegal data processing, as well as measures against misuse of personal data.
- Business entities that process credit card payments are expected to comply with the requirements of the international PCI DSS security standard.
- The Decision on the management of the information system in the bank establishes the requirements and criteria that banks in Bosnia and Herzegovina are obliged to ensure and implement in the process of managing the information system and the risks arising from the use of information systems (FBA, 2017), while the Decision on the management of outsourcing in the bank prescribes the conditions that banks are obliged to ensure in the process of implementation and management of externalization and the risks that may arise from externalization (FBA, 2022).
- Administrative bodies, local government bodies, companies, institutions and other legal and physical persons who have freely expressed their will to accept the use of electronic documents for their own needs as well as for the needs of business relationships and other relationships with others must, among other things, ensure that for every electronic document, in all actions with an electronic document, there should necessarily be the possibility of checking its credibility, originality and immutability.

2. Verification of compliance

One of the important concepts of compliance is a compliance verification, which is a process used to determine how well a compliance plan is being im-

plemented. After all, the implementation of a good compliance program will not make sense if there is no way to check how well it works and to correct any deficiencies found after the checks.

Compliance monitoring and checks are not a one-time process, but an ongoing operation. Employees leave or join the organization, new information systems are introduced and some are no longer used, new regulations are introduced and others are no longer applicable, new jobs and product lines are created and delivered, new technological risks and new risk agents are discovered - these are just a few of examples that can have a great impact on the level of compliance.

It should also be kept in mind that not all security compliance frameworks are the result of a legal obligation, but certain organizations have voluntarily undertaken the obligation to comply with a certain set of security rules - primarily to increase the level of their own security or as part of contractual obligations.

Regardless of the reason for establishing a compliance program, metrics need to be established to measure compliance. However, measuring compliance is not always straightforward. There are many different elements that go into determining the desired levels of compliance, and they are not always as easy to pin down as typical security metrics. In any case, for one to establish a compliance metric, each element of importance should have a defined acceptable level within the compliance framework, and during testing, a comparison should be made between actual performance against predefined desired specifications. As should be obvious, it is crucial to use the information gathered from such an analysis to improve the security posture, because otherwise there would be no point in performing any testing ie compliance checks. In addition, when measuring the level of compliance, organization must remember to ask questions focused on the key security controls that relate to the real goal of the compliance requirement, and not to get bogged down in relatively unimportant areas, focusing disproportionately on less important matters. ((ISC)² Corporate, 2015)

3. Compliance perspectives

There are two perspectives on compliance: one side is legislative mandates (what organization must do) and the other side is good business practice (what organization should do). The term legislative mandates used herein is generic and is intended to include the spectrum of laws, regulations, directives, guidance or other compliance requirements created outside of the business organization. ((ISC)² Corporate, 2015)

Good business practice includes those compliance requirements that are created within a business organization with the intent of enabling the protection of the organization's people, processes, technology, and environment.

It is important to note that failure to follow good business practices regarding security can expose the organization and responsible persons to an increased level of liability in the event of a security breach.

4. Management of legislative requirements

Regulatory requirements management is part of a comprehensive security compliance management program. Legislative management identifies all applicable security laws and regulations that have an impact on the organization. This includes any local regulations (eg fire code - in Bosnia and Herzegovina, for example, this is regulated by entity and cantonal laws) as well as state laws. The purpose of managing legislative requirements is to avoid violations due to non-compliance with legal obligations.

An example of security legislation in Bosnia and Herzegovina would be Regulation on the manner of keeping and special measures of technical protection of personal data („Official Gazette of Bosnia and Herzegovina" 67/09), which, among other things, stipulates that

The personal data security plan contains technical and organizational measures that shall ensure that:

a) Only authorized persons can know the personal data - confidentiality;

b) During the processing the personal data remain unchanged, full and accurate - integrity;

c) That the data are always available and at disposal and can be properly processed - availability;

d) At any time the origin of personal data can be determined - authenticity;

e) That it can be verified who processed the personal data: when, which personal data and in which manner – possibility of revision;

f) The procedure of personal data processing is complete, up-dated and correspondingly recorded - transparency.

but it also lists specific controls that must be implemented, such as a backup control:

(1) The controller shall to carry out backups or archiving the data stored in the system in order to avoid their loss or destruction.

(2) The controller shall inspect the usability of the filing systems backups through the verification procedure of restoring the filing systems stored on devices with removable storage to make sure that the restored data are fully available for use upon inspection, without any data loss.

(3) Each copy of data stored on devices with removable storage must be marked by number, type, date of storage and the name of the person who did the storage...

or imposes an obligation to implement weekly, monthly and annual checking of the system:

The personal data filing systems controller conducts checking of operation of all parts of the system on weekly, monthly and annual basis...

Another example of security legislation in our country would be the Law on electronic documents. In Bosnia and Herzegovina there are laws at the entity and state level, which regulate security obligations related to the management of the use of electronic documents in business. These laws, among other things, prescribe that for all actions with electronic documents, appropriate technological procedures and equipment must be applied that enable the protection of procedures and electronic documents.

But what are "adequate technological procedures and equipment that enable the protection of procedures and electronic documents"?

The ISC2 guideline for information security managers recommends that to avoid arbitrariness in their approach to determining, planning and implementing appropriate safeguards, organizations should find the industry security standard applicable (or most closely applicable) to their organization and work to adapt that standard to their specific needs. This customized standard then becomes the organization's security standard (Enterprise Security Standard - ESS). ((ISC)² Corporate, 2015)

There are many standards from which a business organization's security standard can be derived including the NIST Cybersecurity Framework (CSF), ISO/IEC 27001/27002, and many others. Organizations can use the standard as is or adapt it to other compliance requirements included in security legislation. But how to choose the best security standard? The best choice depends entirely on the situation. Previously mentioned ISC2 guideline lists the following questions organization should to ask when determining the best industry security standard as an ESS foundation:

1. Is your organization a provider of critical infrastructure services?

Examine the national definition of critical infrastructure and determine if your organization falls under that description. Then look at your national security standards to see if they offer a good starting point for your ESS. In Bosnia and Herzegovina, there is currently no legal regulation related to the mandatory protection of critical infrastructure, but considering the obligation to harmonize our legislation with EU legislation, it is to be expected that soon this area will also be regulated in accordance with EU practices. According to the Directive on measures for high common level of cyber security across the Union (NIS2 Directive), organizations identified by member states as operators of key services must take appropriate security measures, such as risk analysis and information system security, incident handling, business continuity management, supply chain security, procurement security, development and maintenance of network and information systems, procedures for evaluating the effectiveness of cybersecurity risk management measures, basic cyber hygiene practices and cybersecurity training, procedures related to the use of cryptography, human resource security, access control policies and asset management, the use of multi-factor authentication, or continuous authentication solutions…

2. Do you need an internationally recognized certified sacurity management system?

If you have need, consider the ISO/IEC 27000 series for your organization.

3. What legislative mandates apply to your IT and overall security posture?

Use these legislative mandates to create or improve your organization's security standard.

4. What best supports your way of doing business?

For example, if the nature of your business is financial, then look for the industry standard that is most applicable to financial organizations.

ISC2 further recommends that once organization have selected an organization's core security standard, it should review it to see if it covers all security categories and controls applicable to organization. If so, great; if not, organization should look at other security compliance requirements and add categories and controls until all of business security needs are met within ESS.

Given that organizations have limited resources that they can use to protect information assets, and the fact that not all information assets are equally important for protection, resources must be used according to the required level of protection. Equal protection of all assets would lead organizations to a situation where they have too much protection for "worthless" assets and too little protection for "valuable" assets. But how to evaluate what is worth a higher and what a lower level of protection. A useful tool can be provided by NIST recommendations using a process called as Security Categorization (SECCAT). The process is mandatory for U.S. government systems, and has been adopted by other organizations as well. Overall system impact rating of High, Moderate, or Low is determined for each property for each information type and operation supported. With this impact rating, NIST 800-53 tables are used to provide recommendations on the types of controls to be used to secure the system – Figure 1.

CONTROL NUMBER	CONTROL NAME CONTROL ENHANCEMENT NAME	PRIVACY CONTROL BASELINE	SECURITY CONTROL BASELINES		
			LOW	MOD	HIGH
AU-8(1)	SYNCHRONIZATION WITH AUTHORITATIVE TIME SOURCE	W: Moved to SC-45(1).			
AU-8(2)	SECONDARY AUTHORITATIVE TIME SOURCE	W: Moved to SC-45(2).			
AU-9	**Protection of Audit Information**		x	x	x
AU-9(1)	HARDWARE WRITE-ONCE MEDIA				
AU-9(2)	STORE ON SEPARATE PHYSICAL SYSTEMS OR COMPONENTS				x
AU-9(3)	CRYPTOGRAPHIC PROTECTION				x
AU-9(4)	ACCESS BY SUBSET OF PRIVILEGED USERS			x	x

Figure 1. Excerpt from NIST SP 800-53B

ESS could find a basis in an industry standard and then apply additions or modifications to reflect relevant legislative mandates and good business practice. If the ESS is based on an industry security standard such as ISO/IEC 27001, the organization can also go through the certification process and obtain an ISO/IEC 27001 certificate to demonstrate to the public that it adheres to good industry practices.

The NIST Cybersecurity Framework (CSF) can also be a good basis for ESS - Figure 2.

The NIST Cybersecurity Framework should first of all be seen as a good tool for building and maintaining an information security program. Considering that not all information assets are equally critical for business organizations, and that organizations have limited resources that they can use for these purposes, it is important to assess where organization currently is in terms of compliance with good practices, where it want to be, and create a plan for compliance – Figure 3.

Function	Category	Category Identifier
Govern (GV)	Organizational Context	GV.OC
	Risk Management Strategy	GV.RM
	Roles, Responsibilities, and Authorities	GV.RR
	Policy	GV.PO
	Oversight	GV.OV
	Cybersecurity Supply Chain Risk Management	GV.SC
Identify (ID)	Asset Management	ID.AM
	Risk Assessment	ID.RA
	Improvement	ID.IM
Protect (PR)	Identity Management, Authentication, and Access Control	PR.AA
	Awareness and Training	PR.AT
	Data Security	PR.DS
	Platform Security	PR.PS
	Technology Infrastructure Resilience	PR.IR
Detect (DE)	Continuous Monitoring	DE.CM
	Adverse Event Analysis	DE.AE
Respond (RS)	Incident Management	RS.MA
	Incident Analysis	RS.AN
	Incident Response Reporting and Communication	RS.CO
	Incident Mitigation	RS.MI
Recover (RC)	Incident Recovery Plan Execution	RC.RP
	Incident Recovery Communication	RC.CO

Figure 2. NIST CSF 2.0 Basic Functions, Categories, and Identifiers (NIST, 2024)

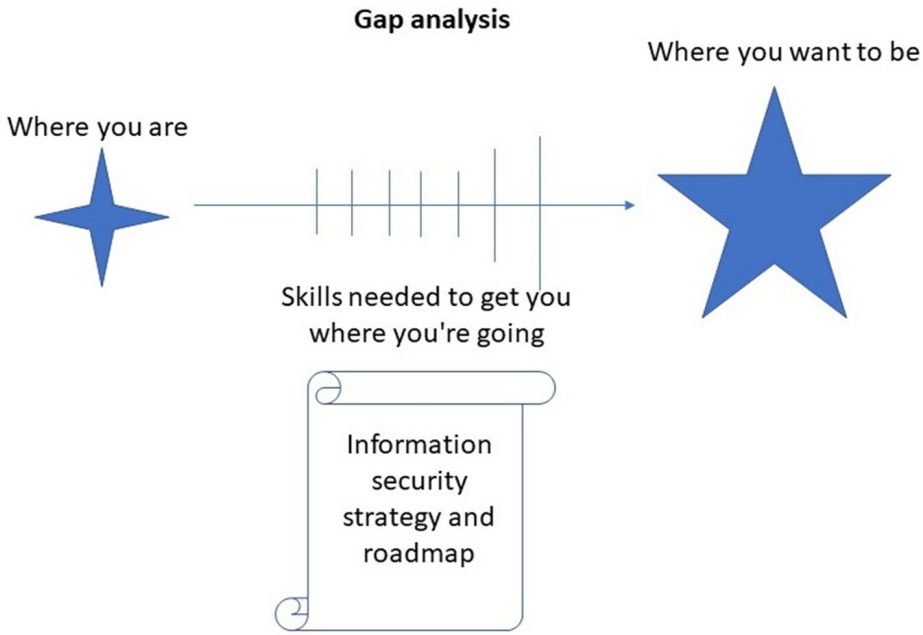

Figure 3. Simplified representation of progress towards compliance

When it comes to the numerical calculation of the degree of compliance with the NIST CSF, a practical example can be found in the work of Ibrahim et al., where the authors state that in their case study, the compliance for each measure was based on the responses provided by the participants. They were graded as either, Complaint, Partially Compliant, or Non-Compliant; and each was assigned scores of either 10, 5, or 0, respectively, for each core function's subcategory. (Ibrahim et al., 2018)

Using a similar approach, an initial assessment of compliance with NIST CSF controls was performed in one of the organizations in Bosnia and Herzegovina, with the aim of obtaining a picture of the current state and creating a program of activities towards the desired state. In the specific case, the degree of compliance is scaled on a scale of 0-1. The results of the initial assessment are shown in Figure 4. (Hamidović et al., 2023)

Based on the initial assessment, the organization in question made an action plan to increase the level of compliance with the NIST CSF in the next three years.

5. Litigation management

Litigation management deals with compliance with legislation and attempts to avoid litigation through incident protection. If an incident occurs (eg, databases full of sensitive personal information are exposed), the result is likely to involve litigation or possibly even criminal proceedings. Although in Bosnia and Herzegovina there are no guidelines for calculating the amount of fines - it is a matter

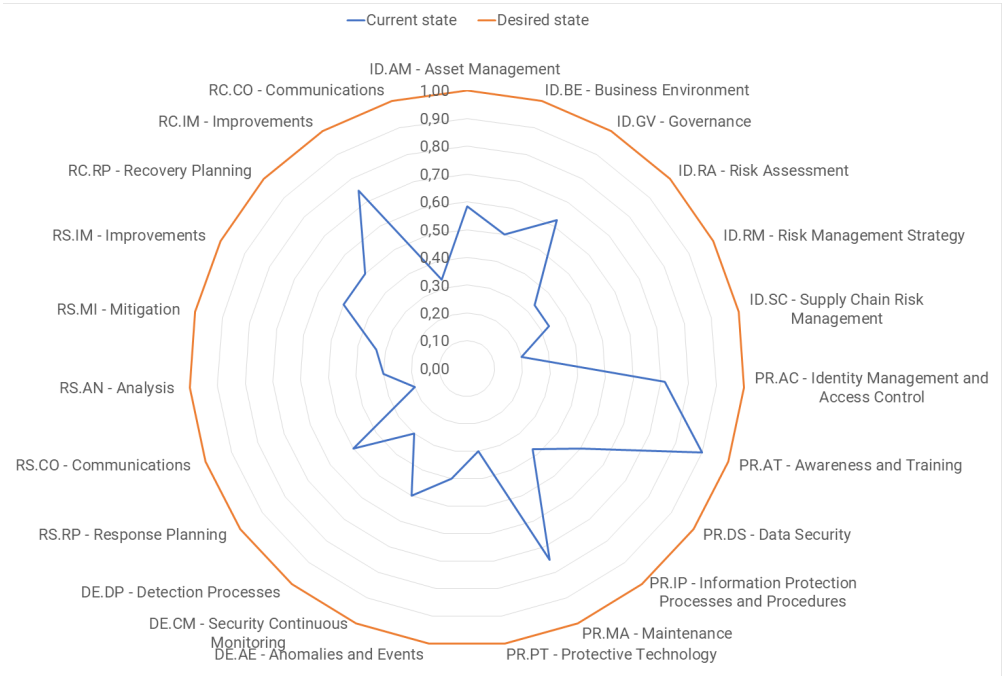

Figure 4. Example of initial assessment of compliance with NIST CSF (Hamidović et al., 2023)

of free judicial assessment or assessment of the court panel - in the context of this paper it is interesting to mention an example from the USA related to the guidelines for calculating the level of guilt. The guidelines highlight, among other things, two main areas for calculating level of guilt: the ethics program and the organization's security program - whether they exist and whether they have been implemented. Organizations can achieve lower culpability through higher preparation, raising awareness throughout the enterprise, training the enterprise, and generally instituting acceptable practices surrounding ethics and security. The US Federal Sentencing Guidelines states that *„Such compliance and ethics program shall be reasonably designed, implemented, and enforced so that the program is generally effective in preventing and detecting criminal conduct. The failure to prevent or detect the instant offense does not necessarily mean that the program is not generally effective in preventing and detecting criminal conduct."* (United States Sentencing Commission, 2016)

6. Conclusion

In addition to the mission, business, and operating requirements, the information security manager must understand the legal and regulatory restrictions and demands that are imposed on the organization. This is critical because deploying security that fails to make the system compliant with one of these can result in major fines or negatively impact the reputation of the organization, and in some cases it can also constitute a criminal offense.

There are many standards from which a business organization's security standard can be derived. Organizations can use international security standard as is or adapt it to other compliance requirements included in security legislation.

What is important is to assess the degree of compliance of the organization, and to make an active plan to reduce non-compliance. It should always be kept in mind that the state of security is changing, and that it needs to be constantly checked and adapted to security needs as well as compliance requirements.

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Original scientific paper

DIGITAL TRANSFORMATION OF CITIES IN BOSNIA AND HERZEGOVINA: THE CASE OF CITY OF ŽIVINICE

Abstract

Digital transformation within any legal entity should primarily result in the use of digital technologies to better connect internal resources with clients, creating a more convincing user experience. It also enables better coordination of internal operations and decision-making process improvement. Digital transformation promotes complementarity and synergy between proposed policy measures supporting digital transformation and existing policies, including digital priorities such as smart cities, digital city, and e-government. This paper explores the accelerated digital transformation era, significantly influenced by the pandemic. It emphasizes the importance of digitizing not only services and client interactions but also various functions within legal entities. The paper argues that successful digital transformation within any legal entity should primarily utilize digital technologies to enhance the connection between internal resources and clients, thereby improving the user experience. It also discusses the role of digital transformation in promoting complementarity and synergy between proposed policy measures and existing policies, including digital priorities such as smart cities, digital city, and e-government. The analysis presented in this paper aims to support the city of Živinice in creating and implementing digital policies that can significantly impact the daily lives of citizens, businesses, employees, and entrepreneurs. The paper concludes by emphasizing the potential of the digital transformation initiative in improving the quality of life for citizens, transforming services and production, stimulating growth, and attracting businesses and talents. This research can serve as a foundation for the city's digitization strategy and other strategic documents.

Key words: *Digital Transformation, Change Management, Urban Economic Growth, Policy Measures, Bosnia and Herzegovina, City of Živinice.*

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1. Introduction

It is abundantly clear that the new normal is the age of digital transformation. Of course, it started much earlier, but the pandemic brought a quantum leap when it comes to the digitization of business, not only in terms of interaction with clients and digitization of services, but also in the organizational sense through the digitization of many functions within legal entities. By using modern technologies, we enable the achievement of sustainable economic growth in urban areas. The very value of digital technologies rests on more efficient coordination of resources.

Digital transformation within any legal entity should primarily result in the use of digital technologies to better connect internal resources with clients with the aim of creating a more convincing user experience. In addition, it enables better coordination of internal operations and improvement of the decision-making process. Digital transformation promotes complementarity and synergy between proposed policy measures supporting digital transformation and existing policies including digital priorities such as smart cities, digital city and e-government. It should be clear that digital transformation will not happen overnight and will vary, given the nature of the business, but any successful digital transformation must follow a clear vision that is focused on customer needs and shared by the entire team.

With an impact on both macroeconomic and microeconomic factors, digitalization is a major force behind economic progress. It increases a nation's appeal to investors and fosters regional economic cooperation. The Covid-19 epidemic has brought attention to the energy transition and digital transformation as important future paths. In order to keep up with digital developments, Bosnia and Herzegovina may need to increase growth and engage in economic cooperation with neighbouring regions.

Digitalization's main goal is to aid in the transformation of the public sector, the economy, and society by creating new types of value through innovation and digital technology. Digital transformation also aims to improve the effectiveness and efficiency of the public sector. Thus, the goal of this essay is to highlight the significance of digital transformation, raise awareness of it, and highlight how emerging nations like Bosnia and Herzegovina.

This analysis was created to support the digital transformation of city of Živinice in the creation and adoption of digital policies that have the potential to change the daily lives of citizens, businesses, employees and entrepreneurs. The digital transformation initiative includes helping cities to improve the quality of life for their citizens, using cutting-edge technology for the benefit of citizens and transforming services and production to increase productivity and drive growth, investing in vital infrastructure, technology and transparency and thereby attracting businesses and talent. This document can serve as a basis for the adoption of the City Digitization Strategy and other strategic documents.

2. Digital transformation

In the public sector, digital transformation entails new linkages, service delivery frameworks, and stakeholder involvement. On the other hand, little factual data is available regarding the definition of digital transformation used by public administrations, their project management methodology, and the anticipated outcomes of this process (Eggers & Bellman, 2015). Terms like "digitalization," "digital management," and "digital transformation" are used interchangeably in the literature. It is imperative for leaders to foster an atmosphere of empowerment and ongoing enhancement, and for employees to possess a distinct perspective on digital change. Digital maturity is directly impacted by leadership (Xanthopoulou & Dimitrios Karampelas, 2020). Strong central leadership and proactive actions by local and regional actors are necessary for the public sector to successfully implement digitalization (Millard, 2010).

The presence of digital technology by itself does not contribute value to organizations. Instead, organizational change is a dynamic process that, when applied in specific contexts, enables enterprises to uncover novel means of value creation. This highlights the importance of reevaluating business models (Osterwalder & Pigneur, 2010; Morakanyane et al., 2017). Citizens' view of the value they receive from e-government and digital management systems has a substantial impact on their efficacy (Scott et al., 2016).

The administration of information systems in public administration is growing progressively intricate. To enhance communication among various entities inside states and across them, it is possible to redirect existing information flows, revamp current applications, and create new applications that effectively utilize the available information resources (Nica et al., 2021; Kovacova & Lăzăroiu, 2021; Novak et al., 2021). The effectiveness of information technology systems in public administration has a substantial influence on decision-making systems (Bednárová et al., 2021). New information programs and procedures are needed to support the process of improving public institution management, reducing corruption, and improving the business environment (Ardielli, 2020; Maris, 2020; Gódány et al., 2021).

The global society and public administration are profoundly influenced by technological advancements, in conjunction with economic factors. Countries that fail to integrate digital technology across sectors will suffer. The adoption of digital technology in public services in industrialized nations indicates the necessity for digital transformation to enhance transparency, provide superior services, and counteract corruption. The advent of the digital revolution has fundamentally altered contemporary economies, corporations, and governmental administration. State governments should persist in the process of updating and improving public administration and services by incorporating information and communication technology (Dumitrica, 2015; Rymarczyk, 2021).

The implementation of digitalization has been effective in diminishing corruption in nations that have undergone digital reforms (Mouna et al., 2020). The digitalization of public organizations is crucial for the development of a smart

community, since it enhances operational efficiency and promotes transparency. Digitalization streamlines the functioning of public institutions across internal, intra-institutional, and external domains, fostering transparency and accessibility for a democratic society (Şandor, 2018; Afonasova et al., 2019; Balzer, 2020).

The process of digitalization is revolutionizing the labour market, leading to a greater demand for skilled professionals while also potentially resulting in job displacement and wage disparities. The impact of digital progress extends beyond just the quantitative changes in employment creation or loss, but also include the qualitative transformation of the work market (Fossen & Sorgner, 2018). AI's impact is evident at the individual level, posing a significant likelihood of individuals transitioning to different professions or facing unemployment. Although advanced digital technologies do not significantly impact the overall employment rate, they do result in a substantial shift of workers between different jobs and industries (Arntz et al., 2021). The impact of AI on employment can manifest in many ways, influencing distinct stages of development (Ping & Yao Ying, 2018).

3. Methodology

The adapted DTPA (Digital Transformation in Public Administration) methodology was used to assess the digital readiness of the city of Živinice with the aim of creating a digital transformation roadmap that will facilitate further development of future digital transformation projects and positioning within digital transformation strategies. This methodology was created as part of the United Nations Development Program (UNDP) project, which developed a set of tools for the implementation of the digital readiness assessment of Bosnia and Herzegovina's institutions with the aim of creating a road map for digital transformation, given the lack of a digital transformation agenda for institutions in Bosnia and Herzegovina, and if we consider the fact that Bosnia and Herzegovina is at the beginning of the path of digital transformation. The pillars of digital transformation on which the DTPA methodology is based are shown in Figure 1.

The methods for collecting primary data are based on scientifically based methodology, using semi-structured in-depth interviews and surveys. Interviews were conducted through conversations with interested parties, and in this way an effort was made to investigate the qualitative aspect of the phenomenon, while quantitative inputs necessary for valid statistical processing and analysis

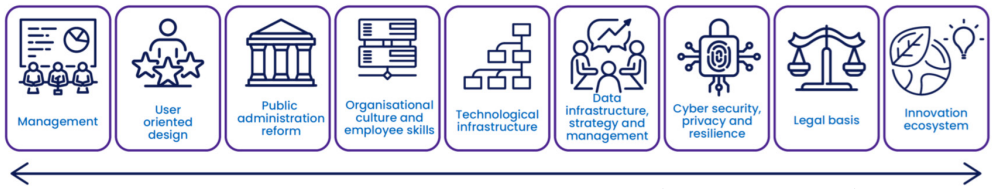

Figure 1. The pillars of digital transformation (UNDP BIH, 2022)

were obtained through surveys. The survey was conducted on a convenient sample of 30 respondents who are employees of the city administration of the city of Živinice. An originally created survey questionnaire was used as an instrument for data collection, and a descriptive statistical analysis was used to process the obtained data.

4. Analysis of pillars of digital transformation

Below is a presentation of the analysis of the pillars of the digital transformation of the city of Živinice through the analysis of the current situation. First, the indexes of digital readiness of the city according to the mentioned areas (pillars) of digital transformation were presented. Based on the calculated indices, and the total answers ***Yes***, ***No*** or ***Information not available***, it is possible to identify the current strengths and weaknesses of the city.

Answers ***Yes*** emphasize the advantages and possibilities of continuous development, while answers ***No*** and ***Information not available*** allow the city to determine priorities in areas where progress is needed and thus define its future activities.

Table 1. Indicators of readiness for digital transformation

Pillar of digital transformation	Index	Yes	No	Information not available
Management	0.71	3	3	0
User centred design	1.25	7	0	0
Public administration reform	0.67	2	1	0
Organisational culture and employee skills	0.44	0	0	5
Technological infrastructure	0.83	8	3	1
Data infrastructure, strategy and management	0.71	5	2	0
Cybersecurity, privacy and resilience	0.20	2	8	0
Legislative and institutional framework	1.00	5	0	0
Digital and innovation ecosystem	0.50	3	3	0

Then, quantitative results are given which are based on scoring the answers from the questions presented in the semi-structured questionnaire. Questions with a ***Yes*** answer were scaled by the evaluators on a scale from 1 to 3 in order to provide a more gradient insight into the level of development and readiness for digital transformation. This three-point scale indicates the perceived level of digitization where:

0 = Undeveloped level of digitization

1 = Low level of digitization – less developed, but aware

2 = Moderate level of digitization – moderately developed and aware

3 = Advanced level of digitization – highly developed and aware

Questions with the answer ***No*** and ***Information not available*** have a value of 0, i.e. undeveloped and unaware or information not available.

As can be seen in Table 1 and Figure 2, the assessment of the city of Živinice readiness for digital transformation according to the indicators shows that ***Technological infrastructure*** and ***User centred design*** have mostly positive responses, while ***Cybersecurity, privacy and resilience*** have the most negative responses.

Figure 3 further indicates that the results show that only two areas have a score of 1 or more, namely ***User centred design*** (1.25) and ***Legislative and institutional framework*** (1.00). All other indicators are below 1 where the worst scores are ***Cybersecurity, privacy and resilience*** (0.20) and ***Organizational culture and employee skills*** (0.44).

It is evident that the city has a lot of room for reaction within each of the indicators, and it is necessary to identify the priorities for further action based on each of the indicated indicators and the results of the survey of the attitudes of employees of the city of Živinice regarding digital transformation.

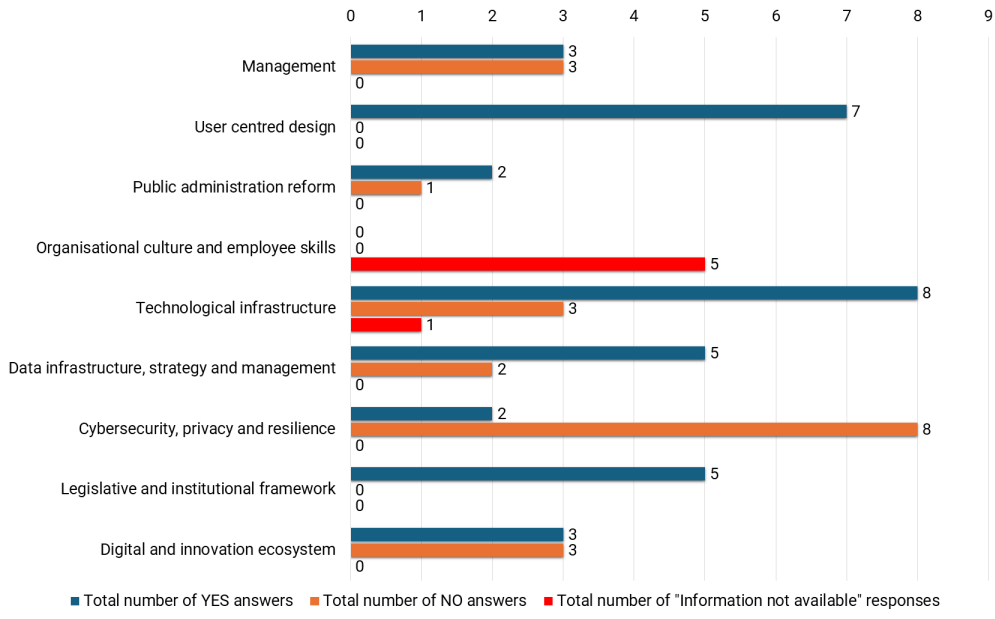

Figure 2. Analysis of readiness for digital transformation by area

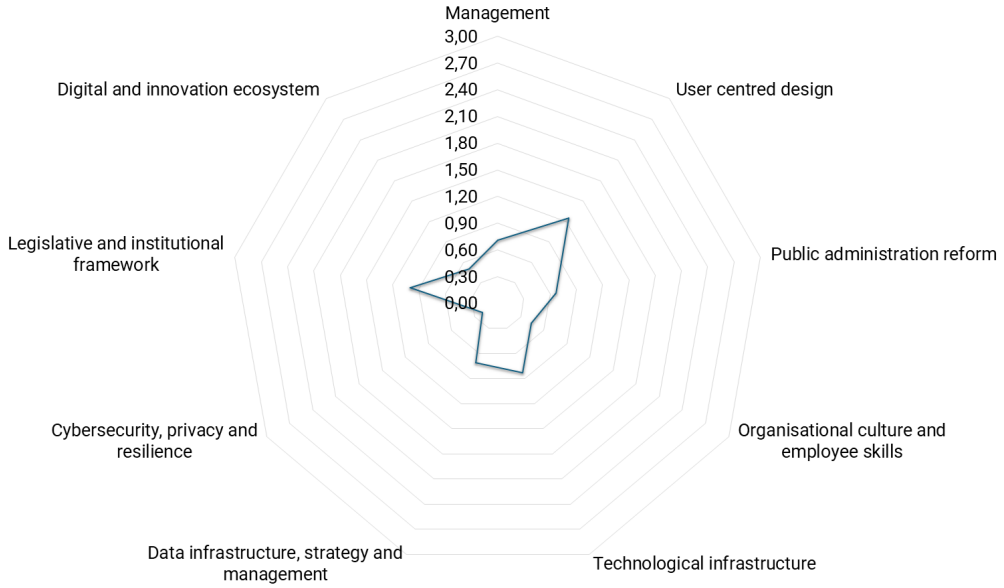

Figure 3. Indices of readiness for digital transformation

5. Results of the survey of the attitudes of employees of the city of Živinice regarding digital transformation

The aim of the empirical part of the research within this document was to examine the attitudes of employees of the city administration of the city of Živinice regarding various aspects of digital transformation. The following dimensions were observed:

- Attitude towards digital transformation,
- Institutional environment and support,
- Analysis of the current level of digital transformation and the readiness of human resources for that process,
- Obstacles to the digital transformation of the city of Živinice.

When it comes to examining the attitude of employees towards the digital transformation of the city administration, a five-point Likert scale was used (from 1 "absolutely disagree" to 5 "absolutely agree"). The average value of the respondent's answer to the statement "I believe that digitization will facilitate the work of the city administration and increase the quality of the services provided" is 4.1.

In the part of the assessment of the institutional environment and support for digital transformation, the respondents responded to two statements (table 2). Also, a five-point Likert scale was used (from 1 "absolutely disagree" to 5 "absolutely agree").

Table 2. Attitudes of respondents regarding the institutional environment and support

Statement	Mean
Institutional management (e.g. councillors, mayor, assistants, expert advisors, heads of departments, etc.) understand and support the vision of digital transformation.	2.6
The level of coordination in the planning and implementation of digital transformation activities with higher levels of government (cantonal/federal/state level) is good.	2.4

We can see that the respondents believe that the institutional leadership does not understand and does not sufficiently support the vision of digital transformation. Also, they believe that coordination in this process with higher levels of government is very weak.

When it comes to the use of modern digital solutions in the daily work of city administration employees, 50% of them stated that they use the Docunova program, 35% of them stated that they also use some form of digital documents in their business. The fact that 50% of employees did not give an answer may also indicate insufficient understanding of what a digital solution in business entails. Information (documents) that are obtained by official duty from other institutions are still predominantly in paper form (50%), while only 10% of them are obtained exclusively in electronic form.

Table 3. Respondents' views on human resources for digital transformation

Statement	Mean
I believe that there are enough trained and qualified employees (with business and technical skills) to implement the digital transformation.	2.6
I believe that there is a high-quality stimulation of professional IT personnel whose duty is to implement digital transformation.	2.5

Table 3 shows the views of respondents regarding human resources necessary for the implementation of digital transformation. A five-point Likert scale was used (from 1 "absolutely disagree" to 5 "absolutely agree"). The average values of the respondents' answers indicate that they believe that the city administration does not have a sufficient number of trained and qualified employees (with business and technical skills) to implement digital transformation, and that professional IT personnel are not properly stimulated to implement digital transformation.

Table 4 shows respondents' answers to questions related to human resources

in the city administration, which includes the issue of education, training and job systematization, in the context of support for digital transformation. The answers of the respondents indicate that most of them do not participate in training and education programs related to the development of skills needed in the process of digital transformation, and consider that these skills are not even required in the systematization of jobs, i.e. that probably most jobs in to the city administration, according to the systematization, it does not require the skills of employees that are necessary in the process of digital transformation.

Table 4. Respondents' views on human resources for digital transformation (systematization and education)

Question	Yes	No	I don't have information
In the systematization of jobs, is there a clear overview of the required business and digital skills by job?	10%	35%	55%
In the systematization of workplaces, are there defined conditions for employees regarding the possession of certificates relevant to digital transformation and associated ICT technology?	10%	30%	60%
Are digital transformation projects using a multidisciplinary (team) approach and knowledge exchange when it comes to specific skills?	10%	20%	70%
Are the employees who work on the development of e-services familiar with (passed training) how to apply user-oriented services?	10%	10%	80%
Is there a system of targeted training and education for employees in your service, which includes the improvement of digital skills?	10%	20%	70%

What is very positive is the fact that the average score of respondents on the statement "I am ready for additional education in order to be ready for all processes of digital transformation of the city administration" is 4.8. A five-point Likert scale was used (from 1 "absolutely disagree" to 5 "absolutely agree").

In Table 5, the respondents assessed the obstacles to the digital transformation of the city administration. A five-point Likert scale was used (from 1 "absolutely disagree" to 5 "absolutely agree"). The average values of the respondents' answers indicate that the high costs of digital transformation and the insufficient IT education of employees represent the most significant obstacles for the digital transformation of the city administration. On the other hand, the resistance of management personnel in the city administration services was marked as the smallest obstacle.

Table 5. Obstacles to digital transformation

Statement	Mean
I believe that the basic obstacle to the digital transformation of the city administration is the insufficient IT education of the employees.	3.8
I believe that the main obstacle to the digital transformation of the city administration is the lack of vision of the city administration.	3.6
I believe that the main obstacle to the digital transformation of the city administration is the resistance of the managerial individuals of the city services.	2.8
I believe that the main obstacle to the digital transformation of the city administration is the high costs of digital transformation.	3.9
I believe that the main obstacle to the digital transformation of the city administration is the existence of other priorities.	3.7

Figure 4 shows us the priority focuses that are necessary within each of the pillars of digital transformation. According to the pillars of digital transformation, the city of Živinice should improve and establish priorities within the pillars over which it has the greatest local control for changes.

6. Conclusion and recommendations

Employees of the city administration are aware that digital transformation would facilitate work and improve the quality of services to citizens. However, the institutional environment of the city administration does not sufficiently consider the vision and strategy regarding the digital transformation process. Also, there is a lack of employees with the necessary skills to successfully implement digital transformation. Education and training of employees in terms of improving digital skills are not at a high level and are not comprehensive. Despite this, employees showed a high readiness for additional education to prepare for all processes of digital transformation of the city administration. According to the respondents, high costs of digital transformation and insufficient IT education of employees represent the most significant obstacles for a successful digital transformation of the city administration.

Based on the analysis and research, the following digital transformation plan for the city of Živinice is proposed:

1. **Digital transformation strategy:** First, it is necessary to adopt a digital transformation strategy for the city of Živinice.
2. **Identification of existing e-services:** Analyse existing e-services and assess their use by citizens and business entities.
3. **Digitalization of services to citizens:** Identify services that can be digitized within the existing legal framework.
4. **Creating user-friendly e-services:** Develop more user-friendly e-services, including the creation of a mobile application.

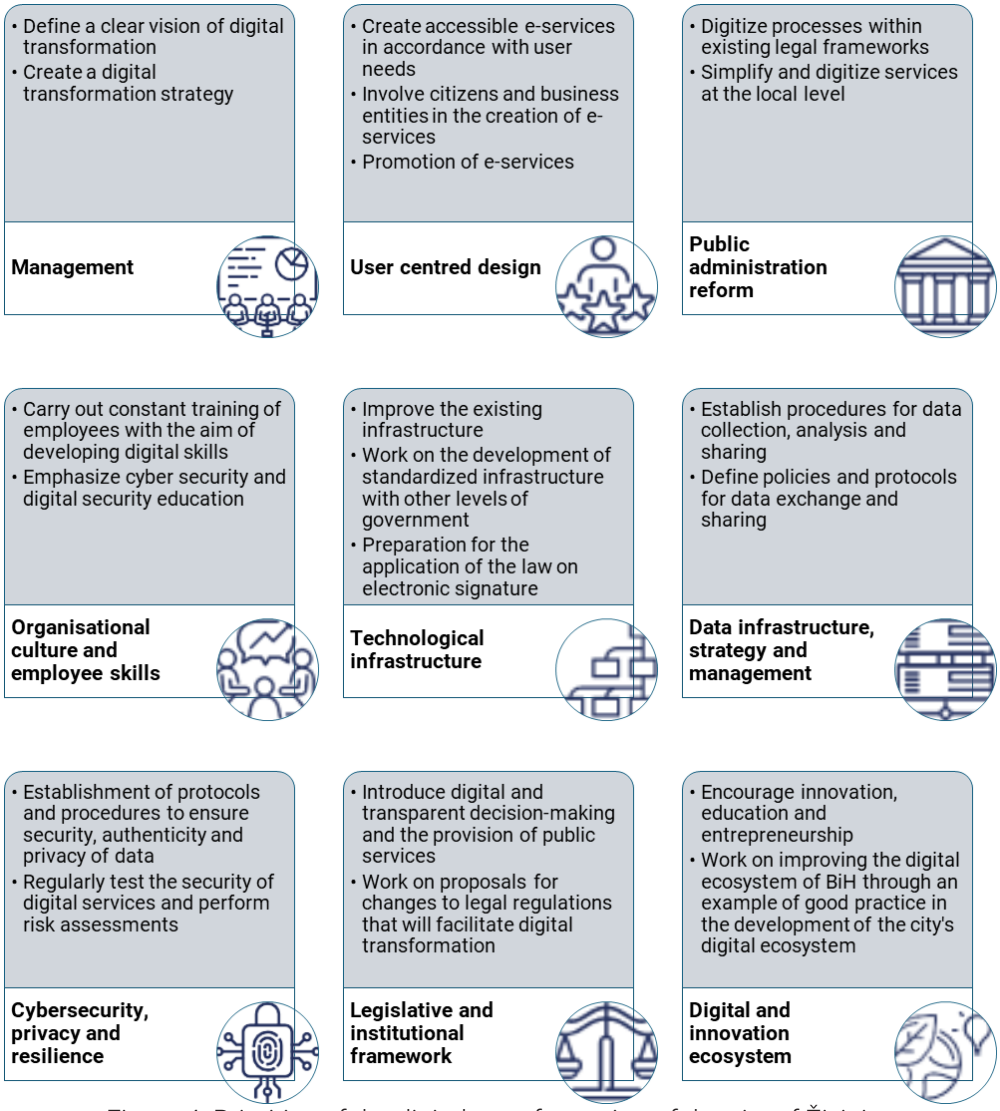

Figure 4. Priorities of the digital transformation of the city of Živinice

5. **Promotion of e-services:** Actively promote the use of developed e-services among citizens and business entities.
6. **Digitalization of internal processes:** Where it is possible according to the law, digitize internal processes and communication within the city administration.
7. **Employee Education:** Continuously educate employees to improve their digital skills and raise awareness of cyber security.
8. **Establishment of an IT service:** Introduce an IT service at the level of the city administration.

9. **Procedure for data:** Establish clear procedures for collecting, analysing and sharing data within the city administration.
10. **Data Security:** Establish protocols and procedures to ensure data security, authenticity and privacy.
11. **Security Testing:** Regularly test the security of digital services and assess risks.
12. **Public availability of decisions:** Through the platform and application, ensure public availability of all decisions of the city administration that are of interest to the citizens and business entities of the city of Živinice.
13. **Support for innovative companies:** Support the development of innovative companies through public procurement policy in the process of digital transformation of the city of Živinice.
14. **Network of business angels:** Support the creation of a network of business angels at the city level. Business angels are important for investing in start-up digital projects at an early stage when financial resources from other sources are not available to them. In addition to financial support, business angels offer access to business knowledge and contacts.
15. **Advocacy of legislative changes:** Actively advocate for legislative changes at higher levels of government in order to enable the smooth implementation of the digital transformation of local government.

Through the establishment of a more open and accessible public administration of the city of Živinice with an emphasis on high-quality digital public services and digital communication with all interest groups, the digital transformation of the city can contribute to the overall improvement of the work of the city administration and transparency.

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Professional paper

SECURE SOFTWARE CONCEPTS

Abstract

As software systems have become deeply embedded in our business and personal lives, the problems that result from software failure are increasing. A failure of software in a health care organization could lead to a decrease in the quality of health services, but also to consequences for the health and life of patients. Because software-intensive systems are so important to governments, companies, and individuals, it is essential that widely used software is trustworthy. This especially applies to software that is part of the critical infrastructure of the system, an example of which are healthcare institutions The software should be available when required and should operate correctly and without undesirable side effects, such as unauthorized information disclosure. For members of the software development team to develop secure software to support healthcare institutions, a reasonable knowledge of security principles is required.

Key words: *Secure Software, Risk, CIA, Critical Infrastructure Systems, Security Principles.*

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1. Introduction

Despite the recognition of the fact that the security of information systems is essential for the operation and sustainability of an business organizations, it seems that the cyber ecosystem today is full of many insecure networks and systems, and especially insecure software. In today's environment where software is full of vulnerabilities, as shown by the results of many studies, software security cannot be ignored, but it is often done. Some of the primary reasons why there is a prevalence of insecure software are (Mano, 2013):

- Project triangle constraints
- Security as an afterthought
- Security versus usability

From the moment when an idea for a solution to a business problem using software appears to the time that, that solution is designed, developed and deployed, there is a need for time, resources and budget. Constraints in resources, time and budget, are often the reasons why security requirements are left out of the software. If the software development project's scope, time, and budget are very rigidly defined, as is often the case, it leaves little or no room for incorporating even basic, not to mention additional, security requirements into software, and unfortunately what is usually overlooked are the security elements of software. Furthermore, developers and management tend to think that security does not add any business value since it is not easy to demonstrate a return on investment in security. The aforementioned project constraints (time, cost, scope) often lead to secure features not being built in software from the beginning. It is important that secure features are built into the software, rather than added at a later stage, because it has been proven that the cost of fixing insecure software earlier in the software development life cycle (SDLC) is significantly lower compared to when the same problem is fixed at a later stage of the SDLC – Figure 1. Addressing vulnerabilities right before a product is released is very expensive. Another reason as to why it is a challenge to incorporate secure features in software is that the incorporation of secure features is often viewed as rendering the software to become very complex, restrictive and unusable. There is absolutely no doubt that the incorporation of security comes at the cost of performance and usability. This is particularly true if the software design does not factor in the concept known as psychological acceptability, is emphasized in the ISC2 guide to the Certified Secure Software Lifecycle Professional Common Body of Knowledge. (Mano, 2013)

2. Quality and security

It is important to highlight the fact that in a world driven by the need to ensure quality products, organizations must recognize that there is a difference between quality and security, especially when it comes to software products. Almost all commercially developed software products go through a quality assurance or testing phase before being released. In the quality assurance phase, the functionality of the software, according to the requirements of the business client or customer, is confirmed and verified. Following standardized manage-

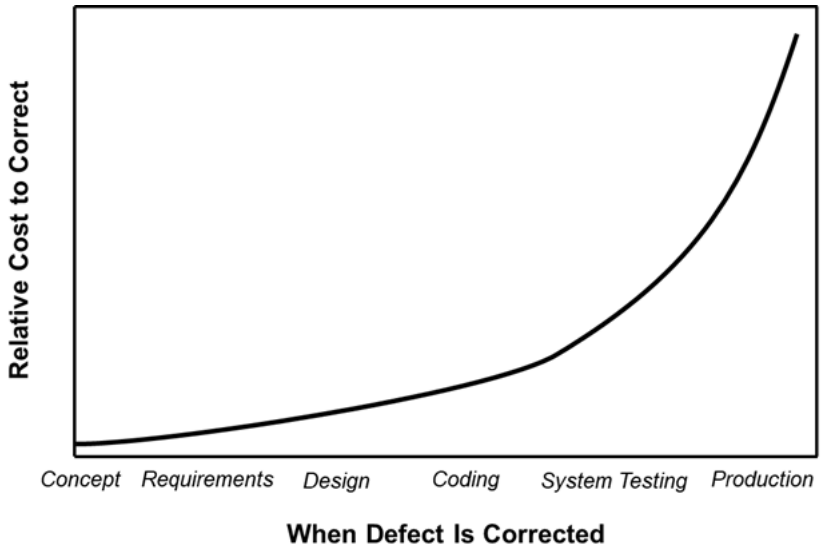

Figure 1. Relative cost to correct defect during the SDLC phases (Wiegers, 2021)

ment processes, such as Six Sigma or software certification according to ISO quality standards are important for creating quality software and achieving a competitive advantage in the market. However, it is important to understand that such quality checks and certifications do not necessarily mean that the software product is secure. A software product that is secure will contribute to the quality of that software, but the reverse is not always true. It is also important to recognize that the presence of a security function in software may support quality certification, but this does not necessarily mean that the software is secure. Vendors often tout the presence of security features in their products to differentiate themselves from their competitors, but it must be understood that the mere presence of security features in a vendor's software does not make it secure. The reason for this is that the security function may not be configured to work in the organization's work environment, or even if it is, it may be implemented incorrectly. It is therefore extremely important for organizations to verify vendor claims within their computing environment. In other words, one should trust, but one should always check. This is critical when evaluating software whether purchased or built in-house, is also highlighted in the ISC2 guide to secure software development. (Mano, 2013)

3. Fundamental security concepts

In order to develop security resilient software, it is important to incorporate security concepts into all phases of the SDLC: requirements, design, code, release, and disposal phases. Security concepts span the entire software life cycle and will require attention at each stage. Lack of or insufficient attention in any phase can render the efforts made in other phases completely futile. Professional literature recognizes the following security concepts as fundamental security concepts (Conklin, Shoemaker, 2022):

- Confidentiality
- Integrity
- Availability
- Authentication
- Authorization
- Accounting

These security concepts are essential building blocks for secure software development. In other words, they are the bare necessities that need to be addressed and cannot be ignored.

In any networked system, there are three main types of security threats (Sommerville, 2015):

- Threats to the confidentiality of the system and its data These can disclose information to people or programs that are not authorized to have access to that information.
- Threats to the integrity of the system and its data These threats can damage or corrupt the software or its data.
- Threats to the availability of the system and its data These threats can restrict access to the software or its data for authorized users.

These threats are, of course, interdependent. If an attack makes the system unavailable, then one will not be able to update information that changes with time. This means that the integrity of the system may be compromised. If an attack succeeds and the integrity of the system is compromised, then it may have to be taken down to repair the problem. Therefore, the availability of the system is reduced.

When talking specifically about access control, the acronym AAA comes up. This stands for Authentication, Authorization, and Accounting. These describe the three areas that need to be covered when granting access to a resource to an individual (BIO-key International, 2023):

- Authentication - A user must be authenticated by proving their identity. A provided identity needs to be verified that they are who they say they are.
- Authorization - Once an individual's identity is verified with authentication, that person's access then needs to go through authorization. The process involves defining an access policy that determines what rights that user has.
- Accounting - Once access to a resource is granted or denied, accounting needs to occur. Accounting is logging an audit trail to keep a record of what happened with the request and outcome. Logging provides a very important function as it can be looked back on when needed to prove an action happened. When investigating security events this can prove to be invaluable.

In addition to the aforementioned CIA Triad and AAA fundamental security concepts, the professional literature recognizes other general or security design

concepts such as (Conklin, Shoemaker, 2022):

- Good enough security
- Defense in depth
- Weakest link
- Single point of failure
- Least privilege
- Separation of duties
- Psychological acceptability
- Fail-safe
- Open design
- Complete mediation
- Leverage existing components
- Least common mechanisms
- Economy of mechanism

A brief description of some of the design concepts is provided below (Mano, 2013):

- Least privilege - A security principle in which a person or process is given only the minimum level of access rights that is necessary for that person or process to complete an assigned operation. This right must be given only for a minimum amount of time that is necessary to complete the operation.
- Separation of duties - Also known as the compartmentalization principle, or separation of privilege, separation of duties is a security principle which states that the successful completion of a single task is dependent upon two or more conditions that need to be met and just one of the conditions will be insufficient in completing the task by itself.
- Defense in depth - Also known as layered defense, defense in depth is a security principle where single points of complete compromise are eliminated or mitigated by the incorporation of a series or multiple layers of security safeguards and risk-mitigation countermeasures.
- Fail secure - A security principle that aims to maintaining confidentiality, integrity and availability by defaulting to a secure state, rapid recovery of software resiliency upon design or implementation failure. In the context of software security, fail secure is commonly used interchangeably with fail safe, which comes from physical security terminology.
- Psychological acceptability - A security principle that aims at maximizing the usage and adoption of the security functionality in the software by ensuring that the security functionality is easy to use and at the same time transparent to the user. Ease of use and transparency are essential requirements for this security principle to be effective.
- Weakest link - This security principle states that the resiliency of your software against hacker attempts will depend heavily on the protection of its weakest components, be it the code, service or an interface...

4. Privacy and software development

Privacy requirements must be taken into account and deemed as important as security or reliability requirements when developing secure and compliant software. Some standards and best practices disallow the collection of certain private and sensitive information. (Conklin, Shoemaker, 2022)

EU legislation in the field of personal data protection introduces as a legal obligation the concept of privacy by design, which must be taken into account when purchasing or internally developing software systems in which personal data will be processed. In the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) is, among other things, stated that *„controller should adopt internal policies and implement measures which meet in particular the principles of data protection by design and data protection by default. Such measures could consist, inter alia, of minimising the processing of personal data, pseudonymising personal data as soon as possible, transparency with regard to the functions and processing of personal data, enabling the data subject to monitor the data processing, enabling the controller to create and improve security features. When developing, designing, selecting and using applications, services and products that are based on the processing of personal data or process personal data to fulfil their task, producers of the products, services and applications should be encouraged to take into account the right to data protection when developing and designing such products, services and applications and, with due regard to the state of the art, to make sure that controllers and processors are able to fulfil their data protection obligations. The principles of data protection by design and by default should also be taken into consideration in the context of public tenders."*

Best practice guidelines for data privacy that need to be included in software requirements analysis, design and architecture can be addressed if one complies with the following rules (Conklin, Shoemaker, 2022):

- If you don't need it, don't collect it.
- If you need to collect it for processing only, collect it only after you have informed the user that you are collecting their information and they have consented, but don't store it.
- If you have the need to collect it for processing and storage, then collect it, with user consent, and store it only for an explicit retention period that is compliant with organizational policy and/ or regulatory requirements.
- If you have the need to collect it and store it, then don't archive it, if the data has outlived its usefulness and there is no retention requirement.

While the protection and security of personal information is important to all individuals, corporations, institutions and governments, there are special requirements in the health sector that need to be met to ensure the confidentiality, integrity, auditability and availability of personal health information. This type of information is regarded by many as being among the most confidential of

all types of personal information. However, it should be taken into account that healthcare organizations have certain specificities, and that information security measures should not indirectly threaten the delivery of healthcare services - endanger the life and health of patients. Taking this into account, it is recommended that when implementing an information security management system in healthcare institutions, the recommendations of security standards for these types of organizations, such as ISO 27799, Health informatics Information security management in health using ISO/IEC 27002 should be used. (Hamidovic, Kabil, 2011)

5. Secure software requirements

The requirements for a system are the descriptions of what the system should do— the services that it provides and the constraints on its operation. These requirements reflect the needs of customers for a system that serves a certain purpose such as controlling a device, placing an order, or finding information. The process of finding out, analyzing, documenting and checking these services and constraints is called requirements engineering. The term 'requirement' is not used consistently in the software industry. In some cases, a requirement is simply a high-level, abstract statement of a service that a system should provide or a constraint on a system. At the other extreme, it is a detailed, formal definition of a system function. (Sommerville, 2015)

Software system requirements are often classified as functional requirements or nonfunctional requirements (Sommerville, 2015):

- Functional requirements These are statements of services the system should provide, how the system should react to particular inputs, and how the system should behave in particular situations. In some cases, the functional requirements may also explicitly state what the system should not do.
- Non-functional requirements These are constraints on the services or functions offered by the system. They include timing constraints, constraints on the development process, and constraints imposed by standards. Non-functional requirements often apply to the system as a whole, rather than individual system features or services.

Non-functional requirements, as the name suggests, are requirements that are not directly concerned with the specific services delivered by the system to its users. Non-functional requirements, such as performance, security, or availability, usually specify or constrain characteristics of the system as a whole. Non-functional requirements are often more critical than individual functional requirements. System users can usually find ways to work around a system function that doesn't really meet their needs. However, failing to meet a non-functional requirement can mean that the whole system is unusable. As we can see from Figure 2, security requirements and legal privacy requirements fall into the category of non-functional software requirements. (Sommerville, 2015)

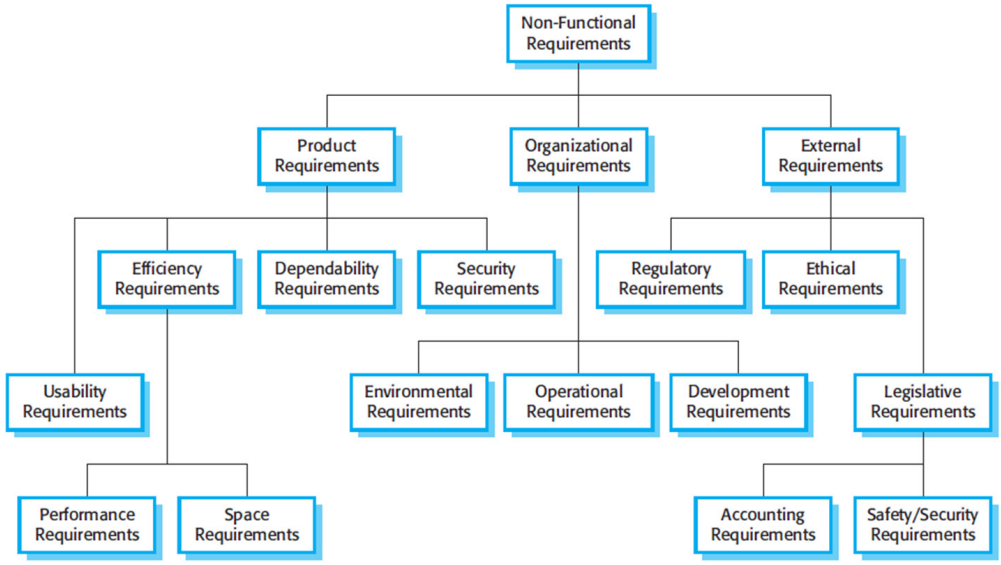

Figure 2. Non-functional software requirements. (Sommerville, 2015)

6. Accepting software formally

The ISC2 Guide to Secure Software Development emphasizes that incorporation of a formal software acceptance process based on security is extremely vital in the deployment or release of secure software. This is the final checkpoint to discover the existence of missed and unforeseen security vulnerabilities and to validate the presence of security controls that will address known threats. By validating that security requirements are included in the design (for software built in-house) or in the request for proposals (for COTS software) and verifying that they have been addressed ensures that security does not need to be bolted on at a later stage post release. It not only ensures that software security issues are proactively addressed and that the software developed is operationally security resilient, but that the software is compliant with applicable regulations as well. The software acceptance process helps to maintain the secure computing ecosystems by ensuring that new software products has achieved a formally defined level of quality and security. Software not meeting these requirements should not be approved for release into the secure computing ecosystem. (Mano, 2013)

7. Installation and deployment

When proper installation and deployment processes are not followed, there is a high likelihood that the software and the environment in which the software will operate can lack or have a reduced level of security. It is of prime importance to keep security in mind before and after software is installed. Without the necessary pre- and post-installation software security considerations, expecting software to be operationally security resilient is a far-fetched objective. Software needs to be configured so that security principles such as least privilege,

defense in depth, separation of duties, etc., are not be violated or ignored during the installation or deployment phase. (Conklin, Shoemaker, 2022)

8. Operations and maintenance

Once the software is installed, it is operated to provide services to the business or end users. Released software needs to be monitored and maintained as well. Software operations and maintenance need to take into account the assurance aspects of reliable, resilient and recoverable processing. Since total security signified by no risk is utopian and non-achievable, all software that is deployed has a level of residual risk that is usually below the acceptable threshold as defined by the business stakeholders unless the risk has been formally accepted. Despite best efforts, software deployed can still have unknown security and privacy issues. Even in software where software assurance is known at release time, due to changes in the threat landscape, computing technologies, etc., the ability (resiliency) of the software to withstand new threats and attack may not be sufficient. (Mano, 2013)

During the operational use of the software, it is important to maintain security features at an acceptable level, by following good change management practices and other recommendations of information security standards.

9. Software disposal planning

Like all formal IT processes, disposal should be conducted according to a plan. The plan defines schedules, actions, and resources that: 1) terminate the delivery of software services; 2) transform the system into, or retain it in, a socially and physically acceptable state; and 3) take account of the health, safety, security, and privacy applicable to disposal actions and to the long-term condition of resulting physical material and information. Disposal constraints are defined as the basis for carrying out the planned disposal activities. The key aim of this plan is to ensure an efficient transition into retirement. (Conklin, Shoemaker, 2022)

10. Conclusion

Security is never absolute and there is no such thing as complete or absolute security. This is an important security principle, as it sets the stage for all security aspects associated with the system. Each system has an appropriate level of security required and it is important to determine this level early in the design process. When it comes to health information systems, security concepts must be taken into account during the entire life cycle of the software, considering the sensitivity of health data and the criticality of certain software systems for the life and health of patients.

If the security requirements are not explicitly specified before the acquisition and development of the system, there is a high probability that the software product being procured will not meet the security requirements. Not only must the security requirements be explicitly defined in advance and clearly communicated to the vendor or organization software developers, but they must also

be verified. Unfortunately, in most cases, when software is acquired, the evaluation of the acquired software is based on the functionality, performance, and integration capabilities of the software, not necessarily on security and privacy requirement. Even in cases where a vendor claims that the security of their software is a differentiating factor, these claims need to be professionally and objectively verified.

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Preliminary communication

AI IN HIGHER EDUCATION: DEVELOPMENT OF A COMPREHENSIVE MODEL

Abstract

Artificial intelligence (AI) technology is increasingly gaining importance in various fields, as it has the potential to drive innovation, enhance efficiency and revolutionize processes. The integration of AI into higher education institutions is transforming the landscape of teaching, learning, research, and administrative functions. This paper presents a comprehensive model designed to include the diverse aspects of AI adoption within the higher education ecosystem. The model includes the following components: AI, infrastructure, ethical and legal considerations, students, teaching staff, management and administration, research and innovation and evaluation. Every component plays an important role in enabling the integration of AI technologies across different areas of higher education. Additionally, the paper outlines various activities and goals for the implementation of AI technology in higher education for different stakeholders. Implementing AI in higher education offers the potential to optimize resource allocation, improve management efficiency, advance scientific research, enhance teaching materials, personalize learning experiences, and enrich the educational journey for both students and faculty members. AI's ability to analyze vast amounts of data and support decision-making processes can greatly improve educational quality and operational efficiency in academic institutions.

Key words: *Artificial Intelligence, Comprehensive Model, Higher Education, AI Tools, Educational Technology.*

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1. Introduction

Artificial intelligence (AI) seeks to replicate human intelligence in machines, enabling them to learn from past experiences and make decisions accordingly. The applications of AI are rapidly growing across diverse fields such as agriculture, industry, healthcare, and education (Hooda et al., 2022). In higher education, the use of AI has risen quickly (Chu, Tu & Yang, 2022), driven by the rapid increase in the availability of new AI tools (Crompton & Burke, 2023).

AI is increasingly transforming various aspects of higher education, offering new opportunities to enhance teaching, learning, and administration (Crompton & Burke, 2023). Its integration presents potential benefits such as personalized learning, automated grading, predictive analytics, and more efficient administrative processes. AI can also support research through the analysis of large datasets and improve accessibility for students with disabilities (Shan, 2024). However, the application of AI brings challenges, including ethical concerns (Shan, 2024), the digital divide, and the need for additional teacher training. Despite these challenges, AI has the potential to significantly improve the quality and accessibility of higher education if implemented thoughtfully and inclusively.

This paper introduces a comprehensive model designed to address the different aspects of AI adoption in higher education. The model encompasses key components such as AI technology, infrastructure, ethical and legal considerations, students, teaching staff, management and administration, research and innovation, and evaluation. Additionally, the paper outlines specific activities and objectives for implementing AI, customized for various stakeholders within the education sector.

2. AI in Higher Education

One of the most important applications of AI is in education. AI enhances face-to-face teaching and smart online learning, and it is particularly impactful in e-learning. E-learning leverages AI to enable direct and customized learning processes using dynamic learning, computer vision, ontologies, conceptual systems, computational linguistics, and deep learning (Gligorea et al., 2023).

With AI, educational institutions can provide tailored learning experiences that adapt to individual student needs, helping to bridge gaps in knowledge and skills (Bajaj & Sharma, 2018; Improvitz, 2023). AI-powered tools and platforms enable instructors to gain deeper insights into student performance, allowing more informed decisions and personalized interventions. Moreover, the automation of administrative tasks through AI can lead to increased efficiency and cost savings for institutions, freeing up resources to enhance the educational experience. AI also has the capacity to revolutionize research by using advanced data analysis techniques to uncover patterns and insights that were previously difficult to detect (Abbadia, 2023). Furthermore, AI-driven solutions can facilitate collaboration among researchers by providing tools for data sharing, analysis, and visualization.

AI offers promising solutions to ensure that higher education is inclusive for all students, including those with disabilities (Shan, 2024). Technologies such as speech-to-text, text-to-speech, and real-time translation services can make educational content more accessible and inclusive, thereby promoting equal opportunities for learning. However, it is crucial to critically assess the potential drawbacks and risks of AI, emphasizing the importance of incorporating ethical considerations into its design and deployment (Shan, 2024).

Although the implementation of AI in higher education has numerous benefits, it must be approached with caution. Ethical considerations such as data privacy, algorithmic bias, and transparency in AI decision-making are critical to address (Shuford, 2024). To fully realize the benefits of AI in higher education, it is essential to provide adequate training and support for educators, ensuring they are equipped to effectively integrate AI tools into their teaching practices. Furthermore, the role of management in the successful integration of AI cannot be understated (Crompton & Burke, 2023). Institutional leaders and administrators must be willing and acting towards creating a supportive environment that encourages the adoption of AI technologies. This involves developing strategic plans that align AI initiatives with the institution's goals and ensuring that the necessary infrastructure and resources are in place.

3. The Comprehensive AI Model for Higher Education

The proposed comprehensive AI model for higher education is presented in Figure 1. It illustrates the integration of AI within higher education, emphasizing its core components and considerations. At the center, AI is supported by infrastructure and ethical and legal considerations, which are critical for its effective implementation. Surrounding the core, four key areas are highlighted: students, teaching staff, management and administration, and research and innovation, indicating the primary stakeholders and domains impacted by AI. Each of these areas interacts with AI to enhance educational processes, administration, and research outcomes. Finally, the model includes an evaluation component, ensuring continuous assessment and improvement of AI applications in higher education.

The technical infrastructure for AI in higher education refers to essential components necessary to support the development, deployment, and utilization of AI technologies across academic and administrative functions. It should include powerful servers and high-performance computing systems. Institutions may also need to invest in specialized AI hardware, such as GPUs and TPUs, which are crucial for training and running AI models efficiently (Gcore, 2024). Networking infrastructure should include high-speed internet and reliable Wi-Fi. Software infrastructure is needed to ensure effective utilization of AI technology. This includes scalable cloud-based platforms for data storage and processing, enabling the handling of large datasets generated by educational activities. Additionally, sophisticated learning management systems (LMS) augmented with AI tools can personalize learning experiences and provide predictive analytics (Subbarao, 2023). Integration of AI-driven virtual assistants and chatbots within these systems enhances administrative efficiency and student support,

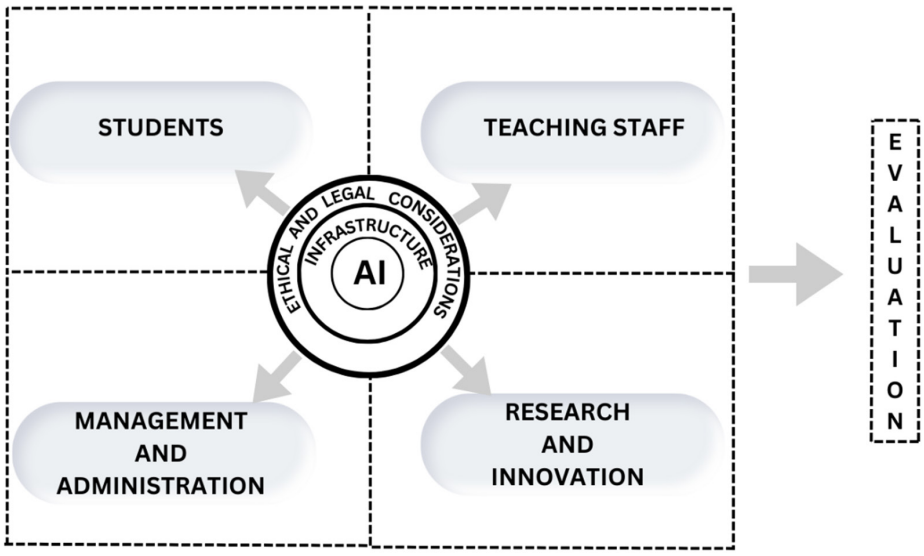

Figure 1. The Comprehensive AI Model for Higher Education

offering real-time responses (Goyal, Minz & Sha, 2023). It is also crucial to have security measures and protocols in place to protect sensitive data and make sure everything complies with privacy regulations.

The proposed model prioritizes responsible AI use by incorporating a dedicated layer that addresses ethical and legal considerations, fostering compliance and ethical implementation in higher education. Activities regarding this part of the model include organizing workshops and seminars to educate stakeholders on ethical principles and guidelines related to AI, as well as fostering discussions on issues like algorithmic bias and privacy concerns (Shuford, 2024). There are many concerns about the implementation of AI within higher education, e.g. one of the primary concerns when it comes to students is that students might utilize AI tools to cheat or plagiarize their academic assignments and exams, as evidenced by a recent survey showing nearly one-third of university students have done so (Chen, 2023). Despite worries that AI might harm students' creativity and critical thinking, some educators view it as a chance to transform teaching and learning, even though AI can produce inaccurate and biased information (Xiao, Chen & Bao, 2023).

Institutions need to create comprehensive guidelines and policies to ensure the ethical use of AI in research, teaching, and administrative practices. These guidelines should address a wide range of issues, including data privacy, algorithmic fairness, and transparency (Shuford, 2024). They should outline clear protocols for data collection, storage, and usage, ensuring that all AI applications comply with privacy laws and protect sensitive information. By setting these comprehensive standards, institutions can promote responsible AI use, fostering trust and accountability in the integration of AI technologies in higher education.

Table 1 (Ahmad et al., 2022; Crompton & Burke, 2023; George & Wooden, 2023) provides the list of potential activities and implementation goals for management and administration.

Table 1. Activities and goals for management and administration

Domain	Activities	Goals
Management and administration	- Data-driven decision making - AI-supported workflow automation - Implementing AI solutions for automated scheduling and logistics - Utilizing predictive analytics - Financial planning and forecasting - Implementing AI-driven academic advising and counseling - Utilizing AI chatbots for 24/7 student support - Risk management - Strategic planning and institutional advancement	- Improved operational efficiency - Enhanced decision support - Improved resource allocation - Enhanced student services - Accurate forecast of enrollment trends, student outcomes and financial projections - Improved financial planning accuracy and effiency

Activities and goals for teaching staff are presented in Table 2 (Ahmad et al., 2022; Bond et al., 2024; Crompton & Burke, 2023; George & Wooden, 2023; Seo, Tang, Roll, Fels & Yoon, 2021).

Table 2. Activities and goals for teaching staff

Domain	Activities	Goals
Teaching staff	- Providing AI-supported tutorials and mentoring - Designing and implementing AI-enhanced curriculum - Integrating AI tools for classroom management and student engagement - Using AI tools for grading and feedback - Utilizing AI for content creation and resource recommendations - Engaging in continuous professional development	- Improve the quality and effectiveness of teaching - Enhance personalized learning experience for students - Increase efficiency in grading and providing feedback - Save time on administrative tasks to focus more and teaching and mentoring - Encourage innovative teaching practices and content delivery - Proficiency of teaching staff in using AI technologies

Table 3 outlines a list of potential activities and goals specifically aimed at implementing AI in higher education for students (Ahmad et al., 2022; Bond et al., 2024; Crompton & Burke, 2023; George & Wooden, 2023; Seo, Tang, Roll, Fels & Yoon, 2021) . These activities and goals are designed to enhance personalized learning, provide academic support, and improve overall student outcomes through the effective use of AI technologies.

Table 3. Activities and goals for students

Domain	Activities	Goals
Students	- Engaging in personalized learning - Participating in AI-supported tutorials and mentoring - Utilizing AI tools for research - Utilizing AI tools for academic advising and planning - Receiving AI-driven career guidance - Accessing 24/7 AI chatbots for academic and administrative support	- Improve academic performance and learning outcomes - Enhance personalized educational experiences - Academic and career guidance - Increase accessibility to support services and resources - Enhance research capabilities - Improve readiness for the job market and career success

Table 4. Activities and goals for research and innovation

Domain	Activities	Goals
Research and innovation	- Automating data collection, analysis and processing - Utilizing AI tools for literature review - Assisting in identifying and writing grant and funding opportunities - Collaboration and networking - Experimentation and simulation - Innovation hubs and incubators - AI research labs and centers	- Increase research productivity and quality - Improve funding success - Promote knowledge exchange and networking opportunities within the AI research community - Enhance experimental design, accuracy and precision - Offer programs that encourage entrepreneurship and the commercialization of AI research - Advancing AI knowledge and technologies

The list of potential activities and goals aimed at enhancing research and innovation through the implementation of AI in higher education is presented in Table 4 (Abbadia, 2024; Bond et al., 2024; George & Wooden, 2023). These activities collectively aim to increase research productivity, enhance funding success, promote knowledge exchange, improve experimental accuracy, encourage entrepreneurship, and advance AI technologies in higher education.

The evaluation component of the comprehensive AI model for higher education ensures continuous assessment and improvement of AI usage and applications. This includes establishing performance metrics, feedback mechanisms and regular ethical audits to assess the impact and effectiveness of AI tools.

4. Conclusion

The comprehensive model presented in this paper serves as a foundational framework for the integration of AI into higher education, encompassing key components such as AI technology, infrastructure, ethical considerations, and stakeholder engagement. It outlines potential activities and goals to optimize educational processes and management efficiency, emphasizing the potential of AI in enhancing teaching, research, and administrative functions. It is important to note that while this model provides a structured approach, it has not been empirically tested in real-world educational settings. Therefore, its applicability and effectiveness may vary across institutions. Future research should focus on empirical validation and addressing potential challenges such as resource constraints and technological readiness in implementing AI solutions in higher education.

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Review paper

APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) IN ACCOUNTING

Abstract

In recent years, technological development and the increasing application of artificial intelligence (AI) have attracted the attention of all professions, including accounting. Trends in the development and application of artificial intelligence in the near future may lead to the shutdown of certain industries, and it also has an impact on the development of the accounting industry. Digitization has imposed rapid changes in the business world. What was once a futuristic idea is now a reality, as a large percentage of companies already use artificial intelligence in at least one of their business functions. Artificial intelligence will not replace accountants, but it will make them more productive, focus more on strategic thinking and solving more complex problems compared to traditional accounting. The subject of research in this paper is the application of artificial intelligence in the accounting profession, and the aim of the research is to point out a new perspective of the development of the accounting profession, and the advantages of the application of artificial intelligence by accountants.

Key words: *Digitization, Artificial Intelligence (AI), Accounting.*

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1. Introduction

Digitization in business implies the use of technological solutions in order to improve the business process and the results of the company's operations. The application of digitalization depends on the needs of companies, while some need simple technological solutions, on the other hand there are companies that require more complex digital technology processes. It is quite obvious that the accelerated development of information and communication technologies facilitates the business process of companies in terms of economy, efficiency and effectiveness. It is precisely this business advantage that has forced the trend that an increasing number of companies are turning to paperless business, i.e. using technology. Digitization in the process of providing accounting services brings a new business advantage, because cloud computing enables access to information at any time and from any location. Cloud accounting removes the obstacles of physical distance and the use of paperwork. The application of digital technology leads to a reduction in the workload of accountants because the actions that were present in traditional accounting are facilitated. It is precisely the accounting profession that is most affected by technological development (Dumont, 2021).

Back in 2017, according to the results of research conducted by Frey et al. 702 professions are at risk of automation, and the accounting profession topped this list with a high probability of being automated and digitized in the near future. Developments in technology such as Cloud artificial intelligence and blockchain have the effect of strengthening the role of the accounting profession by reducing manual data entry and improving the speed, quality and accuracy of data.

Artificial intelligence is a discipline that deals with the generation of software systems that provide functions for the execution of which what is usually called the word "intelligence" is needed (Burgard, 2011).

Artificial intelligence represents a branch of science that aims to create programs that are able to replicate the problem-solving skills and decision-making processes present in humans (Russell and Norvig, 2021).

As an important part of digital transformation, the influence of artificial intelligence in the managerial accounting process represents the future of making the best decisions in organizations (Oncioiu et al., 2019). Researchers in the accounting discipline have with some success applied various artificial intelligence technologies and techniques to specific tasks in financial reporting and analysis (Lam, 2004), and in addition to auditing (Hansen & Messier, 1982), but also in other areas.

2. Artificial intelligence

Artificial intelligence appeared in the fifties of the twentieth century, when the scientist "Alan Turing" created what is now called the "Turing Test" in order to assess and classify the intelligence of computers (Holzinger et al., 2019). This test is reflected in testing that is a computer capable of thinking like a human

being. However, artificial intelligence has seen significant application only in the last few years (ICAEW, 2018).

According to Adersen (2016), artificial intelligence can be defined as a part of computer science that deals with the development of computer software, i.e. the abilities possessed by computers and at the same time give it a form of intelligence with which the computer can solve certain tasks and draw conclusions

The functions of artificial intelligence are "collection and processing of information, interaction with the work environment, communication with humans or with other intelligent systems, collection and processing of data, inference, and planning" (Andersen, 2016).

Artificial intelligence represents the ability of machines - computers to perform tasks that usually require human intelligence, such as learning, evaluating, inferring, deciding, especially when the amount of data exceeds the ability of human analysis.

A term closely related to artificial intelligence is robotization, but they are essentially two different processes. Artificial intelligence is a software solution, and robotization is a process for performing various activities with the help of robots in order to assist and support people. A robot is a machine that is made with the intention of performing certain activities, first of all in production activities, and later with the advent of artificial intelligence in service activities.

According to Russel and Norvig (2020) with regard to the goals set for artificial intelligence, there are four views of the field of artificial intelligence:

- ***Human behavior*** - a view of artificial intelligence in which a person cannot distinguish whether the questions are answered by a computer or a human (the so-called Turing test)
- ***Human thinking*** – a view of artificial intelligence in which artificial intelligence programs mimic the way humans think
- ***Rational thinking*** - a view of artificial intelligence in which artificial intelligence programs rationally conclude and think, i.e. rationally and logically, like a human , they think
- ***Rational behavior*** - on artificial intelligence in which artificial intelligence programs are rational agents that perform assigned tasks for humans.

3. Application of artificial intelligence in accounting

Artificial intelligence is one of the most advanced technologies in the world and can be applied in various professions. Artificial intelligence in the field of accounting can make the accountant's job easier, and provide support in performing simple tasks, but with various upgrades in more complex processes. Artificial intelligence has a particularly positive effect in financial and managerial accounting, as it affects the efficiency of accountants and the minimization of possible errors. There are already software that have automated many accounting, tax, bookkeeping and auditing processes. All this affects changes in

the accounting profession itself, and the need to prepare and educate staff for the challenges that the application of artificial intelligence brings. Accounting sectors need to implement new business models and strategies, in order to adapt to the new culture introduced by companies, in order to be prepared for entering the digital age (Munfaredi at al., 2022).

Artificial intelligence is reflected in the ability of machines to stimulate human intelligence. Before the advent of artificial intelligence, technology could be programmed to perform certain tasks based on simple programming solutions, i.e. inputs and outputs. However, the emergence of artificial intelligence is changing the situation, and now machines can synthesize information, process it and solve complex problems, just as human intelligence does.

The accounting profession is reflected in the recording of business events based on credible documents, and the compilation of various financial reports for the purposes of business decision-making and financial reporting, so that artificial intelligence can facilitate the work of the accountant and increase his efficiency and effectiveness. Predictions are that artificial intelligence will reach a new level of intelligence in the future, and will replace human decision-making.

In order for the accounting profession to remain current and keep pace with changes, accountants must adapt to new technologies and develop their "hard skills" (IT and technology skills), and they must also work on their "soft skills" (communication and relationships with people) (ICAEEW, 2018).

Technological tools and software are considered as one of the most important elements that can maximize the performance of the company, and this technology was introduced by artificial intelligence , which was able to provide the company with many modern tools and software capable of replacing the human being, as well as providing that the company reaches a level of excellence when it comes to performance, both on a financial and non-financial level (Mjongwana&Kemala, 2018).

Thanks to the cooperation of artificial intelligence and accountants, companies, the economy and the accounting profession will greatly benefit, which could influence the development of a country's macroeconomics through such a way of performing activities.

Artificial intelligence in accounting is used in the automation, improvement and simplification of all types of business processes - from simple to complex business tasks. It helps automate and optimize daily routine accounting tasks, such as entering physical invoices into digital form (OCR), processing transactions, posting business changes, verifying the correctness of accounts and compiling financial reports. It enables insight into cash flows, profitability, risk, thereby improving financial management in the company. A large number of companies went bankrupt precisely because of poor cash flow management.

The high-quality and efficient operation of the artificial intelligence system requires the correct settings of the accounting system and accounting principles,

high-quality data, and numerous security measures for data protection and protection against fraudulent actions (ICAEW, 2018).

Fraudulent activities are present in all spheres of life and there are various scams. Managing the risk of abuse and fraud is an important issue for profit-oriented companies, and there is a noticeable increase in financial fraud around the world. Fraudulent financial reporting is a serious problem for investors and creditors (Čović et al., 2022). The application of artificial intelligence has opened up new possibilities for more advanced fraud detection and prevention.

According to the Acumen report[1] artificial intelligence in the accounting market by application is represented by:

- Automatic bookkeeping,
- Fraud and risk management,
- Reporting,
- Classification of invoices and approvals,
- Other applications (cost management and auditing, and tax and income reporting).

In a report by Acumen, artificial intelligence in the accounting market is predicted to reach a whopping $53 million in revenue by 2030.

4. Changes in the accounting profession

The development of the accountant's role will change constantly, and will gain an increasingly important role in the decision-making process, crucial for the continuation of successful business (Knudsen, 2020). The biggest expected change is in the education of accounting workers and the possession of digital skills related to the accounting profession.

The future of accountants largely depends on the agility and flexibility of accountants in accepting and adapting to technological innovations. Although the automation of mechanisms and systems is a process that is increasingly used, experts believe that it cannot completely replace accountants. What accountants possess, and machines and software do not possess, is human intelligence, and rational reasoning and connection of knowledge and intuition in order to reach certain conclusions in a complex economy.

The machine is not there to replace the accountant, but to expand his skills, that is, to perfect his skills. Artificial intelligence does not possess these characteristics, and for this reason it is recommended to perform automated processes. The above is of great use to accounting experts who will direct the time they get by introducing the automation of certain processes towards analyzing and reporting to the company on business events and on the possibilities of business improvement.

Examples of how artificial intelligence makes the accountant's job easier (Edwards, 2024):

1 www.acumenresearchandconsulting.com

- ***Automation of repetitive tasks.*** With artificial intelligence handling day-to-day administrative tasks such as data entry, invoice processing and account reconciliation, accountants are freed up to focus on delivering real value to their clients
- ***Improving data accuracy.*** Automating data processing all but eliminates the risk of human error – and we know that small mistakes in accounting can be extremely costly
- ***Insight into data.*** Accountants have access to real-time data that can help them make smarter strategic decisions and predictive analytics that can help them see from a different angle
- ***Superior client experience.*** Artificial intelligence enables accountants to understand the needs of their clients, allowing them to provide a more personalized client experience across all touch points.

Accountants who embrace the application of artificial intelligence and make an effort to learn how to take advantage of the potential it offers can become even more valuable and improve the quality of the services they offer. Nevertheless, regardless of the emergence of artificial intelligence, the human mind is still replaceable, skills such as assessment, intuition, communication, ethical behavior are what artificial intelligence does not have, nor can it have. Therefore, accountants should by no means consider artificial intelligence as a threat to the extinction of the accounting and auditing profession, but rather an opportunity for professional growth and development by adopting and adapting to new trends.

When it comes to the state of the accounting profession in Bosnia and Herzegovina, there are noticeable changes in the application, development and advancement of information technologies. Software programs are being developed to make the daily work of accountants easier. However, the importance and role of accountants in the business world is still not recognized, in which fees for accountants are still considered a cost that is sought to be minimized. Accountants are not protected by the system, so they often provide services below cost in order to survive on the market. The mentioned problem would be solved by the introduction of uniform tariffs for the provision of accounting services, so that the price depends on the range of services they offer and the size of the company that keeps the business books. Accountants are enabled to do a large part of their work from the office, such as tax returns, employee registrations and deregistrations, electronic signatures, bank transactions and various other online requests, for which it was previously necessary to go to different institutions.

On the other hand, they are faced with the accelerated development of information technologies, which has led to major changes in the accounting profession. Accounting software has made it easier to keep business books, analyze and monitor business and financial reporting. All of the above imposed additional education and continuous improvement of accounting workers, so that they would not cause damage to the company and its stakeholders due to their ignorance.

5. Examples of use of artificial intelligence in accounting

Businesses that follow the trends are highly adapting and adopting the benefits offered by artificial intelligence. Some of the examples are listed below (Edwards, 2024):

- **Deloitte** – introduced automation of the document review process. Deloitte has created an artificial intelligence - based document review platform designed to free accountants from tedious and time-consuming work. The platform combines cognitive technologies, ML (machine learning) and NLP (natural language processing) to interpret language, recognize patterns and identify key information. By introducing artificial intelligence, they got faster and more accurate document processing.
- **PwC** – improving audit accuracy with artificial intelligence - based fraud detection. It is known that major global economic scandals are connected precisely with the accounting profession, from Enron to Lehman Brothers. Detecting fraud in traditional business bookkeeping is very difficult. However, with the advent of artificial intelligence, big changes have taken place. PwC based on artificial intelligence have an innovative bot GL.ai. Powered by machine learning, GL.ai can analyze billions of data points in the blink of an eye. Its algorithm then spots discrepancies in the data that the human eye would likely miss. The result is a faster and more accurate audit process.
- **KPMG** – intelligent forecasting using artificial intelligence . Every company wants to know what the future holds, including accounting. The ability to accurately predict future trends is essentially a hash code when it comes to making smart strategic decisions. Until recently, predicting the future was mainly based on human experience and intuition, but with the advent of artificial intelligence, data-driven insight into future trends and risks has become possible. KPMG's Intelligent Forecasting combines predictive modeling and advanced analytics to help accountants take a more proactive approach to planning, budgeting and forecasting.

6. Conclusion

It is gradually evident that artificial intelligence is introducing changes in all industries, including the accounting and auditing profession, so accountants must adapt to the upcoming trends. Artificial intelligence should be understood as an opportunity for personal growth and development, and not as a threat to the survival of the profession. By using software based on artificial intelligence, accountants will be more productive, efficient, accurate, and their clients will be more satisfied with their services. By using artificial intelligence, they won't waste time on routine tasks that take up a lot of time that they can use for other activities.

Innovations are always good, so the application of artificial intelligence in the accounting profession should be viewed in the same way, because it in no way changes a person and his intelligence and way of thinking. Artificial intelligence is nothing without humans.

Artificial intelligence is automating routine tasks, but the accountant's role is changing and becoming advisory. The accountant will be required to use expertise, experience and knowledge in interpreting data, providing financial insights and giving business recommendations to clients in order to achieve their goals and objectives.

Although artificial intelligence brings many advantages, there are still certain challenges such as the issue of data security, ethical implications and the need for continuous education and adaptation of accountants. Computer managers will have to balance between the technology used and maintaining human judgment and ethics in their work.

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Professional paper

APPLICATION OF LOW-VOLTAGE COMPACT STATIONS IN THE KAKANJ MINE

Abstract

The low-voltage network has the task of providing a continuous, and from the aspect of implemented protective measures, safe supply of electricity to consumers installed on the complex mechanized wide front (KMŠČ) in the Kakanj Mine. Due to the size of the installed power of consumers at KMŠČ, as well as the cross-section of the power cables, the equipment supplier decided on two voltage levels: 1kV and 0,5 kV. For this, three dry pit transformer stations were installed. The transformer station JTS-1 supplies consumers with electricity at a voltage level of 1kV through the compact station W1. These are the pit harvester, produced by the German company "Eickhoff", type SL 300 and the drive of the front rake with two electric motors of 132 kW each. The transformer station JTS-2, through the compact station W2 and the transformer station JTS-3, through the compact station W3, supplies consumers with electricity at a voltage level of 0,5 kV. With JTS-2 and the associated compact station W2, electricity is supplied to drive the haul-off rake (PZP), with one 132 kW electric motor, the crusher with 90 kW electric motor and the water pump drive (wetting the space around the harvester's cutting organ), with a 55 kW electric motor. The subject and goal of the research is the impact of the low-voltage network on the work of consumers in the Kakanj Mine, from the aspect of network stability and implemented protective measures. The results of the research prove to us that the low-voltage network positively and continuously provides power to consumers in the Kakanj mine pit, and especially to the complex of mechanized wide face (KMŠČ). The implications of the results of this work is that for optimality, individual units should share the load so that their marginal costs are equal as the implications of different state readings.

Key words: *Compact Station, Low Voltage Network, Transformer, Mining.*

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1. Introduction

The problem of the research in this professional paper refers to the way of applying low-voltage compact stations in the Kakanj Mine, specifically the "Begići Bištrani" pit.

The aim of the work is to show and prove that low-voltage compact stations in the Kakanj Mine, specifically the "Begići Bištrani" pit, have a positive impact on coal production as well as the safety of workers in the pit.

In the work, the foundations from the project documentation, which is in the possession of the Kakanj Mine, were used, and the design services were performed by the Tuzla Mining Institute.

The structure of the work is arranged so that after the phase of putting into trial operation, all pit transformer stations that make up the KMŠČ technology, and the checking of all the subsystems that are part of the KMŠČ, in the presence and under the direct control of experts, it is moved to the phase of KMŠČ exploitation for coal production and proving capacity of the complete system, and application of low-voltage compact stations in Rudnik.

2. Low voltage network

The low-voltage network has the task of providing continuous, and from the aspect of implemented protective measures, safe supply of electricity to consumers installed on the complex mechanized wide front (KMŠČ). Due to the size of the installed power of consumers at KMŠČ, as well as the cross-section of the power cables, the equipment supplier decided on two voltage levels: 1kV and 0,5 kV. For this, three dry pit transformer stations (JTS-1; JTS-2; JTS-3) were installed as part of the equipment supplied by the company "Becker-Warkop", whose technical description was given in the previous text.

The transformer station JTS-1 supplies consumers with electricity at a voltage level of 1kV through the compact station W1. These are the pit harvester, produced by the German company "Eickhoff", type SL 300 and the drive of the front rake with two electric motors of 132 kW each. This rake has one drive electric motor at the beginning of the conveyor and another, of the same power, at the end of the conveyor. Also, inside the compact station W1, through a 3kVA transformer, transmission ratio 1/0,23/0,042 kV, electricity is supplied to the lighting of the complete KMŠČ, and a 12 kVA transformer; 1/0,23 kVA; from which electricity is supplied to the lighting of the area of the transport corridor where the removal rake BSL and the crusher are located.

The transformer station JTS-2, through the compact station W2 and the transformer station JTS-3, through the compact station W3, supplies consumers with electricity at a voltage level of 0,5 kV. With JTS-2 and the associated compact station W2, electricity is supplied to drive the haul-off rake (PZP), with one 132 W electric motor, the crusher with 90 kW electric motor and the water pump drive (wetting the space around the harvester's cutting organ), with a 55 kW electric motor .

With JTS-3 and the associated compact station W3, electricity is supplied to the pumping unit for the KMŠČ hydraulic system, with two drive electric motors with a power of 160 kW each.

3. Application of low-voltage compact stations in Kakanj Mine

The low-voltage network has the task of providing a continuous, and from the aspect of implemented protective measures, safe supply of electricity to consumers installed on the complex mechanized wide front (KMŠČ) in the Kakanj Mine.

Due to the size of the installed power of consumers at KMŠČ, as well as the cross-section of the power cables, the equipment supplier decided on two voltage levels: 1 kV and 0,5 kV. For this, three dry pit transformer stations were installed.

The transformer station JTS-1 supplies consumers with electricity at a voltage level of 1 kV through the compact station W1. These are the pit harvester, produced by the German company "Eickhoff", type SL 300 and the drive of the front rake with two electric motors of 132 kW each.

The transformer station JTS-2, through the compact station W2 and the transformer station JTS-3, through the compact station W3, supplies consumers with electricity at a voltage level of 0,5 kV. With JTS-2 and the associated compact station W2, electricity is supplied to drive the haul-off rake (PZP), with one 132 W electric motor, the crusher with 90 kW electric motor and the water pump drive (wetting the space around the harvester's cutting organ), with a 55 kW electric motor.

3.1. Technical description of low-voltage compact stations

Compact stations W1 and W2 are type KE 1008 «Becker Mining Europa», based on panel technology and energy bus with plug-in connections on the drain side. They have eight sockets that can accommodate 7 (seven) switch panels and one panel for control and lighting (isolation control). Each socket (panel location) has its own switch handle. The operating characteristics and limit values of the switching panels are adjusted on the display module located in the self-safe connection chamber, without having to open or switch off the station. The panel system enables quick elimination of the consequences of faults and reduction of downtime to a minimum. The compact station consists of four «Exd I» type chambers:

- two panel chambers with energy control;
- one chamber for lighting transformers (12k VA; 3 kVA);
- one chamber for supply connections.

Station W1 also features:

- auxiliary transformer 1000/230 V, power 12 k VA, which supplies two independently protected auxiliary drains of TCU-D type panels with a voltage of 3x230 V;

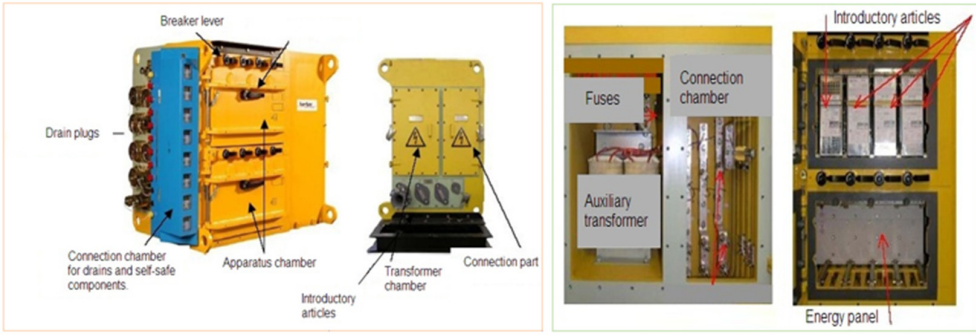

Figure 1. Layout of LV compact station KE1008

- transformer panel, type IMTU, equipped with a 1000/230/42 V transformer with a power of 2,5/0,5 kVA, which supplies two independently protected auxiliary drains with a voltage of 230 V and 42 V;
- reserve drains 1kV.
- The transformer T1, the line station WL1, the compact station W1, and the measurement and protection system for individual discharge voltages of 1 kV are located in a separate chamber.

The TCU-D two-lead lighting panel is powered by a lighting transformer. Four of the eight type 1 panel sockets can be optionally equipped with single or double contactor panels and in this way we can supply up to 12 (twelve) motor drains.

On the supply side, the supply can be connected with cable glands in the connection chamber via the PC 1000-2 connector.

On the drain side, the lines are connected exclusively via connectors.

Plug-in panel technique

Depending on the socket, the following panels can be used in the compact station:

Table 1. Panels in a compact station

Panels in a compact station

	Upper part				Lower part			
Panel	1	2	3	4	5	6	7	8
TCU-D[1]	x							
HPC 450-1[2]		x	x	x	x	x	x	
TCU/TCU-R[3]			x	x		x	x	x
IMTU (42V, 230V)				x				

1. Panel for two drains;

2. Switch panel;

3.Panel for two drains (reversible).

Circuit breaker

Each panel has its own circuit breaker. In the switched off state, the panel is pulled out of the energy bus, and the supply contacts of this bus are then securely shielded. Only when all the panels of one chamber are disconnected can the quick-closing door be opened.

Parameterization

The operating characteristics of each panel are adjusted and permanently stored in a self-safe chamber. Features do not need to be re-entered when replacing.

Management

The panels in the KE 1008 compact station can be controlled in parallel via contacts or sequentially via different bus control systems.

Electrical data

Electrical data of the compact station are given in Table 2.

Table 2. Electrical data of the KE 1008 compact station

The guy	KE1008
Nominal voltage:	500 V; 1000 V
Insulation class:	1,2 kV
Grid system:	IT system
Total current of the compact station:	1200 A
Drain current:	400 A
Short circuit strength:	20 kA ef
Short Circuit Impact Strength:	41 kA
Dimensions:	1390 mm x1950 mm x 950 mm
Mass:	1900 kg
Ex protection:	1M2 Ex d,(ia, ib) m I
Type Test Certificate:	INTERIS 05 ATEX 0059X

The values specified in the technical data are limit values. The permitted operating sizes may deviate from the limit values in the case when the product is used within other systems or in conjunction with other devices.

The compact station W2 KE1004 «Becker Mining System» represents a modern designed low-voltage switching and distribution block, panel construction, with connectors in the form of sockets. Panels with contactors consisting of

Figure 2. Layout of LV compact station KE1004

one or two plates can be mounted in each of the four sockets, while the panel with lighting can only be connected to the left socket.

The compact station KE1004 is a modernly designed low-voltage switching and distribution block, panel construction, with connectors in the form of sockets. It consists of a chamber of self-safe circuits and an impenetrable armor, in which a maximum of four retractable modules (panels) with a vacuum switch can be installed.

Access to the impenetrable chamber is through a door that can be opened easily and quickly. The door is equipped with a central lock and can only be opened with the drains turned off.

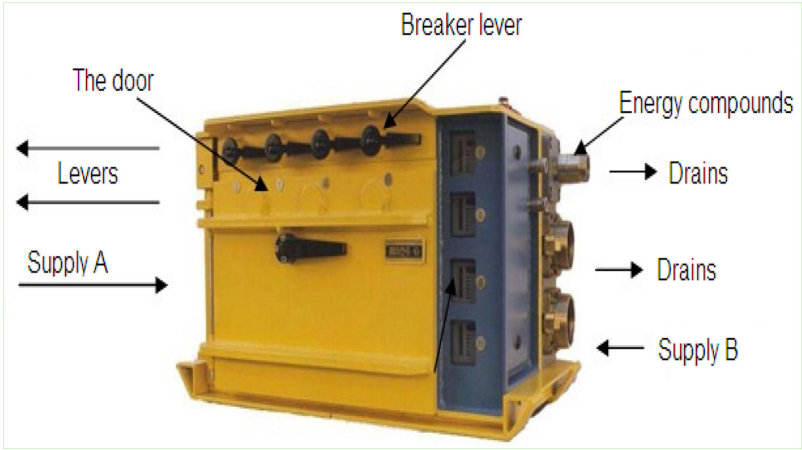

Figure 3. External appearance of the KE1004 compact station

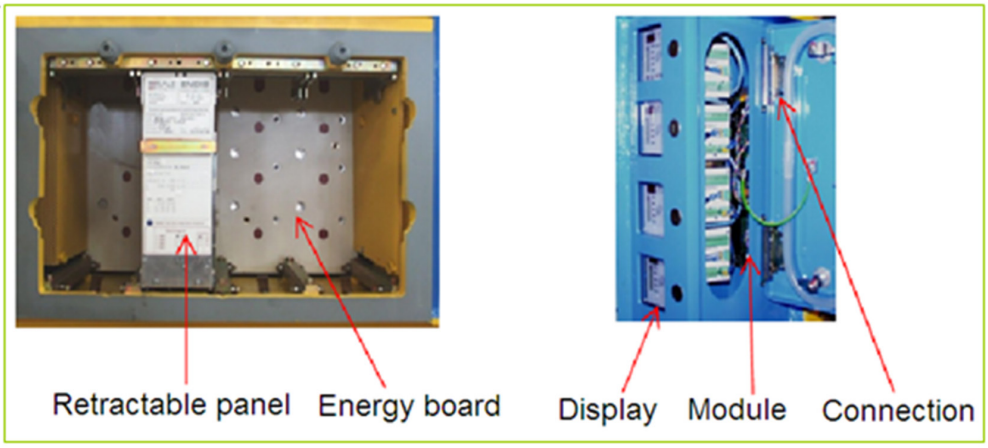

Figure 4. Internal appearance of the body of the impenetrable armor and self-secure connections of the compact station KE1004

Panels with contactors consisting of one or two boards can be mounted in each of the four sockets, while the panel with lighting can only be connected to the left socket. Each panel socket is equipped with a separate circuit breaker. The operating characteristics and limit values of the switching panels are adjusted on the display module located in the self-safe connection chamber, without having to open or switch off the station. The panel system enables quick troubleshooting and reduction of downtime.

The compact station type KE1004 is intended for powering electric motor drives, installed at KMŠČ, with a voltage of 500 V or 1000 V. It is equipped with protective devices for each drain and has the possibility of connecting the temperature protection of the electric motor.

There is a possibility of individual disconnection of individual switchboard panels using disconnecting devices whose drive (lever) is mounted on the housing. Setting the protection parameters for each panel is done with the help of the corresponding display assembly located in the self-safe chamber. Improper cooperation of the given panel with the display assembly causes the disconnection of the switch, through the safety circuit. The panels realize control functions, as well as power supply, and allow changing the direction of rotation, individually for each motor.

Each compact station configuration can be described with a corresponding code, which allows identification of the type of retractable panel, possible for installation in a given bus socket, e.g. KE1004.LHHU.O (.B).

An additional advantage is the possibility of replacing panels of the same type among the following drains or with a spare panel, without the need to change the settings of the parameters on a given drain. The KE1004 stations have a memory of events (existing errors) registered in the DIS-GRACO type display,

where limit parameters and other adjustments are also made with a closed non-penetrating shield.

Table 3. Description of possible configurations of the KE1004 compact station

Power mains socket	Label	Panels available for use
x.1 (220 V) i x.2 (220 V ili 42 V)	L	IMTU
x (do 400 A) for HPC or	H	HPC 450-1
x.1 (do 400 A) for HPC or x.1(do 115 A) i x.2 (do 55 A) za TCU-R	U	HPC 450-1 or TCU or TCU-R
x.1(do 115 A) i x.2 (do 55 A) za TCU-R	T	TCU ili TCU-R

x - socket number

Appropriate block diagram of station KE1004.LTTH;

Panel location I equipped with lighting panel (L);

Panel location II and III equipped with double switch panel (T);

Panel location III equipped with switch panel (H).

The KE 1004 compact stations are characterized by a high level of handling safety, they enable quick troubleshooting based on the principle of replacing the damaged panel, and enable the station to be connected to the power grid, with the help of PC 1000 quick-connect couplings.

The device can be powered from the left or right side of the enclosure, through plugs directly connected to the busbars of the “power panel”. This allows power to be connected to the next device.

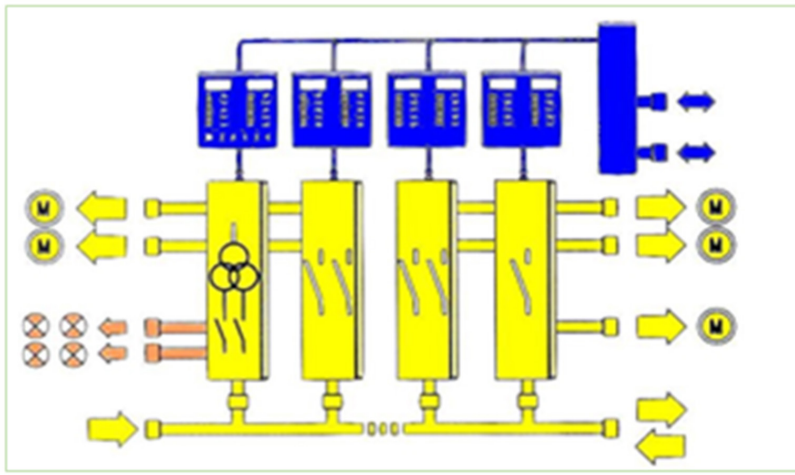

Figure 5. Block diagram of LV compact station KE1004

Energy consumers can be fed from the compact station using two taps:

“A” and “B”. The plug-in connection of supply «B», if it is not used for powering the compact station, should be protected with a plug cover type PC 1000-2E00.

The KE1004 station can cooperate with superior control systems (eg with the PROMOS system, through the PE4200 interface module) that allow data to be sent to any place in the mine.

3.2. Low-voltage network in the installation phase KMŠČ

Before starting the installation of KMŠČ, it is necessary to install all three pit transformer stations JTS-1; JTS-2 and JTS-3, with complete low-voltage equipment.

High-pressure pumps for the KMŠČ hydraulic system will be connected to JTS-3.

The pit transformer station JTS-2, power 630 kVA, 6/0,5 kV, will be used to supply electricity to the pit winches. The pit winches must be connected from the free outlet on the low-voltage compact station W2.

Each winch has a separate distribution battery RB-v1 and RB-v2, through which the drive electric motor of the winch is powered. Both pit winches are located on a route that has a drop, so for the operation of the winches, according to the provisions of the mining regulations, it is necessary to provide signaling.

3.3. Communication protocol and remote transmission equipment

Control of the ROK6-Q compact station, specifying and setting the protection parameter is possible without opening the device, using the buttons located on the outside of the case. Through the glazed visor, in the left part of the cover, the data from the display of the protective device can be read. Similar states of the device are read on the display located behind the glass visor located in the upper, right part of the device cover.

Table 4. Communication protocol and remote transmission equipment

ETHERNET		Serial		
Device	100BASE-TX (elekt)	100BASE-FX (fiber)	IA/232EIA485(elekt) Fiber-optic	Fiber-optic
Protocol				
IEC61850	yes	da	-	-
MODBUS RTU	-	-	yes	yes
MODBUS TCP/IP d	yes	yes	-	-
DNP3 serial	-	-	yes	yes
DNP3 TCP/IP	yes	yes	-	-

The ROK6-Q device is made at the highest technical level, with simple mechanical construction, high short-circuit strength, small dimensions and weight. A high degree of safety is ensured mechanically and electrically. Local and remote control using standard protocols is possible. The requirements for qualified labor in the function of operation and maintenance have been reduced. It is possible to select the function and control parameters in the REF615 relay software, and measurement is possible for each phase.

4. Conclusion

With the introduction of the most modern automatic systems for control, transport and drainage in underground coal mining, the occupational safety system has been significantly improved, especially in the segment of preventive action.

The goal is to achieve long-term successful business, based on the constant increase in demand for energy, the existence of a sufficient amount of ore deposits, the modernization of equipment, the possession of the necessary knowledge and experience, as well as the constant acquisition of new knowledge.

The low-voltage network has the task of providing a continuous, and from the aspect of implemented protective measures, safe supply of electricity to consumers installed on the complex mechanized wide front (KMŠČ) in the Kakanj Mine. The operating characteristics and limit values of the switching panels are adjusted on the display module located in the self-safe connection chamber, without having to open or switch off the station. The panel system enables quick elimination of the consequences of faults and reduction of downtime to a minimum.

The compact station is intended for use in mines with pit exploitation, where an explosive mixture of methane pit gas and air is possible, and in pits with dangerous coal dust.

Investing in the modernization and development of the production capacity of ZD Rudnik "Kakanj" is directly related to the development and modernization of the capacity for electricity production in the Thermal Power Plant "Kakanj".

The goal of this professional work is to show how, with the help of information technology and automation, the hydraulic, pneumatic and electrical functions of all mining machines can be partially or completely designed, modeled, validated and integrated.

The second goal is to demonstrate better protection of the health and life of workers, and a better and simpler organization of the technological process in underground exploitation.

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Review paper

CURRENT APPLICATIONS AND FUTURE DIRECTIONS OF WEARABLE TECHNOLOGIES IN HEALTHCARE: A LITERATURE REVIEW

Abstract

The rise of mobile medicine and personalized healthcare has driven the swift development of smart wearable technology. These devices continually monitor vital signs and metabolic status, offering crucial data to inform diagnoses and guide treatments. This review aims to assess current applications of wearable technology in healthcare settings and pinpoint areas necessitating further investigation. While consumer trends favor wearables for recreation, their broader clinical potential remains understudied. Our primary focus is their utilization in clinical practice beyond routine health monitoring. A narrative review of the use of wearable devices was conducted in healthcare settings, focusing on clinical application in PubMed published from 2019 to 2024. Potentially relevant papers were compared to determine their relevance and independently reviewed. Our analysis will categorize wearable devices by their health monitoring purposes, including chronic disease management, diagnostics, treatment, and rehabilitation. At the same time, wearables promise to revolutionize healthcare, and overcoming existing hurdles requires continued research to promote their expanded integration into clinical practice.

Key words: *Wearable Technology, Healthcare, Public Health, Chronic Diseases, Rehabilitation.*

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1. Introduction

This chapter provides an overview of wearable technologies in healthcare. Wearable technologies, including smartwatches, fitness trackers, and medical-grade wearables, have revolutionized the healthcare landscape. These devices enable real-time data collection, offering insights into various physiological parameters. This review aims to elucidate the current state of wearable technologies in healthcare, exploring their applications, benefits, and future potential. Each chapter is briefly described to provide a clear understanding of its content.

Current Applications: This chapter discusses the role of wearable technologies in managing chronic diseases, fitness and wellness monitoring, and remote patient monitoring.

Case Studies and Applications: This chapter provides specific examples of how wearable technologies are used in clinical practice.

Technological Advancements and User Engagement: This chapter highlights technological advancements and user engagement in wearable health devices.

RPM and COVID-19: This chapter explores the role of wearable technologies in remote patient monitoring, especially during the COVID-19 pandemic.

Future Directions: This chapter discusses the integration of AI and machine learning with wearable technologies, advancements in sensor technologies, and the importance of data security and privacy.

AI and Predictive Analytics: This chapter explores the potential of AI and predictive analytics in wearable healthcare technologies.

Next-Generation Sensors: This chapter highlights the advancements in sensor technologies that enhance the capabilities of wearable devices.

Challenges and Solutions: This chapter addresses the importance of data security and privacy in wearable devices.

Interoperability and EHR Integration: This chapter emphasizes the need for seamless integration of wearable technologies with electronic health records (EHRs) and other healthcare systems.

2. Current Applications

This chapter discusses the role of wearable technologies in managing chronic diseases, fitness and wellness monitoring, and remote patient monitoring.

3. Chronic Disease Management

This section discusses the role of wearable technologies in managing chronic diseases. Wearable technologies have shown significant promise in the management of chronic diseases such as diabetes, cardiovascular diseases, and respiratory conditions. Continuous glucose monitors (CGMs) provide real-time blood sugar levels, enabling diabetics to manage their condition more effectively (Kamei et al. 2022). Similarly, wearable ECG monitors facilitate early detection of arrhythmias and other cardiac anomalies, potentially reducing the incidence of severe cardiac events (Xie et al. 2021).

4. Case Studies and Applications:

This section provides specific examples of how wearable technologies are used in clinical practice.

- **Diabetes Management**: Continuous glucose monitoring systems (CGMs) provide real-time glucose readings, which can alert patients to hypo- or hyperglycaemic events (Kamei et al. 2022). This real-time feedback allows for immediate action, such as administering insulin or consuming carbohydrates, thereby improving glycaemic control and reducing the risk of complications.
- **Cardiovascular Monitoring**: Wearable ECG and blood pressure monitors are instrumental in managing cardiovascular diseases. These devices track heart rate variability and blood pressure, providing valuable data for early detection of arrhythmias, hypertension, and other cardiovascular conditions (Xie et al. 2021). The ability to detect anomalies early can lead to timely interventions, reducing the risk of severe cardiac events.
- **Respiratory Conditions**: Wearable devices equipped with spirometers and pulse oximeters are used to monitor respiratory conditions such as COPD and asthma. These devices track lung function and oxygen saturation levels, helping patients manage their conditions more effectively (Yu et al. 2023).

5. Fitness and Wellness Monitoring

This section highlights how fitness trackers and smartwatches are used for health and wellness. The proliferation of fitness trackers and smartwatches has empowered individuals to take charge of their health and wellness. These devices monitor physical activity, heart rate, sleep patterns, and other vital signs, promoting a healthier lifestyle. The integration of AI algorithms provides personalized recommendations, enhancing user engagement and adherence to fitness goals (Ferguson et al.2022; Tang et al.2020).

6. Technological Advancements and User Engagement:

This section discusses technological advancements and user engagement in wearable health devices.

- **Activity Monitoring**: Fitness trackers such as Fitbit and Apple Watch monitor steps, calories burned, and physical activity levels. These devices encourage users to meet daily activity goals, promoting a more active lifestyle (Ferguson et al.2022).
- **Sleep Tracking**: Wearable devices monitor sleep patterns, providing insights into sleep quality and duration. Improved sleep hygiene can lead to better overall health, reducing the risk of chronic conditions such as obesity and cardiovascular diseases (Menghini et al. 2024).
- **Heart Rate Monitoring**: Continuous heart rate monitoring helps users understand their cardiovascular health. Devices like the Apple Watch can detect irregular heart rhythms, prompting users to seek medical advice if necessary (Lima et al. 2024).

7. Remote Patient Monitoring

This section explores the role of wearable technologies in remote patient monitoring (RPM), especially during the COVID-19 pandemic. Remote patient monitoring (RPM) using wearable devices has become increasingly prevalent, especially in the wake of the COVID-19 pandemic. Wearables enable healthcare providers to monitor patients' health status remotely, reducing the need for in-person visits and minimizing the risk of infection. This application is particularly beneficial for elderly patients and those with mobility issues (Pronovost et al. 2022; Thompson et al. 2024).

RPM and COVID-19:

- **COVID-19 Monitoring**: Wearable devices such as pulse oximeters were widely used during the COVID-19 pandemic to monitor patients' oxygen levels remotely (Pronovost et al. 2022). This approach helped reduce hospital overcrowding and allowed for early intervention in cases of deteriorating health.
- **Chronic Disease Management**: RPM is particularly useful for managing chronic diseases like heart failure and COPD. Wearable devices track vital signs and symptoms, alerting healthcare providers to any significant changes that may require intervention (Thompson et al. 2024).
- **Elderly Care**: RPM devices are beneficial for elderly patients, enabling them to live independently while being closely monitored. Wearables track parameters such as heart rate, blood pressure, and activity levels, ensuring that any health issues are promptly addressed (Joyce et al. 2023).

8. Future Directions

This chapter discusses the integration of AI and machine learning with wearable technologies, advancements in sensor technologies, and the importance of data security and privacy.

9. Integration with Artificial Intelligence

This section discusses the potential of integrating AI and machine learning with wearable technologies for predictive analytics and personalized healthcare. The integration of wearable technologies with AI and machine learning (ML) algorithms holds immense potential for predictive analytics and customized healthcare. AI-driven wearables can analyze vast amounts of data to identify patterns and predict potential health issues before they become critical. This proactive approach can significantly improve patient outcomes and reduce healthcare costs (Tran et al. 2019; Olyanasab et al. 2024).

10. AI and Predictive Analytics:

This section explores the potential of AI and predictive analytics in wearable healthcare technologies.

- **Predictive Healthcare**: AI algorithms can analyze data from wearables to predict health events such as heart attacks or diabetic crises. By identi-

fying patterns and anomalies in the data, AI can provide early warnings, allowing for timely interventions (Xie et al. 2021).

- **Personalized Treatment**: AI can tailor treatment plans based on data from wearables. For example, AI can adjust insulin dosages for diabetics based on real-time glucose readings, improving glycemic control and reducing the risk of complications (Tran et al. 2019).
- **Telemedicine**: AI-powered wearables can enhance telemedicine by providing real-time data to healthcare providers. This data can be used to make informed decisions during virtual consultations, improving the quality of care (Olyanasab et al. 2024).

11. Advanced Sensor Technologies

This section highlights the advancements in sensor technologies that enhance the capabilities of wearable devices. The development of advanced sensor technologies will further strengthen the capabilities of wearable devices. Next-generation sensors will enable more accurate and comprehensive monitoring of physiological parameters, including biochemical markers. These advancements will facilitate early diagnosis and intervention, improving the overall quality of care (Follis et al. 2021; Howard et al.2022).

12. Next-Generation Sensors

This section discusses next-generation sensors and their impact on wearable technologies.

- **Biochemical Sensors**: Advanced biochemical sensors can monitor biomarkers such as glucose, lactate, and cortisol levels. These sensors provide real-time data on metabolic status, enabling early detection of metabolic disorders (Follis et al. 2021).
- **Flexible and Stretchable Sensors**: The development of flexible and stretchable sensors allows for continuous monitoring of physiological parameters without causing discomfort. These sensors can be integrated into clothing or worn as patches, providing seamless health monitoring (Khan et al. 2016).
- **Implantable Sensors**: Implantable sensors offer continuous monitoring of health parameters from within the body. These sensors can track vital signs and biochemical markers, providing valuable data for managing chronic conditions (Howard et al. 2022).

13. Data Security and Privacy

This section addresses the importance of data security and privacy in wearable devices. As wearable devices become more ubiquitous, ensuring data security and privacy will be paramount. Future research should focus on developing robust encryption methods and secure data transmission protocols to protect sensitive health information. Additionally, establishing regulatory frameworks and guidelines will be essential to address ethical and legal concerns (Jiang et al. 2021; Chikwetu et al. 2023).

14. Challenges and Solutions

This section discusses the challenges and solutions related to data security and privacy in wearable technologies.

- **Encryption and Data Security**: Robust encryption methods are necessary to protect data from wearables. End-to-end encryption ensures that data is secure during transmission and storage, preventing unauthorized access (Jiang et al. 2021).
- **Regulatory Frameworks**: Establishing regulatory frameworks is crucial to ensure the ethical use of wearable data. Regulations should address issues such as data ownership, consent, and the use of data for research and commercial purposes (Chikwetu et al. 2023).
- **User Awareness**: Educating users about data security and privacy is essential. Users should be aware of the potential risks and take steps to protect their data, such as using strong passwords and enabling two-factor authentication (Cilliers et al. 2020).

15. Integration with Healthcare Systems

This section emphasizes the need for seamless integration of wearable technologies with electronic health records (EHRs) and other healthcare systems. Seamless integration of wearable technologies with electronic health records (EHRs) and other healthcare systems will enhance their utility. Interoperability standards and data-sharing protocols will facilitate the efficient exchange of information, enabling healthcare providers to make informed decisions based on comprehensive patient data (Dinh-Le et al. 2019; Karako et al. 2024).

16. Interoperability and EHR Integration

This chapter emphasizes the need for seamless integration of wearable technologies with electronic health records (EHRs) and other healthcare systems.

This section discusses the importance of interoperability and EHR integration.

- **Interoperability Standards**: Developing interoperability standards is essential for the seamless integration of wearable data into EHRs. Standards such as HL7 and FHIR facilitate the exchange of data between different healthcare systems, ensuring that wearable data is accessible to healthcare providers (Dinh-Le et al. 2019).
- **Data Sharing Protocols**: Establishing data-sharing protocols ensures that data from wearables is shared securely and efficiently. These protocols define how data is transmitted, stored, and accessed, protecting patient privacy and ensuring data integrity (Karako et al. 2024).
- **Clinical Decision Support**: Integrating wearable data into EHRs enhances clinical decision support systems (CDSS). Wearable data provides real-time insights into patient health, enabling healthcare providers to make informed decisions and provide personalized care (Carter et al. 2023).

17. Conclusion

This chapter summarizes the overall impact of wearable technologies on health care and highlights future research and collaboration needs. Wearable technologies have already significantly impacted healthcare, offering innovative solutions for chronic disease management, fitness tracking, and remote patient care. As these technologies continue to evolve, their integration with AI, advanced sensor technologies, and secure data systems will unlock new possibilities for personalized and predictive healthcare. Continuous research and collaboration among stakeholders will be critical to solving the challenges and realizing the full potential of wearable technologies in healthcare. The increase in the number of publications is the result of cooperation between scientists. It is necessary to advocate the ethical use of patient data and it raises questions about how the data will be stored and used. There are data security concerns. And more research is needed to offer the best solutions for how data should be stored and processed.

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Valerij Grašič, PhD[1] *Original scientific paper*

REAL-TIME ANALYSIS OF STATUS AND CHANGES OF ELECTROMAGNETIC FIELD USING CROWD MAG APPLICATION FOR SMART ENVIRONMENT

Abstract

Part of Smart Environments are also electromagnetic fields. Even if we cannot see them, they are omnipresent. They are typically fairly static but change due to various elements in the surrounding area. Additionally, they can also change due to events related to space weather, which is becoming more and more relevant as we move towards the peak of solar activity. This was again very relevant recently, in May 2024, when we saw major changes in the earth's magnetic field due to events on the sun, which resulted on the earth in the appearance of aurora and also impacted critical infrastructure, such as the problem with the operation of GPS systems. The subject of the research is the evaluation of the magnetic field in real-time. The CrowdMag application released by NOAA is used for this purpose. Based on some typical day-to-day usage scenarios, the main goal is to explore the possibilities offered by the hardware magnetometers of the telephone set. The goal is also to evaluate the results of the on-site measurement with the mentioned tool. The obtained results of the analysis will help assess the possibilities offered by this tool. And to assist in obtaining a map of the magnetic field in real-time, which is independent of satellite data.

Key words: *Smart City, Smart Environment, Geomagnetic Data, Magnetometers, CrowdMag.*

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1. Introduction

Electromagnetic fields, even if we cannot see them, are omnipresent. They are typically static but change due to various elements in the surrounding area or change due to events related to space weather. The latter is becoming even more and more relevant as we move towards the peak of solar activity of this sun cycle. Recently, in May 2024, we saw major changes in the earth's magnetic field due to events on the sun, which resulted on the earth in the appearance of aurora and impact on critical infrastructure, such as it was the problem with the operation of GPS systems (Albeck-Ripka, 2024).

The main idea of the given article is to evaluate the possibilities offered by the mobile phone for capturing data on the value of the magnetic field. Our proposal is the first step in exploring the possibility of measuring the electromagnetic field in real-time with a mobile phone. The idea is to check and evaluate several options: what a mobile phone offers, a static location field, a field in case of dynamic movement, and a comparison of the measured values with the WMM (World Magnetic Model) field model.

2. Problem definition

In the case of electromagnetic fields, these fields are omnipresent, and they extend on the one hand to the sun and into space, such as our solar system, and on the other hand to the very core of the earth. In addition, the mentioned fields also change dynamically. The question of the exact value of the magnetic field is a topical issue both for the smart environment and for smart cities.

Collecting data from smartphones allows scientists to overcome or compensate for many of the limitations that accompany satellite geomagnetic data (CrowdMag, 2024). They also allow scientists to develop magnetic models with much higher resolution than with satellites alone, which can be closer to a few meters versus around 3,000 kilometers. Ultimately, these data and the research that uses them help to improve navigational accuracy as well as our understanding of Earth's magnetic field and the changes it undergoes.

3. Related work

The given work covers several areas of research, such as the field of Smart Environment, Smart Cities and Control Rooms. The basic content refers to the field of space weather and magnetic field measurements. Due to the specificity of data processing, it also covers crowd souring and artificial intelligence in connection with these issues.

In case of Smart Cities information and communication technology enables the transformation of traditional cities into smart cities (Mohanty, Choppali, Kougianos, 2016). We are still at the very beginning of smart city development (European Commission, 2019). By definition, a smart city is a place where traditional networks and services are made more efficient by the use of digital and telecommunication technologies for the benefit of its residents and businesses (European Commission, 2019). Moreover, by UK government, the concept of

smart cities is not static (Department for Business Innovation and Skills, 2013), because there is no absolute definition of a smart city or an endpoint, but rather a process or a series of steps that make cities more alive and flexible and therefore able to respond more quickly to new challenges. The guidelines for smart cities are going in the direction that problem-solving should be more innovative and intelligent (Komninos, 2015) and that systems and solutions within should be made more intelligent (Picon, 2015).

An important question is how to increase situational awareness since any additional information is welcome (Middleton, Middleton and Modafferi, 2014). And also about the intelligence, like for incoming calls for a smart city (Grasic, Kos, Mileva-Boshkoska, 2018; Grašič, Robnik, 2022).

The research on crowdsensing domains has pivoted from solely technology concepts to now including how they improve the quality of life of citizens and their utility (Miranda, Ramos, Ribiero et al, 2023). Mobile Crowdsensing (MCS) has garnered considerable attention and emerged as a promising sensing paradigm (Suhag, Jha, 2023), as enables extensive coverage and contextual awareness, thereby providing valuable insights for various applications.

4. Geomagnetism description

Magnetic field

The geomagnetic field protects the Earth's atmosphere against charged particles from the solar wind (Cires, 2024). Rapid and long-term changes in the field are monitored by low-orbiting satellites and a global network of about 200 magnetic observatories. Field models, computed from these measurements, provide the direction and strength of the magnetic field at any desired location. Magnetometers (or a simple compass) can then be used to compute pointing directions, complementing the location information provided by the global positioning system (GPS).

The fields can be measured. The earth's magnetic field is complex and influenced by several factors (Olsen, Hulot and Sabaka, 2010). Several models are pivotal for representing and understanding the Earth's magnetic field, which are WMM (World Magnetic Model), HDGM (High Definition Geomagnetic Model) and IGRF (International Geomagnetic Reference Field).

Structure of the magnetic field

What is happening around the earth, as far as the magnetic field is concerned, also affects what is happening on earth. The Figure 1 represents individual segments that concern the earth.

There are several factors that affect the magnetic field (HDGM, 2024). The most important are Earth's main magnetic field generated in the conducting, fluid outer core, the crustal field generated in Earth's crust and upper mantle and the combined disturbance field from electrical currents flowing in the upper atmosphere and magnetosphere, which induce electrical currents in the sea

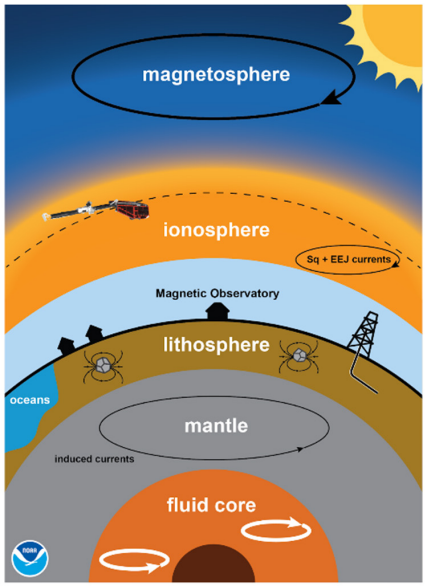

Figure 1. Segments related to Earth (HDGM, 2024)

and ground. The observed magnetic field is a sum of contributions of the main field (varying in both time and space), the crustal field (varies spatially), and the disturbance fields (varying in space and rapidly in time). Earth's main magnetic field dominates, accounting for over 95% of the field strength at Earth's surface. Secular variation is the slow change in time of the main magnetic field.

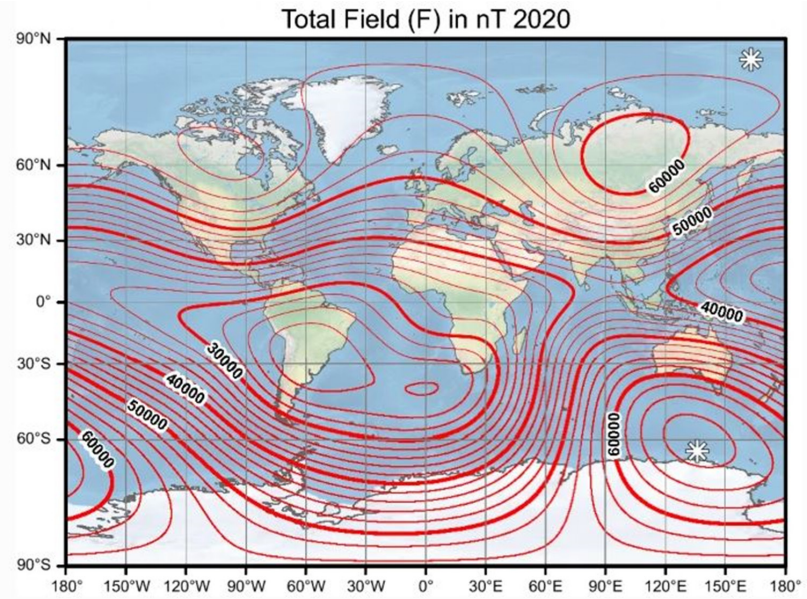

Figure 2. Magnetic Total Field (F) values for the whole earth as defined by a model IGRF (Alken, Thébault, Beggan and et al, 2021)

The magnetosphere is the region of space surrounding Earth where the dominant magnetic field is the magnetic field of Earth, rather than the magnetic field of interplanetary space. The magnetosphere is formed by the interaction of the solar wind with Earth's magnetic field. Conditions inside the magnetosphere are highly dynamic and create what we call "space weather" that can affect technological systems and human activities.

Space weather influences on atmospheric electricity (Nicoll, 2014). The terrestrial ring current (Daglis, Thorne, Baumjohann and Orsini, 1999) is an electric current flowing toroidally around the Earth, centered at the equatorial plane and at altitudes of ~10,000–60,000 km. Changes in this current are responsible for global decreases in the Earth's surface magnetic field, which are known as geomagnetic storms. Intense geomagnetic storms have severe effects on technological systems, such as disturbances or even permanent damage to telecommunication and navigation satellites, telecommunication cables, and power grids.

Figure 2 shows the value of the total magnetic field (F) for the whole earth as defined by the IGRF model (Alken, Thébault, Beggan and et al, 2021). According to estimates, the magnetic field on earth is between 25 (at the equator) and 65 μT (at the poles). The figure also shows that the magnetic field in the Slovenian subregion is between 40 and 60 μT.

5. Application CrowdMag

NOAA's CrowdMag is a crowdsourced data collection project that uses a mobile app to collect geomagnetic data from the magnetometers that modern smartphones use as part of their navigation systems (CrowdMag, 2024). These data have the potential to provide a high-resolution alternative to geomagnetic satellite data, as well as near real-time information about changes in the magnetic field.

The goal they pursued in this is to build, grow, and foster a worldwide community of citizen scientists and enthusiasts in sharing and collecting magnetic field data to further our understanding of Earth's magnetic field. Additionally, the aim is also to develop magnetic models and maps using data shared by CrowdMag users. Combining these data with data collected by ships, aircraft, and satellites helps fill in the gaps of the professional mapping of Earth's magnetic field.

6. Methodology description

Methodology framework

The following applies to the framework of the methodology:

- Static and dynamic measurements are used, which includes both static measurements at fixed locations and dynamic measurements while moving. This helps in differentiating between localized anomalies and broader geomagnetic variations.
- Repeat measurements ensure data reliability, and take multiple meas-

urements at different times and under different conditions (e.g., different times of the day, varying weather conditions).
- Basic statistics methods are used (James et al., 2014; Han, Kamber and Pei, 2011; Hastie, Tibshirani and Friedman, 2009).

Magnetic components for the evaluation

From the seven magnetic components of the geomagnetic field (WWM, 2024), three are measured, and provided by CrowdMag. These are total field (F), horizontal intensity (H) and vertical component (Z).

The horizontal component (H) is the intensity of the component of the magnetic field which is tangent to the Earth surfacer at a given point. It is often calculated as the resultant of the North (X) and East (Y) components of the magnetic field. The horizontal component is particularly important for navigation, as it affects compass readings and the direction of magnetic declination.

The vertical component (Z) is the portion of the magnetic field that is directed perpendicular to the Earth's surface at a given location. It is positive when the field points downward (into the Earth) and negative when it points upward. The Z component is crucial in understanding phenomena like geomagnetic inclination and can be significantly influenced by local magnetic anomalies.

The total magnetic field (F) is a vector quantity representing the combined effect of the Earth's magnetic field in three dimensions. It includes contributions from the magnetic field's horizontal and vertical components. The total field is the magnitude of the vector sum of these components.

Tools

Tools used for the evaluation:

- CrowdMag App, version 2.0.7: For data collection and initial visualization.
- Advanced magnetometer sensors in the iPhone 13 and the capabilities of the CrowdMag app to use it.
- All measurements were saved in csv format. Each measurement in its own csv file. This was provided by the CrowdMag app. Statistical analysis was done on these files.
- Python version 3.12.4. For data processing and statistical analysis, using libraries like Pandas, NumPy, SciPy and Matplotlib.

7. Measurements results

Results of the measurements are presented below, and includes evaluation of phone magnetometer, of static location, of dynamic movement and comparison with WMM values.

Evaluation of iPhone magnetometer

The iPhone 13 is equipped with a suite of advanced sensors. These include a

magnetometer, accelerometer, and gyroscope. However, no information about iPhone magnetometers can be found on official pages from Apple. Therefore, the main information about the magnetometer itself is obtained from Phyphox Sensor Database (Phyphox, 2024). Unfortunately, Apple devices have no interface to retrieve detailed information about the sensors, also magnetometers. Therefore, it is not possible to find information about the brand and model of each sensor and no information about the range or resolution.

By Phyphox Sensor Database, in the case of iPhone 13 magnetometers a standard deviation of 140 nT (0.14 μT) I present.

Static location

The idea is to measure a magnetic field at a static location, in our case at an indoor location. The location is in the countryside, about 30 km north of the capital Ljubljana (Slovenia), nearby Kranj. The measuring point is located inside the house, on the ground floor, next to the outer wall and on a stable surface (on the cupboard), which is 50 cm above the floor.

Basic statistical analyses were made on the basis of five measurements. Since these are static measurements, each of the measurements is marked with letter "s", which goes from s1 to s5.

Table 1 presents the results. Presented are all the measurements (Measure) and the aggregated (Agg), for all three magnetic components (F, H, Z). Aggregate (Agg) data combine the results of all measurements. Results include day of the measurement, end of measurement and duration (dur) of measurements.

Statistical analysis includes mean (Avg), maximum (Max) and minimum (Min) value of the field.

95th percentile identify the point by which 95% of the measurements fall below the 95th percentile value. In the context of our data, the 95th percentile value provides an indication of the magnetic field measurement levels below which 95% of the observations fall. This can be useful in understanding the distribution of measurements and identifying any unusually high values. It gives a threshold that represents the upper bound of the data's distribution, excluding the top 5% of values.

We can also find that quite all measured values are within the 95th percentile range of values.

Skew measure the skewness of the data within the 95% interval compared to the average. It measures asymmetry of the distribution.

Figure 3 shows the results of measurement for each of the cases concerning the time axis and considering the absolute value of the geomagnetic field. Values refer to total magnetic field (F).

We can see that the absolute values are different for each case. Thus, the first and second measurements (s1, s2) are in the range of 45-46 μT, and the third

measurement (s3) is in the range of 43-44 μT. The last two measurements (s5, s6) have higher values, namely between 46.5 and 48 μT. We can conclude that the magnetic field changes with time.

Table 1. Results of geomagnetic field measurements for a static indoor location (field values are in nT)

Mea-sure	Field comp	Day & End time	Dur (s)	Avg	Max	Min	95th per	Skew
s1	F	2024-06-28	5520	45504.70	46245.52	44841.79	45797.74	-0.0422
	H	9:56:42		27032.69	28389.65	26391.52	27361.14	1.5844
	V			36603.75	37129.14	35833.88	36919.00	-0.5965
s2	F	2024-06-28	5005	45326.01	45872.52	44662.91	45672.45	-0.1356
	H	12:32:24		26215.03	27343.22	19209.21	26940.66	-2.0865
	V			36964.51	40714.89	35923.63	37952.09	1.3561
s3	F	2024-06-29	5601	43267.76	44063.01	42597.43	43695.82	-0.1243
	H	19:14:31		24647.42	25418.58	23821.79	25055.69	-0.1430
	V			35560.56	36231.61	34957.13	35947.85	-0.1081
s4	F	2024-07-13	5121	47337.52	47889.58	46749.29	47661.17	-0.2588
	H	10:37:06		26944.36	27618.59	25737.39	27318.27	-1.8312
	V			38919.85	39453.50	38264.98	39255.66	-0.1812
s5	F	2024-07-14	3771	46773.54	47319.77	46336.09	47098.55	-0.0212
	H	10:21:15		26651.82	27094.79	26127.82	26975.42	-0.0987
	V			38437.06	39013.86	37977.86	38746.39	0.1041
Agg	F		1389393	45534.79	47889.58	42597.43	47489.95	-0.3844
	H			26259.72	28389.65	19209.21	27246.99	-0.9618
	V			37193.00	40714.89	34957.13	39075.31	0.1499

All these values for different cases have values range which is greater than the standard deviation of the measurement for the given phone (iPhone 13). This means that the measured values are real and that they actually change over time.

Figure 4 shows the magnetic field measurements for each of the individual cases. From the previous figure, we already found that the field values for each of the measurements are different. In this figure, we additionally see that the magnetic field also changes within each of the individual measurements.

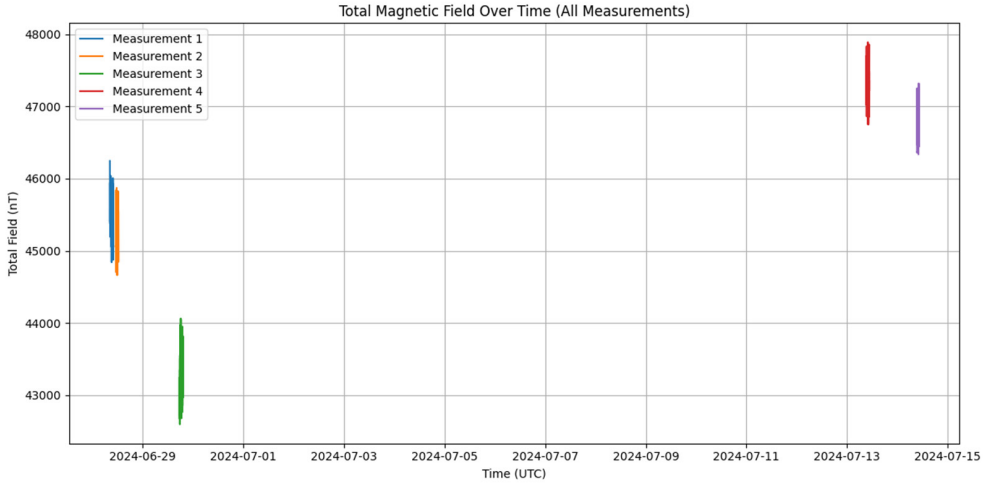

Figure 3. Total magnetic field (F) for all measurements (in nT)

Dynamic movement, with walking

Another evaluation is for the dynamic movement case. The idea is to measure a magnetic field at a dynamic location, for the walking example. The location is in the same area as in previous case. The measuring point is located outside.

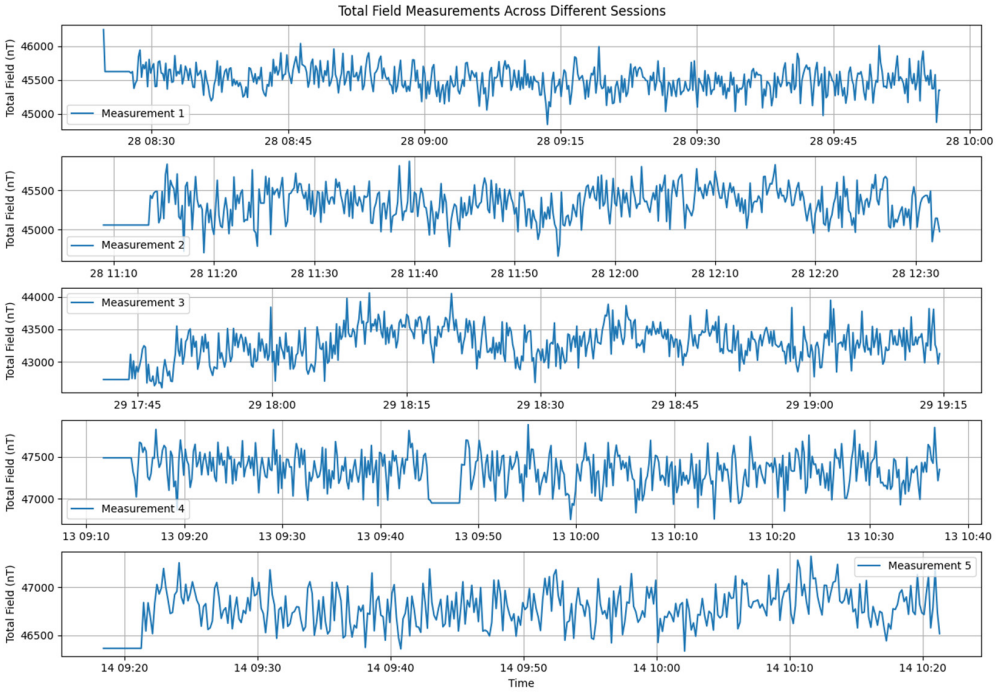

Figure 4. Total field measurements across different sessions in case of static locations

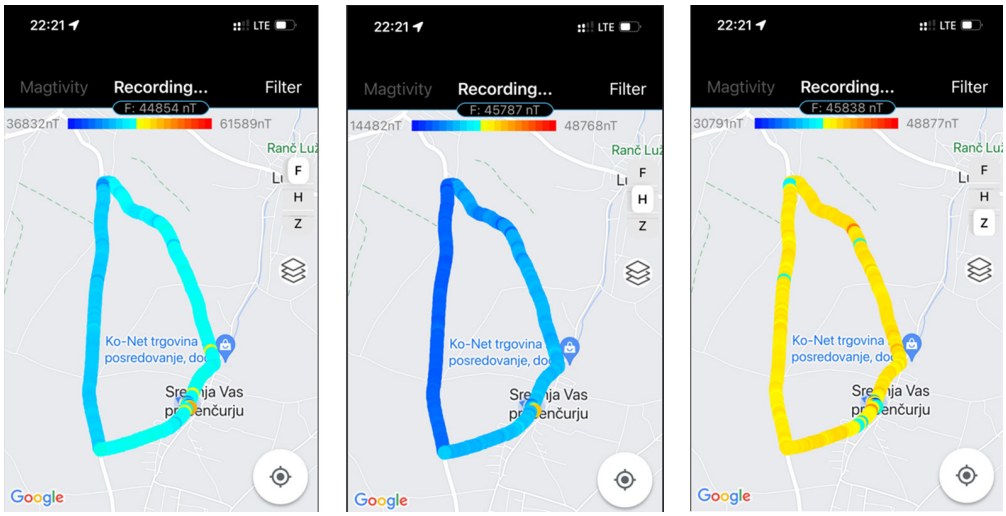

Figure 5. Magnetic field for the example of dynamic movement (walk) for all three field components (F, H, Z) - first measurement – as seen by CrowdMag

This is a walking path that goes past fields and woods, a local road. The location of the phone was in the back pocket of the pants. It is a circular walking path on the plain, about half an hour to an hour long.

Three measurements are made for the given dynamic movement. Due dynamic movement, they are given with the letter “d”, therefore these measurements are d1, d2 and d3.

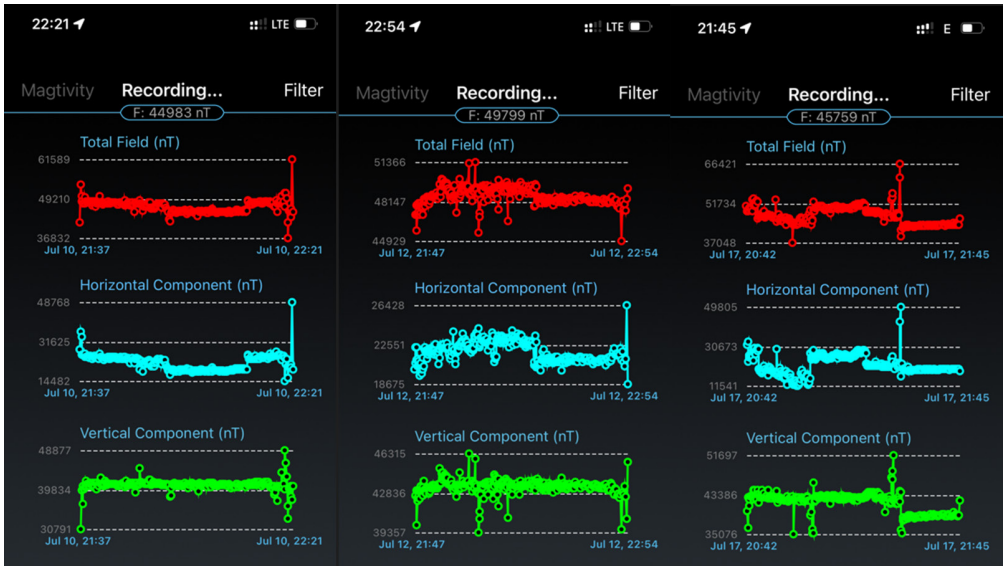

Figure 6. Magnetic field for the example of dynamic movement (walk) for all three cases and field components (F, H, Z) – as seen by CrowdMag

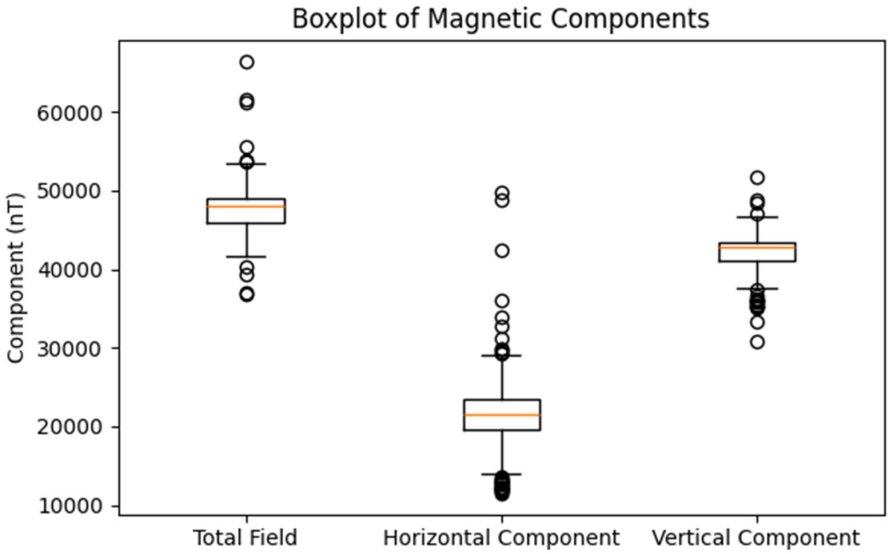

Figure 7. Boxplot of magnetic components

Figure 5 represent the display of magnetic field values for the example of dynamic movement (for measurements d1, d2 and d3) for all three components of the magnetic field (F, H, Z). The same is also for Figure 6. All this is as seen in the CrowdMag application.

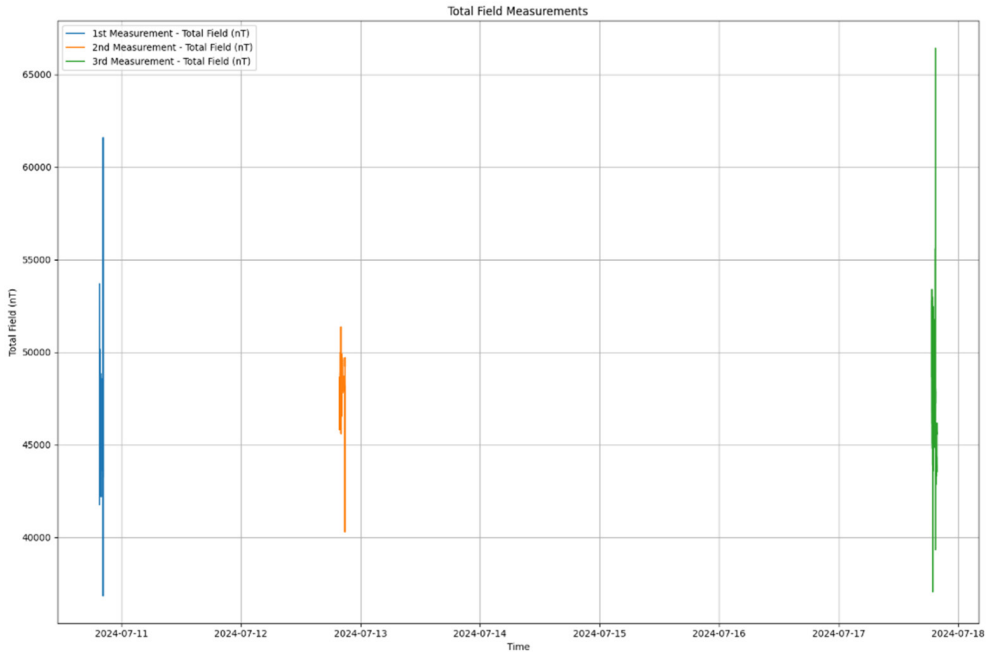

Figure 8. Total magnetic field (F) for all measurements (in nT)

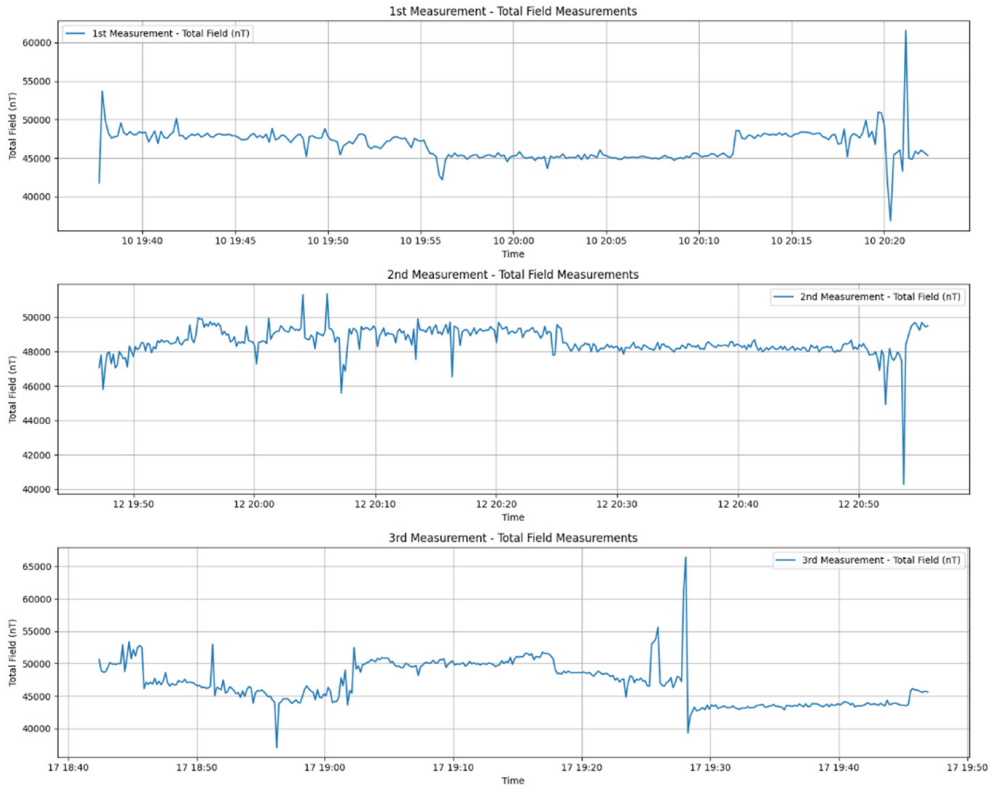

Figure 9. Total field measurements across different sessions in case of dynamic movement

Figure 7 represent boxplot of magnetic components for all three components. It is valid for all three measurements.

Figure 8 shows total magnetic field (F) for all measurements on a common time axis. The range of values is quite large, as it goes below 40 μT and above 60 μT.

Figure 9 shows the magnetic field measurements for each of the individual cases. It is about total field.

Comparison with the WWM model

A comparison of the results for static and dynamic location with the values as defined by the WMM model is made. The Figure 10 shows the magnetic field values as defined by WMM. The values are calculated using a magnetic calculator (MFC, 2024).

Table 2 shows the measurement analysis. Values for static, dynamic, and combined (static and dynamic together) measurement cases are compared against these of the WMM model. Analysis includes mean difference (Mean), standard deviation (Std Dev) and mean absolute error (Mean Abs Err).

Model Used:	WMM-2020						
Latitude:	46° 14' 37" N						
Longitude:	14° 21' 20" E						
Elevation:	0.0 km Mean Sea Level						
Date	**Declination (+ E | - W)**	**Inclination (+ D | - U)**	**Horizontal Intensity**	**North Comp (+ N | - S)**	**East Comp (+ E | - W)**	**Vertical Comp (+ D | - U)**	**Total Field**
2024-01-01	4° 35' 58"	62° 51' 34"	22,067.3 nT	21,996.2 nT	1,769.5 nT	43,048.2 nT	48,374.7 nT
Change/year	0° 8' 47"/yr	0° 1' 34"/yr	6.6 nT/yr	2.1 nT/yr	56.7 nT/yr	61.5 nT/yr	57.7 nT/yr
Uncertainty	0° 22'	0° 13'	128 nT	131 nT	94 nT	157 nT	145 nT

Figure 10. Values for magnetic field as defined by WMM

Mean difference indicates the average difference between the given measurements and the WMM values. Standard deviation: shows how much variability there is in the differences. Mean absolute error provides the average absolute difference, giving an overall sense of accuracy.

Table 2. Measurement analysis when comparing to WMM (values are in nT).

Type	Component	Mean	Std Dev	Mean Abs Err
Static	F	-2839.91	1450.98	2839.91
	H	4192.42	1004.22	4194.7
	Z	-5855.2	1273.68	5855.2
Dynamic	F	-814.2	2358.19	1718.51
	H	-237.65	3310.8	2386.92
	Z	-896.21	1812.36	1378.27
Combined	F	-2237.76	1997.18	2506.57
	H	2875.57	2839.99	3657.33
	Z	-4381.13	2693.34	4524.42

The Figure 11 shows difference in fields, with comparison for static and dynamic measurements against WMM. This is a single figure with histograms for better comparison between static and dynamic measurements.

Discussion

Based on the given measurements is the basic conclusion, that it is possible to measure the magnetic field by a phone. What's more, the values are quite comparable to the official models.

In the case of static measurements, the absolute values are different for each case. Values go from 43-44 μT up to 47-48 μT. In the case of dynamic movement, the differences are even greater. Dynamic cases are more comparable to the official WMM model as static cases.

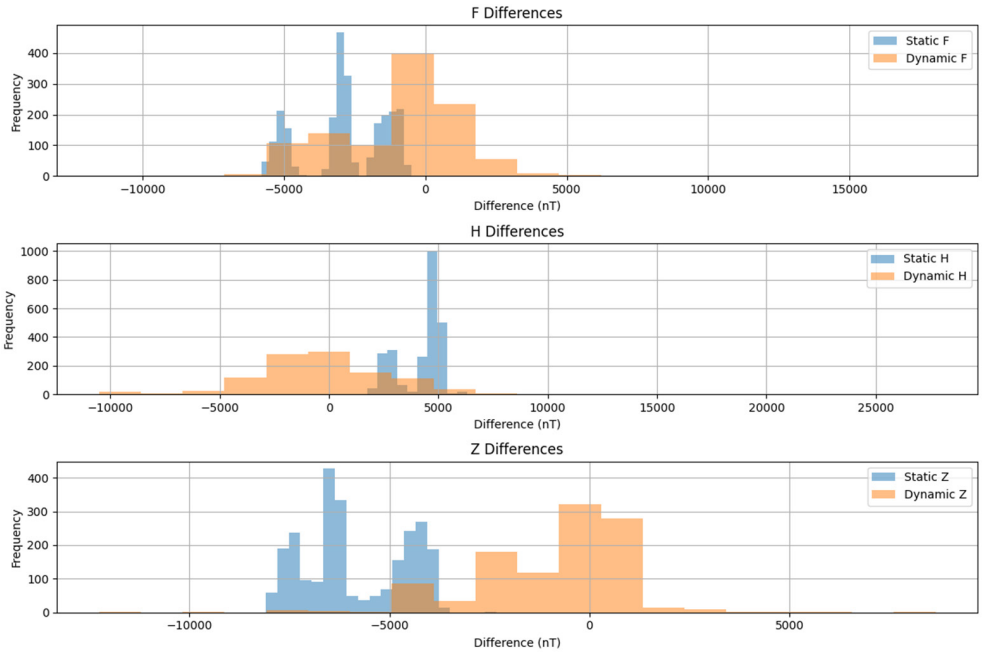

Figure 11. Values for magnetic field as defined by WMM

Certain fluctuations and deviations for individual cases are visible in the measurements. Some topics make sense to explore further in the future. Like making a comparison among different phones, a comparison for different use cases and a comparison with nearby magnetometers.

8. Conclusion

In the given paper we looked at the issue of measuring electromagnetic fields, which is part of a smart environment and smart cities. Electromagnetic fields have very dynamic characteristics, so researching this is very interesting. For this purpose, we used a very universal instrument, which was a mobile phone. Such a device enables real-time monitoring of the field.

We were interested in what the phone's options are for measuring the magnetic field. We additionally checked the field for case of static location and dynamic movement. We also evaluated the measured values in comparison with WMM. The conclusions are that the given area is interesting for research and work in this segment. Such a system based on a mobile terminal works and is welcome. We can assess that such a method is useful and a big step forward in monitoring magnetic fields in real-time.

The obtained results of the analysis are helpful in evaluating the possibilities offered by phones. And to help in obtaining a map of the magnetic field in real time, which is independent of satellite data. All this represents great potential for future research. Mainly in the direction of checking the possibilities of dif-

ferent phones, for different everyday situations and cases of use, and possible correlations with other data sources.

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Preliminary communication

IMPORTANCE OF FACEBOOK IN DIGITAL MARKETING

Abstract

With more people exploring social networking sites, Facebook has become one of the prime online sources for marketing your business. People learn more about products, organizations, artists and world events through it. By creating Facebook business pages, it offers a distinctive marketing opportunity for businesses. Facebook pages can be created and promoted easily. When it comes to marketing of your business, Feedback is of vital importance. It helps you to understand what are the customer's expectations and their buying behavior. This in turn helps you to market your business in a perfect way. Facebook provides brand exposure to a potentially new audience, which then helps your business to position themselves in better and unique ways. This work introduces the framework of this technology and the reasons for its creation, explaining how to use this technology can improve efficiency in finance and the economy, as it is the new form of business.

Key words: *Facebook, Digital Marketing, Social Media, Engagement, Ads.*

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1. Introduction

In the digital age, social media platforms have revolutionized the way businesses engage with their customers, and Facebook stands at the forefront of this transformation. For restaurant chains, leveraging Facebook marketing can be particularly effective in reaching a diverse and expansive audience. This paper delves into an in-depth analysis of a year's worth of Facebook ratings data for a chain of restaurants. By examining metrics such as the number of reviews, average star ratings, and the competitive landscape of local rivals, we aim to uncover the strategies that have proven successful and identify areas for improvement. Through this evaluation, we will highlight the critical role that Facebook ratings play in driving customer engagement, brand loyalty, and ultimately,

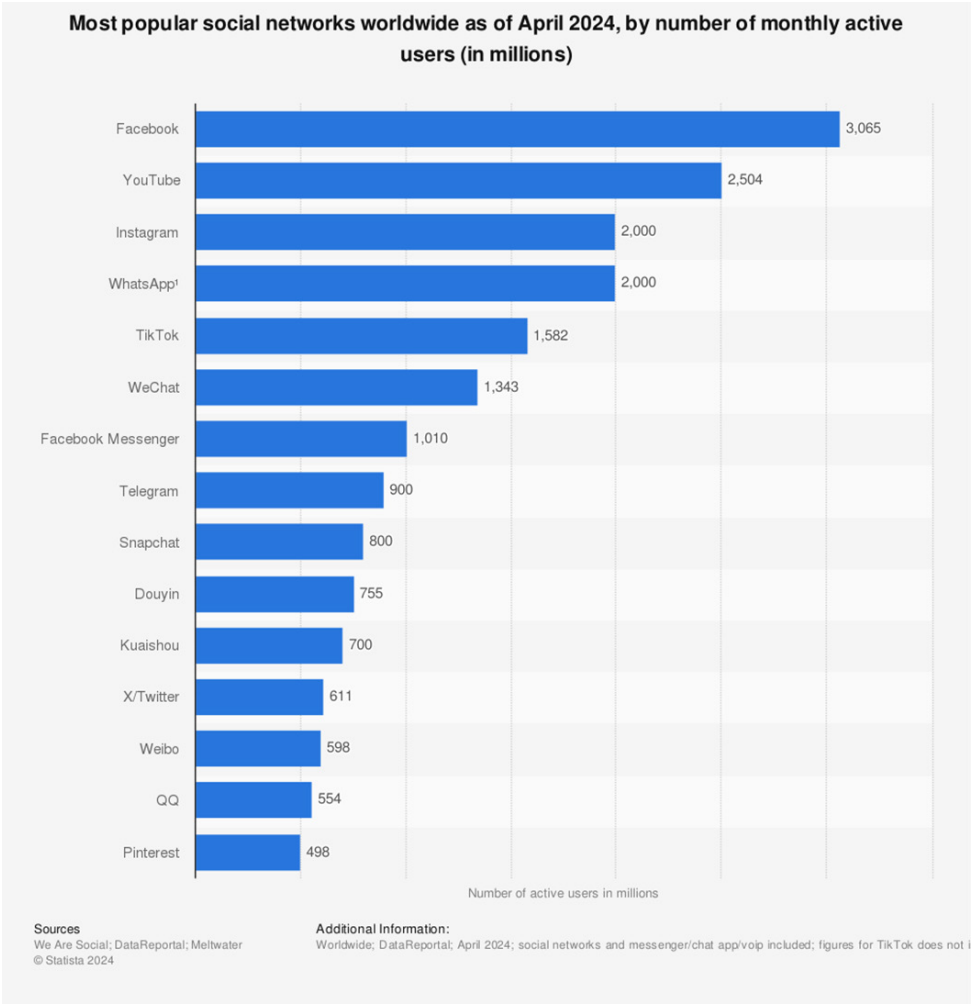

Figure 1. Worldwide; DataReportal; April 2024; social networks and messenger/chat app/voip included; figures for TikTok does not include Douyin

Source: © Statista 2024

business growth for restaurant chains. By understanding these dynamics over a twelve-month period, we can draw valuable insights into the effectiveness of Facebook as a marketing tool in the highly competitive restaurant industry.

Facebook, the market leader, was the first social network to surpass one billion registered accounts and currently has over three billion monthly active users (Statista Search Department, 2023). Meta Platforms owns four major social media platforms, each with over one billion monthly active users: Facebook (core platform), WhatsApp, Facebook Messenger, and Instagram.

1.1. What customers want

The pandemic-era surge in social media usage wasn't just a passing trend. As consumers settle into a new normal, they continue to value their online connections and habits. Amid a cultural landscape, social media has emerged to fill a seemingly endless need for content. Brands benefit from offering a variety of it to support the full customer journey.

53% of consumers say their social media usage has been higher over the last two years than the previous two years (The Sprout Social Index™, 2023).

During the discovery phase, audiences seek authentic content that promotes transparency around business practices and values. These posts help further establish your brand ethos and personality, driving credibility that builds deeper connections with consumers.

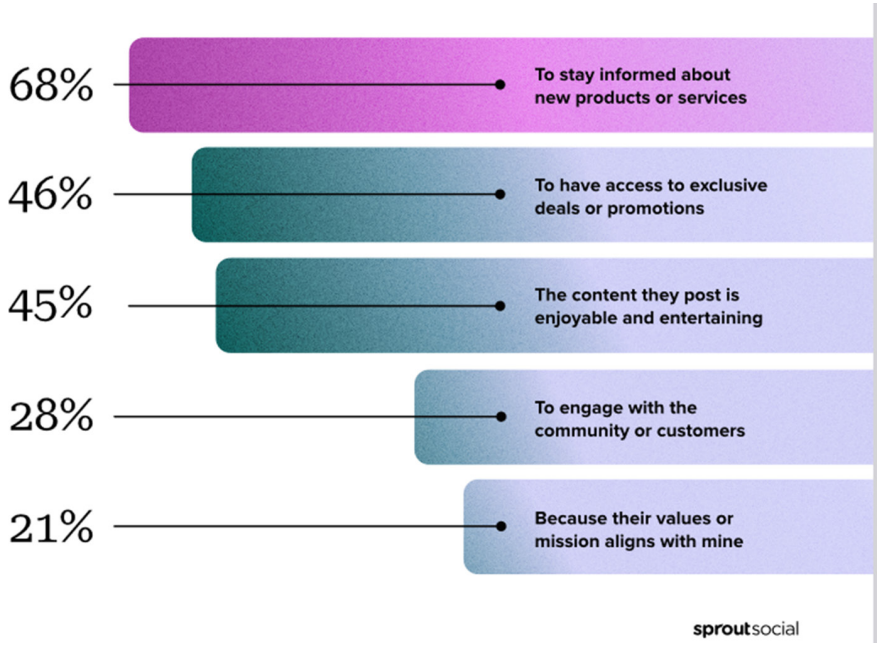

Figure 2. Consumers primary reason for following a brand on social

Source: © The Sprout Social Index™

1.2. Leaving a lasting impression

For all the discourse on generational differences, consumers of all ages have similar opinions on what makes a brand memorable.

A few years ago, brands taking a stand on tough issues was non-negotiable. Today, only 25% of consumers believe brands must speak out on causes and news that align with their values to be memorable. With skepticism around performative activism on the rise, audiences value brands that prioritize providing excellent service over public statements (The Sprout Social Index™, 2023).

The most memorable thing a brand can do across all age groups is respond to customers, proving that responsiveness leaves an impression on everyone. These one-on-one connections are even more important to younger consumers, who prioritize engagement over publishing volume and on-trend content.

1.3. Delivering exceptional customer experiences

Social has amplified the importance of strong customer relationships for brands. A single interaction between a brand and their customer can create a

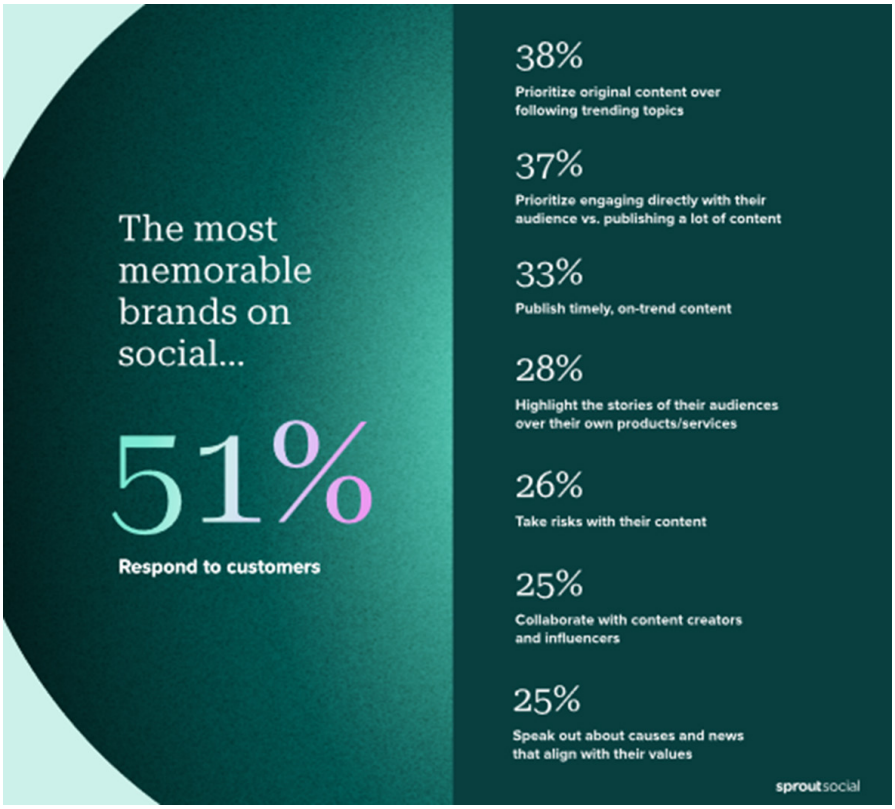

Figure 3. Responses to the most memorable brands on Social Media

Source: © The Sprout Social Index™

lasting impression on more than just the individual. It can create connections with an entire audience, too.

But what it takes to make memorable customer experiences is changing. In the past, providing superior customer service was a matter of speed. But as consumer expectations continue to evolve, so does the need for quality, personalized care on social.

Today, the majority of consumers (76%) place equal value on brands that prioritize customer support and brands that respond quickly to customer needs. It's not enough to resolve an issue quickly anymore. Businesses need to meet their customers with the personalized service they're used to on channels beyond social (The Sprout Social Index™, 2023).

Achieving the level of personalization consumers desire can't be done without an integrated tech stack that enables a clear flow of information between marketing and service teams. Your team brings the compassion and skills; it's your job to supply them with the context needed to solve customer issues.

2. Evaluating a Year's Worth of Facebook Marketing for Restaurant Chains

In the digital age, social media platforms have revolutionized the way businesses engage with their customers, and Facebook stands at the forefront of this transformation. For restaurant chains, leveraging Facebook marketing can be

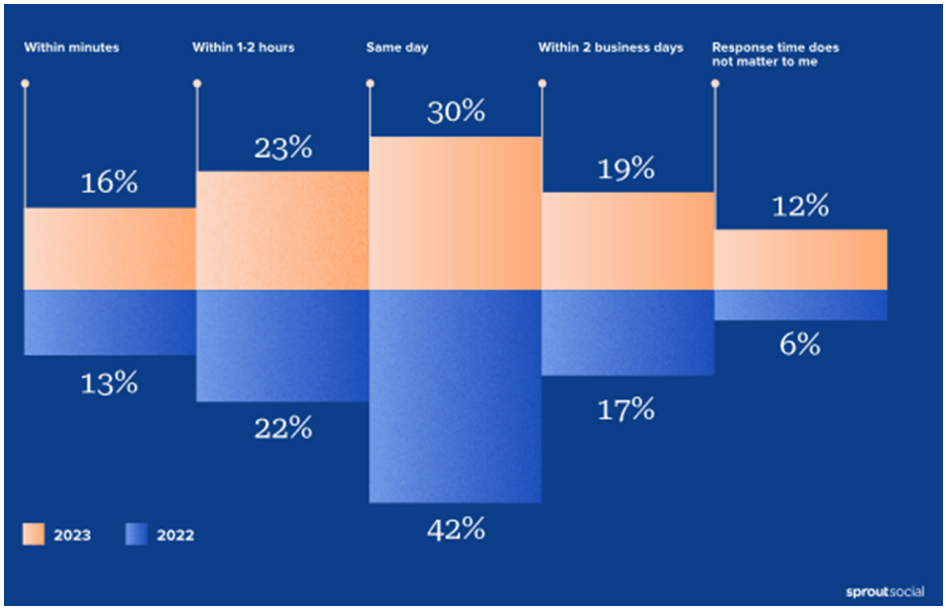

Figure 4. How quickly customers expect a response from brands on social

Source: © The Sprout Social Index™

particularly effective in reaching a diverse and expansive audience. This paper delves into an in-depth analysis of a year's worth of Facebook ratings data for a chain of restaurants. By examining metrics such as the number of reviews, average star ratings, and the competitive landscape of local rivals, we aim to uncover the strategies that have proven successful and identify areas for improvement. Through this evaluation, we will highlight the critical role that Facebook ratings play in driving customer engagement, brand loyalty, and ultimately, business growth for restaurant chains. By understanding these dynamics over a twelve-month period, we can draw valuable insights into the effectiveness of Facebook as a marketing tool in the highly competitive restaurant industry.

2.1. Data Collection

The data for this study has been collected from the official Facebook pages of a Popular Chain of restaurants in United States of America that owns 961 restaurants in 36 States. The review data has been collected over a twelve-month period. The dataset includes the number of reviews left by customers, the average star ratings (ranging from 1 to 5 stars), and data on local competitors, including their review counts and average ratings.

2.2. Data Analysis

To analyze the collected data, we employed various statistical methods. We performed trend analysis to identify patterns in review counts and average ratings over the year. Comparative analysis was conducted to assess the restaurant chain's performance relative to its local competitors. Correlation analysis was used to explore the relationship between Facebook ratings and key business performance indicators.

3. Results of the Analytics

3.1. Monthly Positive and Negative Reviews for "Our Brand" and "Local Competitor"

This clustered column chart provides a visual comparison of the number of positive and negative reviews received by "Our Brand" and a "Local Competitor" over a twelve-month period. The x-axis represents the months from January to December, while the y-axis shows the number of reviews. Each month includes four bars—two representing "Our Brand" (positive and negative reviews) and two representing the "Local Competitor" (positive and negative reviews).

The data reveals several key trends:

- **Monthly Fluctuations:** Both brands experience significant fluctuations in the number of reviews throughout the year. Notably, October stands out with the highest number of reviews for both brands, suggesting increased customer engagement during this period. "Our Brand" received 1747 positive and 592 negative reviews, while the "Local Competitor" received 1373 positive and 123 negative reviews.

- **Overall Trends:** "Our Brand" consistently receives more reviews than the "Local Competitor," indicating a higher level of customer engagement or a larger customer base. This trend is consistent across both positive and negative reviews.
- **Positive vs. Negative Feedback:** In most months, "Our Brand" has a higher number of positive reviews compared to negative ones, indicating a generally positive customer sentiment. For instance, in January, "Our Brand" received 1076 positive reviews and 404 negative reviews, while the "Local Competitor" received 611 positive and 53 negative reviews.
- **Seasonal Trends:** There is a noticeable increase in reviews during the holiday season (October to December). This seasonal trend could be due to increased customer activity and engagement during this period.
- **Actionable Insights:**
  - **Addressing Negative Feedback:** The significant number of negative reviews in October and December for "Our Brand" suggests areas for improvement in customer service or product quality.
  - **Leveraging Positive Feedback:** Analyzing the factors contributing to the high number of positive reviews during certain months can help replicate successful strategies and enhance customer satisfaction.

Table 1. Facebook Recommendations

	Facebook Recommendations					
	Our Brand			Local competitor Average		
Month	Positive	Negative	Average Rating	Positive	Negative	Average Rating
January	1076	404	3.8	611	53	3.9
February	5	3	4.0	1	0	4.5
March	35	7	4.0	12	3	4.5
April	92	14	4.1	21	2	4.5
May	202	40	4.0	59	6	4.4
June	278	64	4.0	69	8	4.5
July	237	70	3.8	105	10	4.5
August	689	319	3.6	443	55	4.4
September	733	262	3.8	678	48	4.4
October	1747	592	3.6	1373	123	4.3
November	917	289	2.1	685	58	2.8
December	1044	417	3.6	871	89	3.9

Source: Author

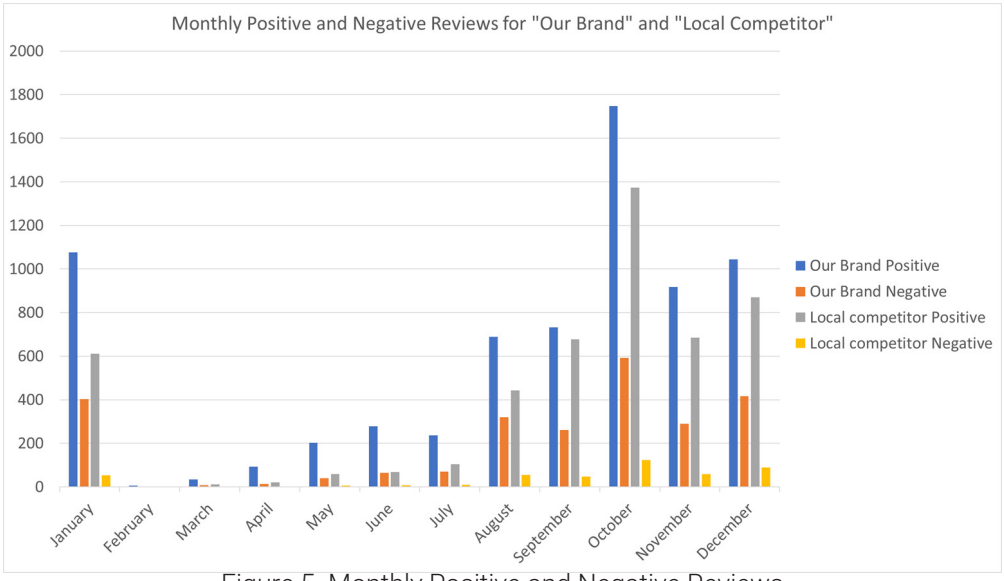

Figure 5. Monthly Positive and Negative Reviews

Source: Author

By analyzing these trends, "Our Brand" can identify key periods requiring additional focus and potentially adjust their marketing and customer service strategies to improve overall customer satisfaction and ratings.

3.2. Average Monthly Ratings for "Our Brand" and "Local Competitor"

This line chart provides a visual representation of the average monthly ratings for "Our Brand" and a "Local Competitor" over a twelve-month period. The x-axis represents the months from January to December, while the y-axis represents the average star ratings, ranging from 1 to 5 stars.

The data shows that the "Local Competitor" consistently received higher average ratings compared to "Our Brand" throughout the year. Notably, "Our Brand" experienced a significant decline in ratings during November, dropping to 2.10 stars, while the "Local Competitor" also saw a decline but maintained a higher average rating of 2.80 stars.

Overall, the "Local Competitor" maintained relatively high and stable ratings, with peaks at 4.50 stars in several months (February, March, June, July), whereas "Our Brand" showed more fluctuation, with ratings ranging from 2.10 to 4.10 stars.

These trends highlight areas where "Our Brand" can focus its efforts to improve customer satisfaction, particularly during months where there are significant drops in ratings. Additionally, the consistent performance of the "Local Competitor" suggests that they might have effective customer engagement and retention strategies that could serve as a benchmark for "Our Brand".

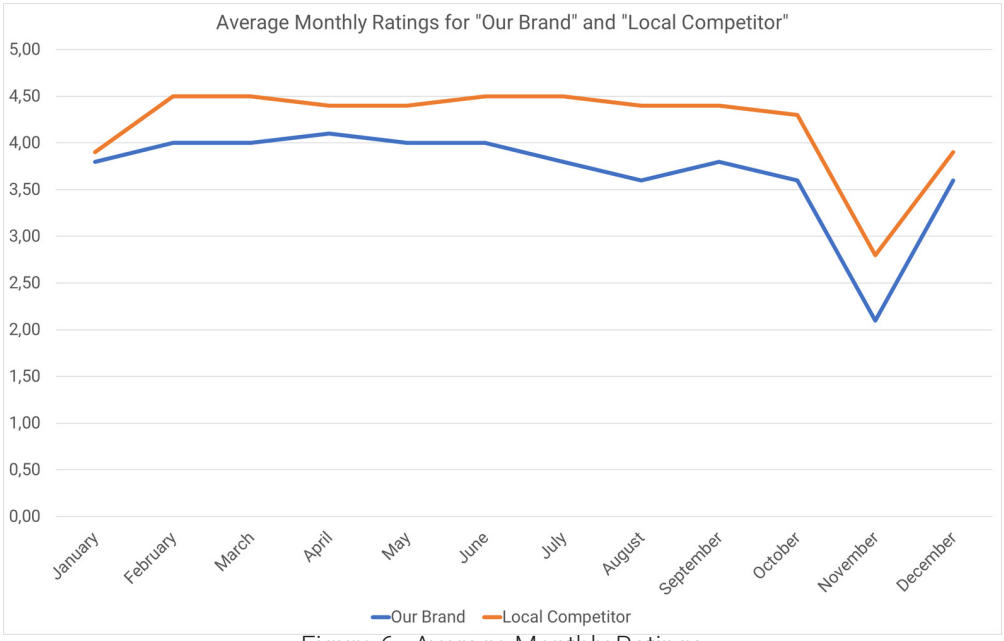

Figure 6. Average Monthly Ratings

Source: Author

By analyzing these trends, "Our Brand" can identify key periods requiring additional focus and potentially adjust their marketing and customer service strategies to enhance overall customer satisfaction and ratings.

3.3. Distribution of Restaurants by State

This bar chart illustrates the distribution of the 961 restaurants owned by the popular chain across 36 states in the United States.

The data reveals significant variations in the number of restaurants per state, reflecting the chain's market penetration and regional focus. For example, Texas emerges as the state with the highest number of restaurants, housing 206 of the chain's outlets. This indicates a strong market presence and potentially high customer demand in Texas.

In contrast, states like Michigan have a relatively lower number of restaurants, with only 16 outlets. This suggests potential opportunities for market expansion and increased brand presence in such states. By targeting states with fewer restaurants, the chain can explore new markets and grow its customer base.

The distribution pattern also highlights key insights for strategic planning. States with a high concentration of restaurants, such as Texas, require efficient supply chain logistics to ensure timely delivery of products and services. Additionally, marketing efforts can be tailored to reinforce brand loyalty and attract new customers in these regions.

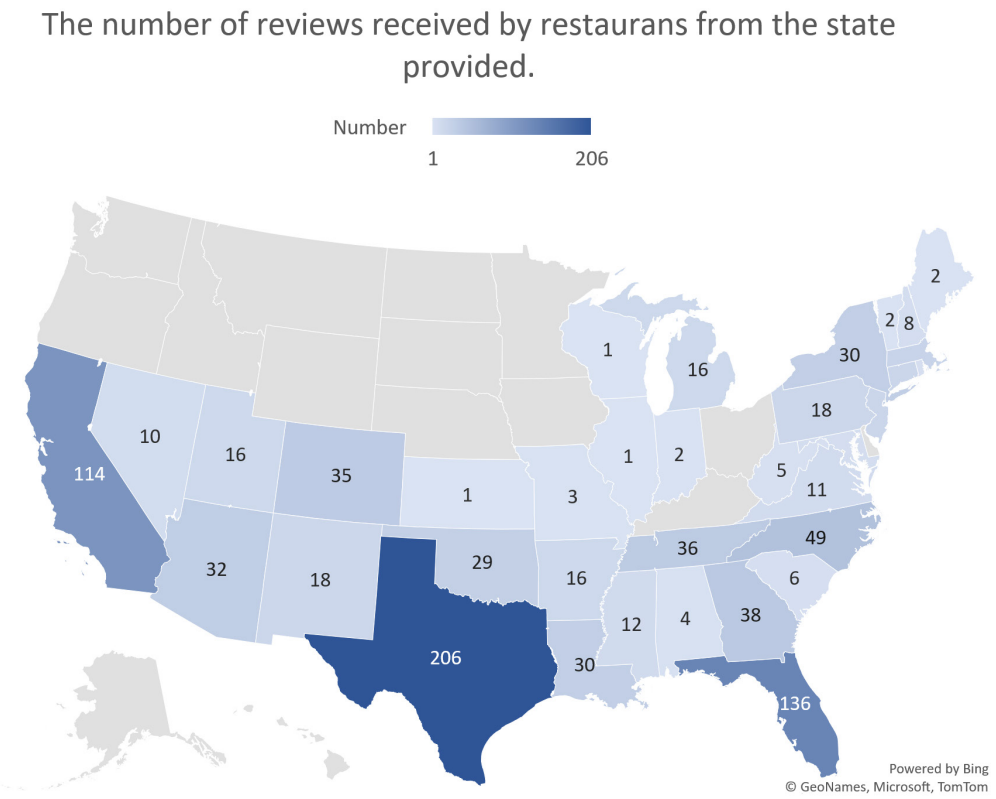

Figure 7. The number of reviews received by restaurants from the state provided

Source: Author

Conversely, states with fewer restaurants might benefit from increased marketing efforts to raise brand awareness and attract potential customers. This approach can help in balancing the distribution and ensuring a more uniform market presence across the country.

Overall, the distribution of restaurants by state provides valuable insights into the chain's market strategy and helps identify areas for potential growth and improvement. By analyzing this distribution, the chain can make informed decisions to enhance its market presence and achieve sustained growth.

4. Conclusion

The analysis of a year's worth of Facebook marketing data for a chain of restaurants underscores the platform's vital role in digital marketing. By understanding customer engagement trends, competitive performance, and effective strategies, businesses can leverage Facebook to enhance customer satisfaction, drive brand loyalty, and achieve sustained growth.

Over the twelve-month period, the restaurant chain saw fluctuations in the num-

ber of reviews and average ratings. Notably, there was a peak in reviews during the holiday season, corresponding with higher customer footfall. The average rating remained relatively stable, with slight variations that aligned with major promotional campaigns.

As of impact of reviews on business performance, the analysis revealed a strong positive correlation between the number of reviews and customer visits, suggesting that increased engagement on Facebook translates to higher in-store traffic. Similarly, higher average ratings were associated with increased sales, underscoring the importance of maintaining positive customer feedback online.

On the other hand, if we take a look on the competitive analysis when compared to local competitors, the restaurant chain generally maintained a higher average rating but had fewer total reviews. This indicates a strong base of loyal customers but highlights the potential for increasing engagement to match or exceed competitor review counts.

Effective Facebook marketing strategies shows us that the data indicate the promotional campaigns and special events drive increased customer engagement and positive reviews. Strategies such as regular updates, engaging content, and prompt responses to customer feedback have proven effective.

Despite positive ratings, the restaurant chain can benefit from strategies aimed at increasing the total number of reviews. Encouraging satisfied customers to leave reviews and engaging with dissatisfied customers to address their concerns can help enhance online presence.

The competitive analysis highlights the influence of local rivals. Keeping track of competitor strategies and adjusting marketing efforts accordingly is crucial for maintaining a competitive edge.

Customer experience should be a driving force for any social program, and yet few organizations have dedicated resources or infrastructure to support sophisticated social customer care.

Creativity and authenticity are key to success on social. Team bandwidth has long threatened both, and AI offers a solution. Although, we can use AI tools to generate the content for our customers, we need to be humans and decide it the created content robotized or humanly accessible. Organic posts are something that will never get out of the trend. Customers always appreciate care and love when they feel that they are important and that they are not just a static number for the brand.

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Original scientific paper

THE STRUCTURE OF PARTICIPANTS IN HALF-YEAR EDUCATION PROGRAMS COMPARED WITH STUDENTS IN HIGHER PROFESSIONAL PROGRAMS AT THE FACULTY OF INFORMATION STUDIES AND RELATED STUDY PROGRAMS IN SLOVENIA AND EUROPE

Abstract

Rapid technological development changes labour market needs, requiring lifelong learning - the constant upgrading of employees' skills and knowledge. One of the goals of the European Commission under the Recovery and Resilience Plan is therefore also the adaptation of the tertiary education system. As part of these efforts, pilot projects in higher education are being funded in Slovenia, offering shorter forms of education, and within Faculty of Information Studies in Novo Mesto offers half-year education programs in the fields of informatics and computer science. Since this is a new form of education, we compared the structure of participants in these half-year programs with the structure of 1st Bologna cycle professional study program students at the faculty based on enrolment data. We found that women predominate among the participants in the half-year programs, which differs from the situation in study programs, where males constitute the majority of enrolled students. Participants in the half-year programs are also, on average, significantly older than the students at the faculty. Additionally, we compared these data with data for Slovenia and Europe. It is evident that interest in education in the fields of information and communication technologies is increasing. Moreover, women's interest in this area of education is slowly growing, although this is still a male-dominated field, on which students of the younger age group mainly enrol. These findings highlight the need to adapt the education system to different groups of learners to become more responsive to labour market needs and enable greater inclusion of more heterogeneous social groups.

Key words: *Lifelong Learning, Tertiary Education, Informatics And Computer Science, Demographic Diversity, Trends In Education.*

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1. Introduction

Rapid technological development changes labour market needs, requiring constant upgrading of employees' skills and knowledge. Therefore, one of the goals of the European Commission under the Recovery and Resilience Plan (RRP) is also the adaptation of the education system, including the tertiary level. As part of these efforts, pilot projects in higher education (HE) are being funded in Slovenia at public higher education institutions, offering shorter forms of education, considered life-long education. One of these pilot projects is being implemented at the Faculty of Information Studies in Novo Mesto (FIS), where within the »Advanced Computer Skills« (ACS) project half-year education programs are offered.

The RRP pilot project ACS aims to modernize the curricula of higher education professional programs (1st Bologna cycle) with an emphasis on the green and digital transition. As part of the project, half-year education programs are conducted at FIS for two educational fields: Digitalization, Internet of Things and Industrial Automation (DITIA), which is content related to the higher education professional study program Informatics in Contemporary Society (ICS HE), and Programming and Application Development (PAD), which is related to the higher education professional study program Computer Science and Web Technologies (CSWT HE).

Since this is a new form or format (half-year) of education in the higher education system, this paper presents the findings of a comparison of data on gender and age structure among participants in the half-year education programs within RRP pilot project ACS (DITIA and PAD) and the profile of newly enrolled students in higher education programs at FIS (ICS HE and CSWT HE), as well as in Slovenia and European countries in the academic years 2022/23 and 2023/24.

Upon preliminary comparison of the data, we observed noticeable deviations. Therefore, we set a goal to examine the differences in more detail and formulated two hypotheses, which are presented in the Research Goal and Hypotheses chapter. In the following chapter of the paper, in the first part of the literature review, we examine gender inequality in education and employment. Studies highlighting the underrepresentation of women in STEM, particularly in the ICT field, are described. In the second part of the literature review, we focus on the age structure of ICT professionals and students in the EU. The Methodology chapter describes the process of data collection and the analysis for the research. In the Results chapter, we compare the demographic variables of age and gender across different forms of education at the faculty, in Slovenia and Europe. The results are presented with statistical data and graphs. In the Discussion, we interpret the results and relate them to the hypotheses. Research highlights the success of the RRP project in attracting women and the difference in gender and age structure between the participants in the half-year education programs within the RRP pilot project ACS, FIS students, and students at the Slovenian and European levels. At the end of the paper, the conclusion presents the limitations of the research and provides final thoughts.

2. Literature Review

The gender gap in the fields of Science, Technology, Engineering, and Mathematics (STEM) has become a major concern for the research and academic communities. Recent studies indicate that women enrol in STEM studies at a lower rate compared to men and are more likely to leave their jobs. Addressing this issue requires continuous efforts from educational institutions, public entities, professionals, and families. (López-Iñesta, Botella, Rueda, Forte in Marzal, 2020) Gender equality in education and the labour market is a prerequisite for a sustainable society and a more efficient economy. (Krchová, Höesová, 2021) The gender ratio in education and the workplace has changed over the past decades: women have made progress in representation, fair pay, and recognition through awards, scholarships, and publications. However, despite these overall changes, disparities in STEM fields persist. (Charlesworth, Banaji, 2019) Although great efforts have been made, and social and political measures have been promoted to create gender equality in STEM, inequalities towards women are still evident in both higher education and industry. (Parmaxi et al., 2024)

Women in industry and higher education face challenges in STEM fields, such as pay disparities, sexism, sexual harassment, bias, stereotypes, discrimination, the need to constantly prove themselves, exclusion from decision-making, difficulties in balancing work and private life, and a lack of women in leadership positions; and they usually have to work harder to achieve the same recognition as men. (Parmaxi et al., 2024) The lower number of women in the ICT field leads to low expectations regarding the inclusion of girls in ICT. (Corneliussen et al., 2021) Research has shown that the lack of gender balance in male-dominated environments creates several challenges for women, including feeling "out of place" and difficulties regarding their sense of belonging. (Riegle-Crumb, Morton, 2017) Additionally, it is concerning that the proportion of women earning degrees in computer science in Europe is decreasing. This indicates that efforts and interventions to attract, recruit, and retain girls and women in ICT and STEM are either not succeeding or need to be strengthened. (Kamberidou, Pascall, 2020) Even more concerning is the trend that shows that as the number of women in ICT education increases, the number of men in ICT increases even more, leading to an even wider gender gap in ICT. (Simonsen, Corneliussen, 2020)

Proposals and recommendations to overcome gender equality challenges recommend raising awareness of gender inequality through public events and promotions, empowering and supporting women to participate and stay active in all STEM fields, and recognizing women's achievements and presenting them as role models for young women to engage and remain active despite the many challenges and barriers.

Suggestions and recommendations for overcoming gender equality challenges include raising awareness about gender inequality through public events and promotions, empowering and supporting women to participate and remain active in all STEM fields, and recognizing women's achievements and presenting them as role models to young women to engage and stay active despite the numerous challenges and obstacles. (Parmaxi et al., 2024)

It is important to increase diversity in STEM education by incorporating the gender dimension, as gender stereotypes and social biases begin in early childhood. (Kamberidou & Pascall, 2020) Digital transformation can contribute to greater equality between women and men, as the internet, digital platforms, and digital financial services enhance employment opportunities and access to knowledge and general information. (OECD, 2018)

Regarding age, the latest available data show that in 2022, slightly more than two-thirds (67.8% or 2.018.700 out of a total of 2.975.400) of employed people in the EU with an ICT education were aged 15 to 34 years, and additionally, young people in this age group accounted for the majority of employed people with an ICT education in all the EU Member States; the highest proportions were recorded in Slovakia (84%) and Romania (82%). (Eurostat, 2022)

Between 2016 and 2022, the number of young employed people (aged 15-34 years) with an ICT education in the EU increased by just over 4% on average per year, while the corresponding increase for people aged 35-74 years was just under 4% per year. During this period, the total number of employed people aged 15-34 years with an ICT education increased by approximately 450.000, while the number of people aged 35-74 years increased only by slightly less than 200.000. As a result, the share of young people aged 15-34 years in the total number of employed people with an ICT education in the EU increased by just under 1 percentage point between 2016 and 2022. At the level of individual countries, the highest rates of young ICT-educated people were observed in Ireland (with an average of 22% per year), followed by Luxembourg and Slovenia. In most EU countries (19), both age groups progressed in synchronicity. (Eurostat, 2022)

3. Research goal and hypotheses

The goal we set for this research is to identify the discrepancies between the demographic structure of participants in the half-year education programs within the RRP pilot project ACS, which are part of the so-called lifelong learning, and traditional higher education study programs. In this context, we formulated the following two hypotheses:

H1: Similar to Slovenia and Europe, where men predominantly enrol in higher education study programs in the ICT field, men also predominantly enrol in the half-year education programs within the RRP pilot project »Advanced Computer Skills« and in the higher education study programs at the Faculty of Information Studies in Novo Mesto.

The reasons for formulating this hypothesis are based on the past and current situation in the ICT sector. According to Eurostat (2024), in 2022, men accounted for 84% of the 3 million people in the EU, who were employed and had an ICT education, while women accounted for the remaining 16% of those employed with ICT education. This gender gap was present in all EU Member States in 2022, with Slovenia recording the highest share (93%) of men in the total number of employed people with an ICT education. In most of the other EU Member States, this share ranged between approximately 70% and 90%. (Eurostat, 2022)

Although women in the EU have, on average, a higher level of education than men, only a fraction of women's potential is being used in STEM professions, especially in ICT (European Commission, 2017). As a result of a series of policy initiatives taken across the EU to promote the study in the ICT field among women, statistics reveal, that the number of employed women with an ICT degree increased between 2016 and 2022, rising by an average of just under 4% per year, while the number of employed men with a degree in ICT field increased by an average of just over 4% per year. (Eurostat, 2022)

H2: Participants enrolled in the half-year education programs within the RRP pilot »Advanced Computer Skills« project are, on average, significantly older than newly enrolled students in higher education study programs at the Faculty of Information Studies in Novo mesto and on general in higher education study programs in the ICT field in Slovenia.

The reasons for formulating this hypothesis stem from the very nature of the educational and study programs themselves. Education programs, such as those within the RRP pilot project ACS, are part of lifelong learning. They therefore attract individuals who already have work experience and wish to upgrade their skills in specific areas, or who already have a degree in higher education. Compared to traditional higher education study programs, this can include older participants, who may seek retraining or career advancement. Meanwhile, higher education study programs are aimed at attracting younger adults who have recently completed secondary education. As presented in the Literature Review, in 2022, slightly more than two out of every three (68%) employed people with an education in ICT in the EU were aged 15-34 years. Moreover, young people in this age group represented the majority of employed persons with an ICT education in all EU Member States. (Eurostat, 2022)

4. Methodology

The data for this research were obtained from the enrolment information for both, participants enrolled in the half-year education programs within the RRP pilot project ACS and newly enrolled students in higher education study programs at FIS. To calculate the age of the participants and students, we followed specific guidelines regarding the reference date. The age information for participants in the half-year education programs within the RRP pilot project ACS in 2023 and 2024 is based on the reference date of October 1, 2022, and October 1, 2023, respectively. The age of FIS students for the academic year 2022/23 is determined by using the reference date of September 1, 2022, and the age of students for the academic year 2023/24 is determined by using the reference date of September 1, 2023.

Data on students in higher education study programs in Slovenia are available on the website of the Statistical Office of the Republic of Slovenia (SORS). The unit described by the published data is a student enrolled in a publicly recognized study program at a higher education institution in a given (observed) academic year. We analysed the data on newly enrolled students in higher education professional institutions in the field of information and communication

technologies (ICT). Due to data protection regulations, some data are withheld. Nevertheless, we analysed data for 499 out of 509 students available for the academic year 2023/24 (98% of the total data) and for 495 out of 511 students for the academic year 2022/23 (97% of the total data). This means that only a small proportion of data is missing, which does not significantly affect the integrity of the analysis and research.

In analyses based on the age data of students enrolling in higher vocational institutions in the ICT field, we followed the methodology of official institutions (e.g., Eurostat) and used the age range of 15-19 years as the initial age group, even though individuals in the Slovenian educational system typically enrol in higher education at the age of 19. We adopted the 15-19 age range to maintain consistent age group widths (5 years), which allows more consistent data categorization. There is also a limitation of SORS data for Slovenia, that the official age data defines the highest age group as 40+ years, but since there have been only 5 students in this age group over the last 2 years, this does not affect the credibility of the research results.

For analysis of the demographic structure of participants in half-year education programs within the RRP pilot project ACS and students at FIS, we first pre-processed the data using Python, and after that, Microsoft Excel was used for effective comparison and identification of differences between participants and students. For additional comparison and analysis, also some other calculations were included, such as the average age of participants and students, the Compound Annual Growth Rate (CAGR), and the Average Annual Growth Rate (AAGR) of the number of students in Slovenia.

5. Results

Related to H1, we first examined the gender structure among newly enrolled undergraduate or equivalent professional education students in the ICT field between Slovenia and Europe. According to Eurostat (2022), a total of 18.711 students enrolled for the first time in ICT programs at the undergraduate or equivalent professional education level in European countries[1] in 2022. These data indicate a predominance of male students (86%).

We conducted a similar analysis for Slovenia, where a total of 490 students enrolled in higher professional study programs in the field of ICT in 2022. (SORS, 2024) Out of these, 87% were men. The percentage of male students in Slovenia was therefore even slightly higher compared to Europe in 2022. In 2023, 509 students enrolled in higher professional ICT study programs, of which 84% were men, which is a lower percentage of men compared to the latest data at the European level.

The long-term data for Slovenia (SORS, 2024) in Figure 1 show an increase in the number of students in the ICT field from the academic year 2017/18 to 2022/23, with a slight decrease noted in the last year. The largest increase in

1 Research included the following European countries: the Netherlands, Belgium, Poland, Germany, Slovenia, Switzerland, Lithuania, Croatia, Luxembourg, Bulgaria, Serbia, Malta, North Macedonia, Denmark, Greece and Latvia.

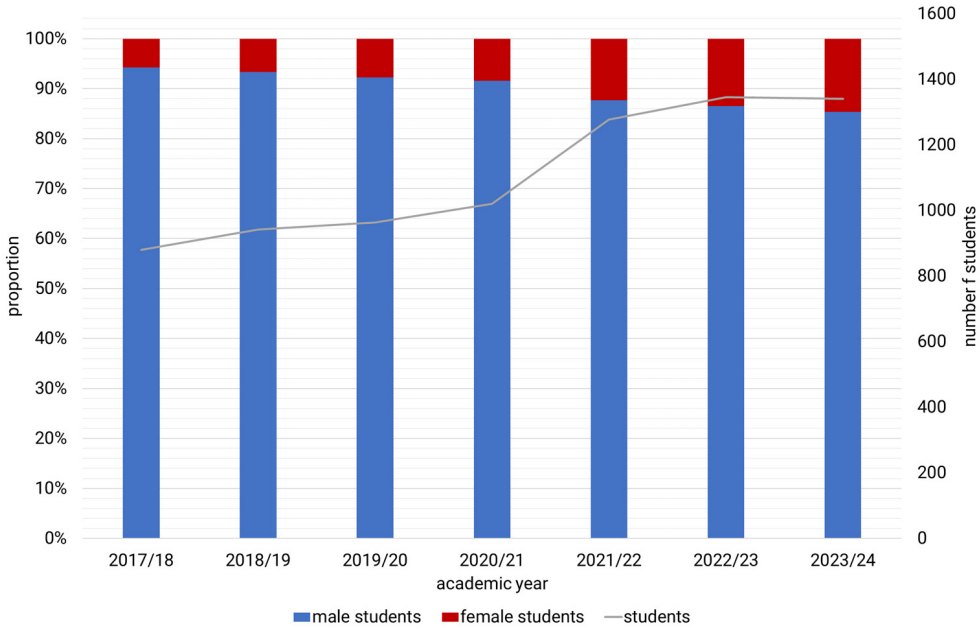

Figure 1. Newly enrolled students in higher professional education (1st Bologna level) in the ICT field by gender, Slovenia, annually (source: SORS, 2024)

the number of newly enrolled students occurred in 2021/22, with nearly 100 more students compared to the previous academic year. The total number of students increased from 356 in 2017/18 to 509 in 2023/24. During the observed period, the proportion of women also grew. In 2017/18, the proportion of women was 6%, which increased to 16% by 2023/24. The increase in the number of women among newly enrolled students is most pronounced between the academic years 2020/21 and 2021/22, when the proportion increased by 4 percentage points.

The compound annual growth rate (CAGR) for men is 6%, indicating stable and moderate growth over the analysed period. The average annual growth rate (AAGR) is slightly higher, but still 6%, implying constant growth without major fluctuations.

For women, the growth rates are notably higher. The CAGR is 25%, indicating a relatively rapid growth in the number of women in these programs. The AAGR is even slightly higher, at 27%, implying that in some years there have been significant jumps in the number of women enrolled. These values clearly show that the efforts to encourage more women to enrol in technical study programs have been successful. While the growth for men is stable, the growth for women has been more rapid, indicating important shifts in the demographic structure of students in these higher professional education study programs.

In the continuation, we focused on the comparison of the gender structure of the enrolled participants in the half-year education programs within the RRP

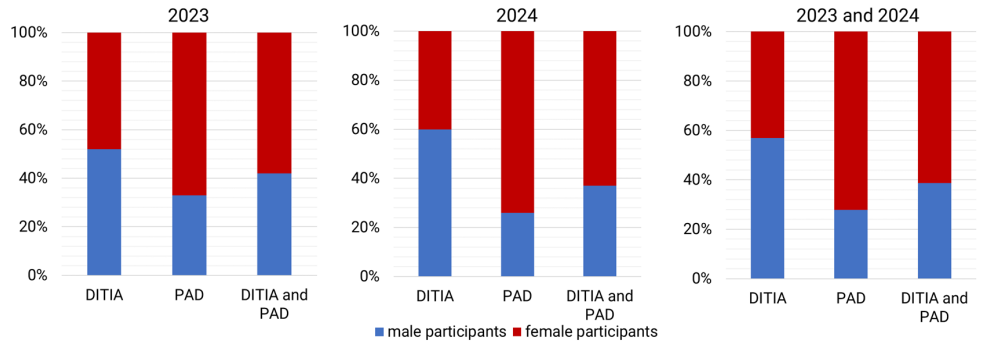

Figure 2. Gender structure of participants in the half-year education programs within the RRP pilot project ACS

pilot project ACS and the newly enrolled students in higher education study programs at FIS in the academic years 2022/23 and 2023/24.

The data in Figure 2 show that women predominate among the participants in the half-year education programs within the RRP pilot project ACS. In both years, 2023 and 2024, they represent approximately 60% of all participants. The educational field DITIA has a slightly higher proportion of men in both years, while in the PAD educational field, women dominate with approximately 75%.

On the other hand, Figure 3 shows that the proportion of women in higher education study programs at FIS is considerably lower, around 20%. Despite a slight increase between the academic years 2022/23 and 2023/24, men still constitute the majority of students.

Figure 4 shows a slight increase in the proportion of women between 2023 and 2024 in both, within the RRP pilot project ACS and FIS. The situation within the RRP pilot project ACS stands out due to the exceptionally high proportion of women compared to general data for the ICT field. On the other hand, the proportion of women in higher education study programs at FIS is considerably lower and more consistent with the situation in Slovenia and European

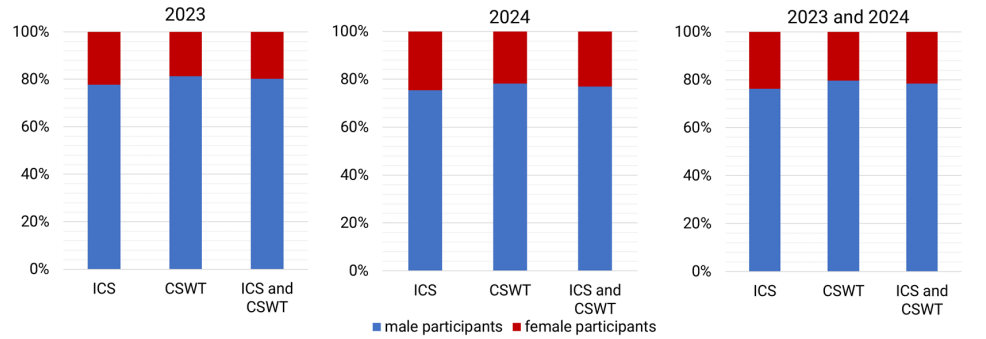

Figure 3. Gender structure of newly enrolled students in higher professional education programs at FIS

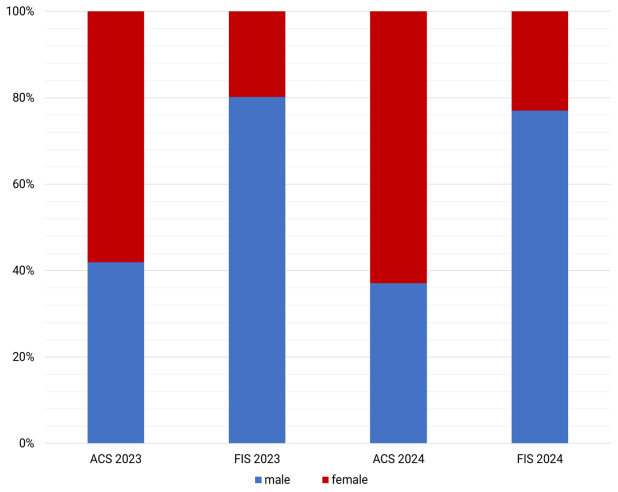

Figure 4. Gender structure of participants in the half-year education programs within the RRP pilot project ACS and of newly enrolled students in higher professional education programs at FIS, 2023 and 2024

countries, but with a slightly higher share of women. Despite the slight increase in the proportion of women between 2023 and 2024, men still represent the majority of students.

Based on the collected data, it is clear, that hypothesis H1 about the majority of men among the participants in the half-year education programs within the RRP pilot project ACS and newly enrolled students in higher education study programs at FIS, in Slovenia and Europe, is only partially confirmed. The RRP pilot project ACS stands out for its high proportion of women participants. This reveals the success of the project in attracting women to the field of advanced computing skills and can serve as an example of good practice for promoting gender equality in these professional programs.

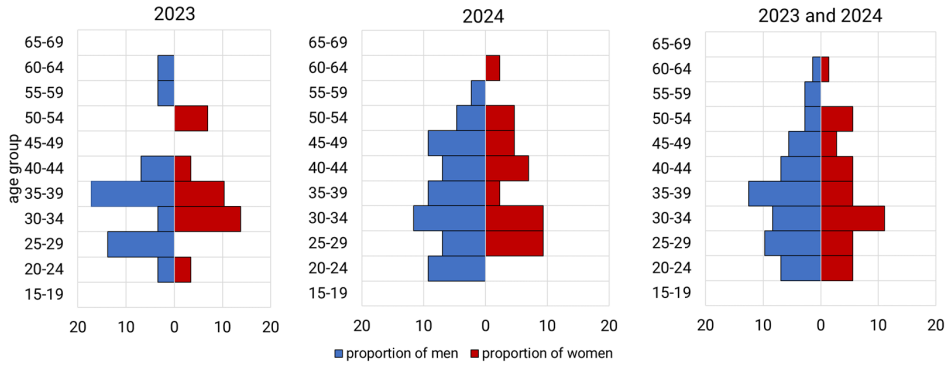

Figure 5. Age structure of participants in the educational field DITIA within the RRP pilot project ACS

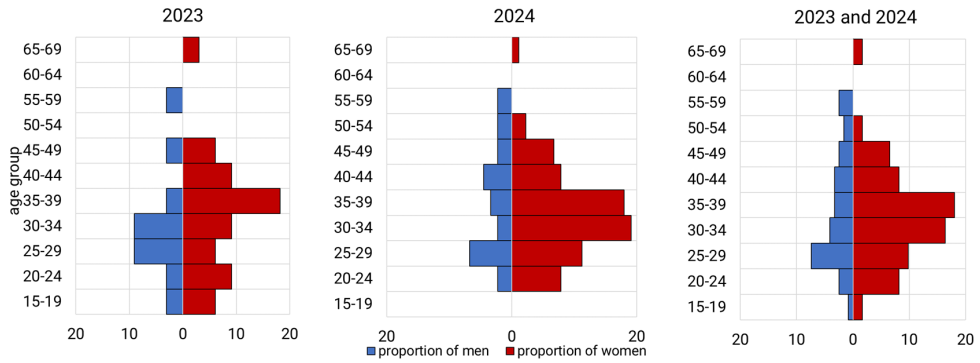

Figure 6. Age structure of participants in the educational field PAD within the RRP pilot project ACS

Related to H2, we then examined the age structure of the enrolled participants in the half-year education within the RRP pilot project ACS, newly enrolled students in higher education study programs at FIS and in Slovenia in the academic years 2022/23 and 2023/24.

As shown in Figure 5, none of the participants in the half-year educational field DITIA were under 20 years old. This is in complete contrast to the higher education study programs, which have the highest proportion of students in the 15-19 and 20-24 age groups (Figure 7). The largest number of participants is in the 35-39 age group. The 25-29, 35-39, and 45-49 age groups have a slightly higher predominance of men, while the 30-34 and 50-54 age groups show a higher predominance of women.

The age pyramid for participants in the half-year educational field PAD (Figure 6) for 2023 shows a slightly higher proportion of participants in the 30-34 and 35-39 age groups, especially among women. The 20-24 and 25-29 age groups also have a considerable share, with a higher percentage of males in

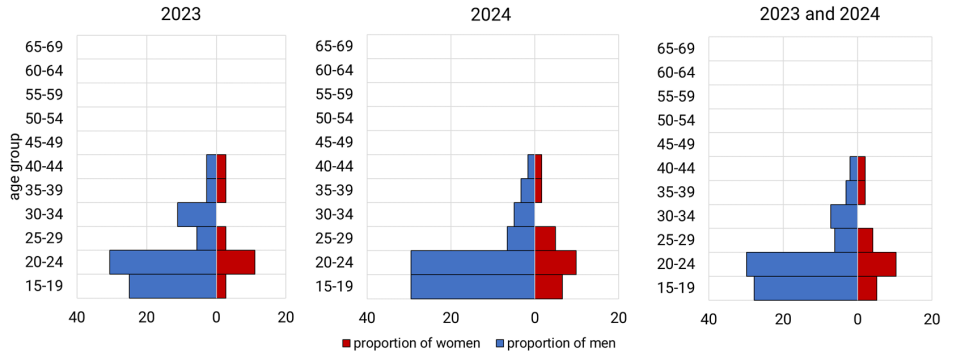

Figure 7. Age structure of students in the higher professional education study program ICS HE at FIS

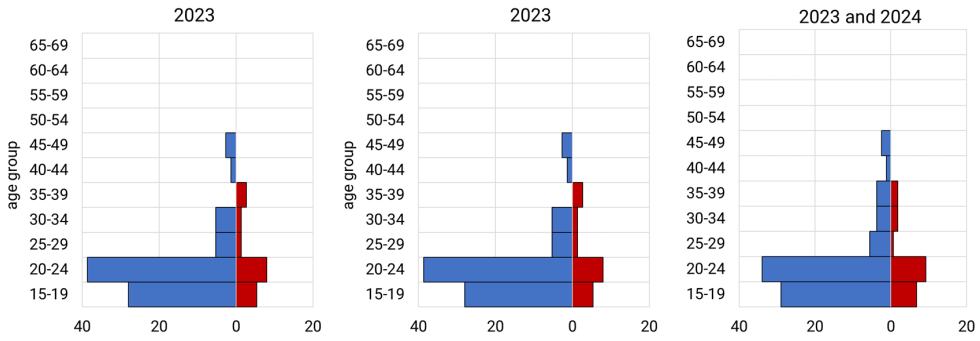

Figure 8 Age structure of students in the higher professional education study program CSWT HE at FIS

the 25-29 age group. In 2024, there is a clear female predominance in almost all age groups. The highest proportions of women are in the 30-34 and 35-39 age groups. The 25-29 age group has a higher share compared to 2023, with more female participants than male. Younger age groups (15-19 and 20-24) and older age groups (55-59 and over) show a lower share of the population compared to the middle age groups. The graphs therefore show the predominance of the middle age group (especially 30-39 years) in the population structure for both years. Certain age groups exhibit gender imbalance, with women generally having a higher share in the middle age groups.

The graphs in Figure 7 show that the largest share of newly enrolled students is in the 15-19 and 20-24 age groups, with men being much more represented

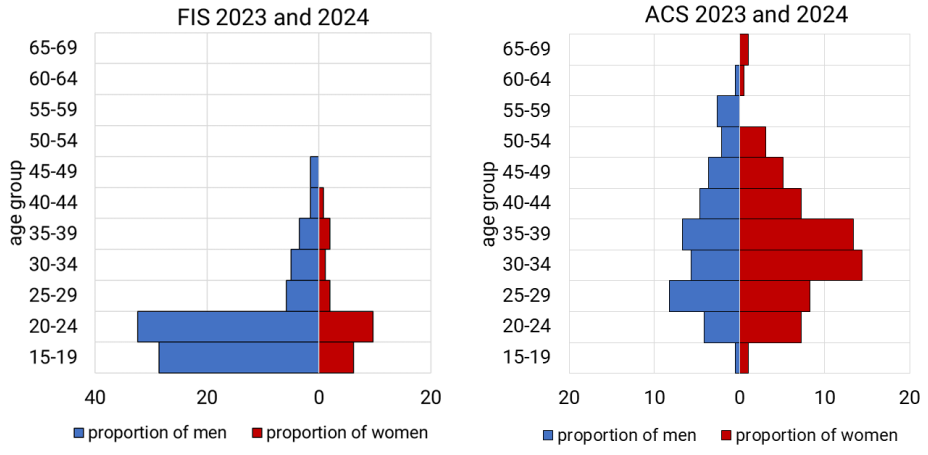

Figure 9. Age structure of newly enrolled students in the higher professional education programs at FIS and of participants in education programs within the RRP pilot project ACS

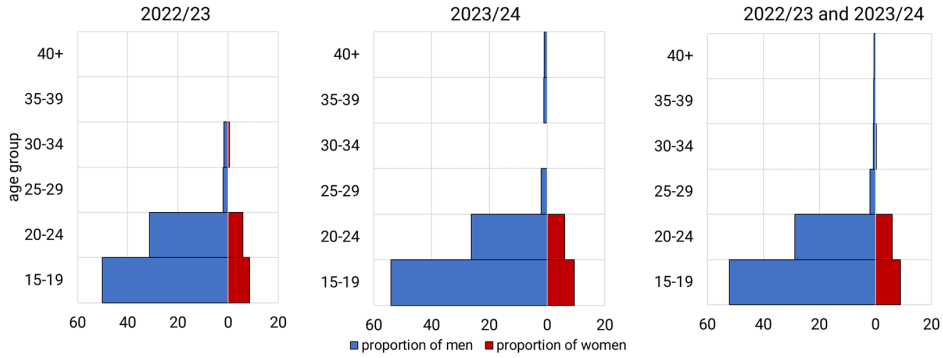

Figure 10. Age structure of newly enrolled students in higher professional study programs in the ICT field for the academic years 2022/23 and 2023/24, Slovenia (source: SORS, 2024)

in both years. The 25-29 age group has a somewhat more balanced proportion between men and women.

When comparing the age pyramids for the RRP pilot project ACS and the age pyramids of newly enrolled students in study programs at FIS, two distinct features can be observed. The first is the evident predominance of men in the student population. The second feature is the majority of students in the 15-19 and 20-24 age groups, which proves, that most students enrol in study programs at FIS directly from high school and/or are in their early twenties. These data are similar to those at the Slovenian level (Figure 10).

The largest proportion of students at FIS is in the 15-19 and 20-24 age groups, which reflects young population. Here again, a gender difference is obvious with a large proportion of male students. This trend continues into the higher age groups, where a larger share of the student population is male. Women are less represented in all age groups. A slightly higher proportion of women is observed in the 20-24 age group. It is important to note that individuals, who have recently completed secondary education, typically enrol in higher education programs; usually at the age of 18 or 19. This case is known as continuous further education.

The graph for the RRP pilot project ACS shows data with significant differences compared to the one for FIS. The majority of participants in the RRP pilot project ACS belong in the range of 25 to 40 years, indicating a somewhat older student population compared to FIS and also a greater age diversity among participants. The RRP pilot project ACS has a more even gender distribution, with more women in the 30-34 and 35-39 age groups. In contrast, the FIS program has a distinctly more male population, with the highest concentration in the 20-24 age group, whereas in the RRP pilot project ACS education programs women predominate. The main finding is that higher professional study programs at FIS primarily attract younger male students, whereas the RRP pilot project ACS attracts a more diverse and somewhat older population of participants.

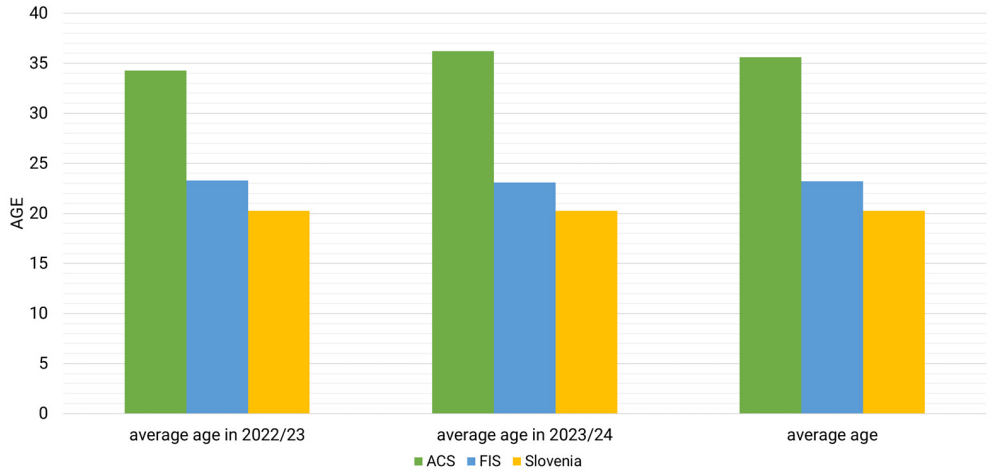

Figure 11. Average age of participants in the RRP pilot project ACS, newly enrolled students in higher education programs at FIS and newly enrolled students in higher education programs in the ICT field in Slovenia (source: SURS, 2024)

In the graphs in Figure 10, which depict the gender ratio at the Slovenian level and for FIS (Figure 8), a similar pattern in the proportion of men and women across different age groups is evident. In addition to these similarities, the differences are apparent for the ACS project, as the age structure is quite different (Figure 7), more dispersed and denser around an average age of 36 years.

Figure 11 shows that the average age of students at FIS for the academic years 2022/23 and 2023/24 does not differ much and is slightly above 23 years. The same is true for Slovenia, but the average age is much lower than for FIS, slightly above 20 years. The average age of newly enrolled students in higher education programs in the ICT field in Slovenia is the lowest among all the groups analysed, at 20.3 years. This indicates a relatively young student population and where the average age of newly enrolled students suggests a direct transition from secondary to tertiary education. The average age of participants in the RRP pilot project ACS is significantly higher than that of the FIS and at the Slovenian level, at 35.6 years. We can conclude that the RRP pilot project ACS attracts older students, whereas newly enrolled students at FIS and in ICT study programs in Slovenia are considerably younger. This confirms hypothesis H2.

Since data for newly enrolled students in higher education programs in the ICT field programs in Europe are not freely available, we could only compare data for all new entrants and those findings are presented below. We still conducted the comparison to identify age differences across European countries. Based on data for Slovenia (Figure 10), where there is a clear predominance of the 15-19 and 20-24 age groups, the figure below shows data for these two age groups.

Following Figure 12, Slovenia (48%) for the 15-19 age group is above the European average (42%), which is calculated from the countries listed in Figure

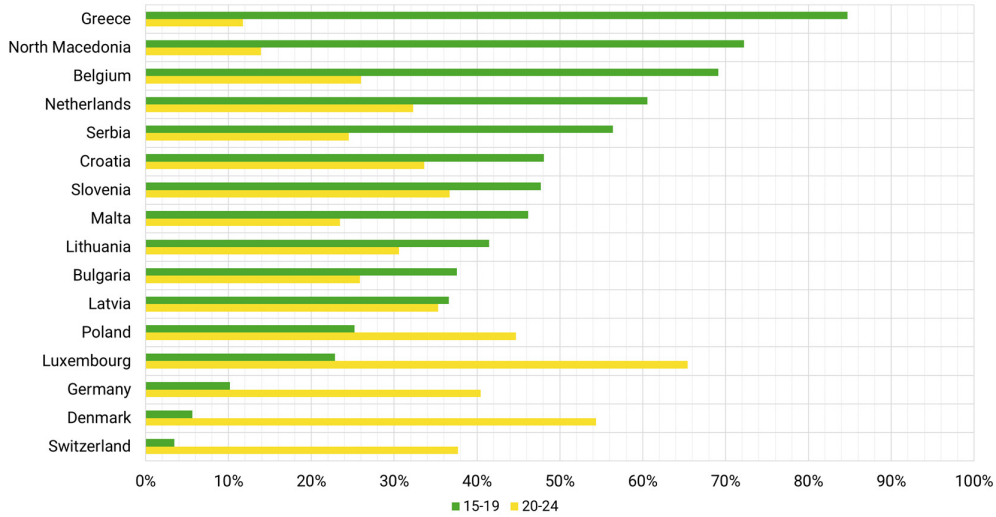

Figure 12. Percentage of newly enrolled students in undergraduate or equivalent professional programs in the age groups 15-19 and 20-24, 2022 (source: Eurostat, 2024)

12. Similarly, for the 20-24 age group, Slovenia (37%) is also above the average (34%) for those countries. This shows that a higher proportion of students in Slovenia enrol immediately after completing high school.

6. Discussion

Based on the collected information, the first hypothesis (H1: Similar to Slovenia and Europe, where men predominantly enrol in higher education study programs in the ICT field, men also predominantly enrol in the half-year education programs within the RRP pilot project "Advanced Computer Skills" and in the higher education study programs at the Faculty of Information Studies in Novo Mesto.) is only partially confirmed.

The data for the RRP pilot project ACS does not support the H1 hypothesis, but instead, it shows that women constitute the majority of participants in the education programs, contrary to the assumption that men would dominate. Specifically, in 2023 and 2024, women represent approximately 60% of all participants in the education programs within the RRP pilot project ACS. This demonstrates the success of the RRP pilot project ACS in attracting women to the field of advanced computing skills, serving as an example of good practice for promoting gender equality in these professional education programs.

On the other hand, H1 is confirmed by the data for higher education study programs at FIS. In the academic years 2022/23 and 2023/24, men constituted the majority of students, although the proportion of women was slightly higher than at the European level. In 2022/23, women made up 20% of the student population at FIS, increasing to 23% in 2023/24. Nevertheless, men still represent 77% of the student population.

The data for Europe and Slovenia in 2022 show an even more pronounced predominance of male students in the ICT study programs. In Europe, men represent 86% of all enrolled students, while in Slovenia, they represent 87%. This indicates that the gender structure of students at FIS is somewhat more balanced than in the broader European context, but still with a significantly higher representation of men.

However, our research does not confirm the "worrying trend" identified by Simonsen & Corneliussen (2020), which states that as the number of women in ICT education increases, the number of men in ICT increases even more, thereby widening the gender gap. Data for Slovenia reveal that over the past 7 years, the CAGR of male students enrolled in ICT programs is 6%, while for women, it is as high as 25%.

The second hypothesis (H2: Participants enrolled in the half-year education programs within the RRP pilot project "Advanced Computer Skills" are, on average, significantly older than students enrolled for the first time in higher education study programs at the Faculty of Information Studies in Novo mesto and on general in higher education study programs in the field of ICT in Slovenia.) is confirmed. The analysis of the age structure of the participants in the RRP pilot project ACS and the newly enrolled students at the FIS shows distinct age differences between these two groups. The average age of participants in the RRP pilot project ACS is significantly higher than the average age of newly enrolled students at FIS. The average age of the RRP pilot project ACS participants is 35.6 years, with the highest proportion of participants in the 30-39 age group. On the other hand, the average age of newly enrolled students at FIS is slightly over 23 years, while in Slovenia, it is slightly over 20 years, indicating a younger population that transitions much more directly from secondary to tertiary education. Lastly, the comparison of enrolments in all higher education programs in Slovenia with other European countries also showed that Slovenia has a more pronounced direct transition from secondary to tertiary education compared to the average for European countries.

7. Conclusion

We have encountered several limitations in our research and data analysis. Data for participants in the half-year education programs within the RRP pilot project ACS are only available for two years since the project has only been running for two years, which limits the possibility of analysing trends over a longer period. In the research and interpretation of the results for Slovenia (SORS data), it is also important to mention that ICT study programs encompass a broader spectrum than just informatics and computer science, which is covered by the higher professional education programs at FIS. Although computer science and informatics predominate, ICT study programs also include data from fields such as telecommunications and digital media. Moreover, even though Eurostat data did not provide data for all European countries, significant deviations in the comparison could still be identified.

Despite the mentioned limitations, the data analysis provides current and interesting insight into the present state of higher education in the ICT field and

allows the identification of differences and key changes in recent years. Our research also shows that the RRP pilot project ACS has managed to attract a larger number of women to its half-year educational programs, which is in contrast to the proportion in higher education study programs at FIS, and as regards ICT study fields also in Slovenia and Europe. Furthermore, we observed that there are distinct age differences, with the participants in the education programs within the RRP pilot project ACS being on average significantly older.

These findings confirm that policies, that aim to attract more women to the ICT field and emphasize lifelong learning, are indeed effective. In addition, they highlight the need to adapt the traditional education system to different groups of students to become more responsive to labour market needs and allow greater inclusion of more heterogeneous social groups.

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Original scientific paper

ANALYSIS OF STUDENT'S ENTREPRENEURIAL INTENTIONS IN BOSNIA AND HERZEGOVINA

Abstract

Entrepreneurship has a deep impact on several components which can affect one another. This paper is going to pay attention to the entrepreneurial intention as dependent variable. The other variables in this cycle are access to finance (A2F), entrepreneurial education (EE), personal attitudes (PA), social norms (SN), perceived behavioural control (PBC). Following the association between A2F and EI, we will see the impact of entrepreneurial education (EE). Influence on education can correlate with the intention of young entrepreneurs. Also, this paper mentions key elements that affect individuals in their decisions to become entrepreneurs. Moreover, personal attitudes (PA) will be investigated as part of the cycle. Attitudes play an important part in decision-making for youths. In addition, attitudes relate to social norms (SN) which together have the supremacy to change people's behaviour, and approach in life. Their attitudes could lead to potential positive or negative opinions about entrepreneurship. The paper gives attention to the perceived behavioural control (PBC) which is a piece of the puzzle in this cycle. The research covers students from several universities in Bosnia and Herzegovina and their responses on this topic through structured questionnaire. Research follows literature of the similar titles and its results and evaluation impact opportunities and possibilities that could be achieved in Bosnia and Herzegovina. Institutions in Bosnia and Herzegovina need to recreate policies and simpler conditions for the future of entrepreneurship in order to increase entrepreneurial intention among students.

Key words: *Entrepreneurship, Entrepreneurial Intention, Access to Finance, Entrepreneurial Education, Personal Attitudes, Social Norms, Perceived Behavioural Control.*

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1. Introduction

Many fields of economy had their part in explaining the field of entrepreneurship. Going into generalization, Jablanka and Stawska introduced entrepreneurship as a phenomenon which covers multi-faces of research with countless academic fields (Malgorzata & Stawska, 2020). As the government start to influence privatization for individual businesses, the cultural environment affects different people in different ways. In many countries, entrepreneurship is part of economic growth. Going through general knowledge, theories, and the importance of finance, the main problem that we face today is the low presence of entrepreneurship in other economies in the world. As some countries recognise entrepreneurial activity as a benefit, others are still in the process of implementing it. The Balkans are one of them. The government should be a big support at the beginning of entrepreneurial development. Failing to step in the early stages of any business can lead to less interest in engaging in this sector of the economy. As Cassar (2004) said at the beginning of any activity important critical part is finances which affect the endurance of a business (Umihanić, Đonlagić, & Piplica, 2016). According to Learner (2009) the government has a positive role in starting an entrepreneurship business.

The development of entrepreneurship was recognized in the European Union. The market will grow with labour, and entrepreneurship is a boost to it. Influence through the educational process has positive outcomes. In addition, to create more new jobs in society European Education Policy (EEP) actively impacts the factors which will make entrepreneurship attractive to young people and their careers (Bičo Ćar, Šestić, Softić, & Stupar, 2019). However, the situation of entrepreneurs in Bosnia and Herzegovina is still in progress to achieve a satisfactory level. The concept of entrepreneurial intention was explained as a conscious awareness of the entrepreneur and conviction by an individual that they intend to set up a new business venture and plan to do so in the future. A person has attention on his special goal which he wants to achieve creating his own idea and executing it (Urban & Ratsimanetrimanana, 2019). On top of that, Ajzen's theory about intention is one of the most popular for the entrepreneurial sector. His definition of entrepreneurial intention was connected with personal attitudes and social norms. The theory explains that behaviour has an impact on intention and behaviour is a general ability which can influence different situations and decisions (Ajzen, 1985).

Every business has to have a planning process which includes finance, behaviour, level of education, and attitudes. However, everything is at some point a risk. Access to finance in many ways brings the problem to the front door of an entrepreneur. Even if finances can be internal (our own money, family, friends) and external (investors, loans, potential clients, partners), it has its pros and cons. Financial resources are the key segment of entrepreneurial intention. However, the government can influence the level of interest. Policies can provide support or block for an individual who has an intention to start or create a business. In this research it will be covered how access to finance affects students in Bosnia and Herzegovina, and what is the impact of entrepreneurship in this country.

Following the literature, many authors interpret that entrepreneurial education affects intention and its impact on finances. Regarding education, new studies show us that Universities are the modern way to improve the skills and awareness for entrepreneurship (Ahmed, Chandran, & Klobas, 2017). Young people who have basic experience and training in entrepreneurial intention should be a real investment. The government or universities should focus on impacting students with many programs related to educational entrepreneurship. Different regions and countries have their impact on social norms and entrepreneurship is one of them. In this paper, we are going to evaluate student perception and the influence of social norms on intention in Bosnia and Herzegovina. However, experience and awareness could bring a whole new recognition of entrepreneurial intention. Through time society adapts to new approaches and new ways of business cycle. Therefore, social norms can be influenced to change their opinion about any kind of new process in the community.

Regarding politics or poor economic position in the country students could see entrepreneurship as hard and difficult to achieve. The effect of society and, the attitudes of others could bring their feelings positively or negatively. Also, we have to consider self-efficacy and abilities to maintain behaviour toward entrepreneurship. Self-efficacy is the belief to perform engagement in business with abilities to control their outcome (Svotwa, Jaiyeoba, Roberts-Lombard, & Makanyeza, 2022). Also, access to finance connected with attitudes will contain abilities and self-efficacy as a common chain leading to entrepreneurial intention. The next figure introduces their significance through research that was proven (Svotwa, Jaiyeoba, Roberts-Lombard, & Makanyeza, 2022). Perceived behaviour control affects students in their will to become an entrepreneur based on other influences such as access to finance, education or social norms. They can directly cause a behavioural attitude toward entrepreneurial intention. A positive attitude toward entrepreneurship will impact a person's behavioural control. Access to finance has a positive relationship with perceived behaviour control. It can happen when a person gets information and all the necessary data about his project, so he can evaluate his chances and progress (Urban & Ratsimanetrimanana, 2019). The main key to success in these circumstances is the possibility to have an educational background. Education has a positive relationship with perceived behavioural control. Knowing how to respond in a decision-making position is a key element of controlling the situation. In addition, it can help a person to control their behaviour and intuition.

The main goal of this study is to evaluate students' opinions about the possibilities and opportunities that entrepreneurship demands. Visual variables and graphic tables will be presented through this research. Certain demographic variables will be a part of comparing results between different groups of students, different faculties, and different departments. Also, we are going to see many conditions about entrepreneurship that exist or are in the process of achieving a satisfied level.

2. Literature review

Entrepreneurship is a modern activity in the world of business. People use their opportunity to gain a profit Shane and Venkataraman (2000) spoke about entrepreneurship as the identification, evaluation, and exploitation of opportunities (Tur & Soriano, 2018). To contribute to the factors that affect intention we have to consider political, economic, and social influences on entrepreneurs. Their motivation is driven by controlling behaviour, attitude toward entrepreneurship, and perception of the norms that society performs (Ajzen, 1991).

Every intention in business needs optimism. Entrepreneurs through their planning process must include financial self-esteem or confidence. Wherever they find their financial confidence, they can continue with their process to perform the execution of the plan (Khazaei & Sadeghi, 2022). Intending to discover their possibilities entrepreneurs are in the middle of a cycle of opportunities and elements of required capabilities. The environment can influence attitudes for difficult procedures, such as culture, nationality, social norms, values or politics. Many countries have different approaches and behaviours for the intention of an entrepreneur (Rusu, 2022).

Entrepreneurs need to establish their decision-making process in very risky ways. Access to finance can be difficult to get. Limitations are the main problem that entrepreneurs face themselves with. Their finance can be provided by many associates. However, research shows us that finance can be internal and external. Both sides have their advantages and disadvantages, but risk is the first used word for entrepreneurs. Without risk, finance would be obstructed which would stop any forward step (Junoh, Hidthiir, & Basheer, 2019). Supporting entrepreneurship with institutional policies for creating new business has to be priority for future economic growth. Entrepreneurship Indicators Programme (EIP) highlighted 2006, main determinants for boosting entrepreneurship. There was six of them: regulatory framework, market conditions, access to finance, creation and diffusion of knowledge, entrepreneurial capabilities, and culture (Anton, 2017).

Some authors through their research show that universities are modern ways to provide needed education for students to improve their awareness and skill set (Ahmed T. C., 2017). Other researchers accept the importance of educational teaching as a positive income for entrepreneurial intention in the future (Bergmann, 2016). Education can easily predict that entrepreneurs will have the intention to create their ideas. Many young people, students, by having courses or educational startups will be more interested in entrepreneurship. When researching new ideas for a business, male and female students are equal in deciding to be entrepreneurs (Rusu, 2022).

Social norms can be defined as guidance to people's behaviour within the community which has different beliefs and is affected by social class, career, age, and environment on a daily basis (Tarapuez-Chamorro, Parra-Hernández, & Gil-Giraldo, 2020). It is crucial to have unity and cohesion in the society. Ajzen (1991) introduced social norms as a reference to pressure and control of behaviour on certain topics or perceptions. An interesting fact about social norms is

that regional tradition is affected by domestic politics and economic situation. That would lead us to the positive or negative position of financial access to entrepreneurship (Tarapuez-Chamorro, Parra-Hernández, & Gil-Giraldo, 2020).

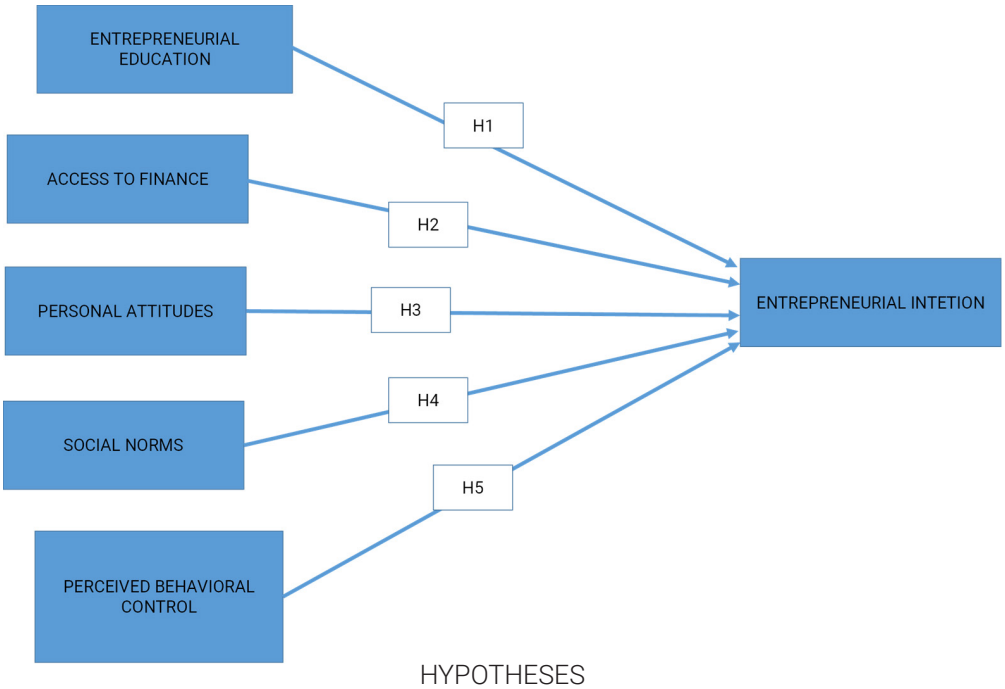
Each person has a different attitude in the life. Attitudes have a key impact on our opinions about something. In this research, attitudes are common words to use when describing entrepreneurs. The perspective of entrepreneurial intention by individual attitude is followed by behavior which a person shows with his characteristics. Entrepreneurship has a specific role with specific attitudes toward entrepreneurial intention (Khazaei & Sadeghi, 2022). Individual behaviour influences entrepreneurial intention with different segments. Through self-esteem, confidence, and perceived persistence, the entrepreneur will conclude which steps to take to make his idea acceptable. Therefore, different attitudes that a person possesses will help us to stabilise our intentions (Khazaei & Sadeghi, 2022). Attitude toward an entrepreneur is defined as "attitude as the tendency to react positively or negatively to an object, person, organization, or moment" (Phan, 2021).

Personal behavioural control (PBC) is the personal ability to perform behaviour according to the expected attitude toward entrepreneurship. It is related to self-awareness, confidence, and motivation to conceptualize activity that an individual person needs for the entrepreneurial intention (Khazaei & Sadeghi, 2022). Perceived behaviour control is the belief about factors that affect behaviours. Through the research of (Wong, Lee, & Leung, 2006) and other authors behaviour control is the main element of entrepreneurial intention. perceived behaviour control is related to the theory of planned behaviour. As planned behaviour intends to show its part when a person has a positive attitude toward his personal assessments, we can say that this model has a positive relationship with behavioural control (Urban & Ratsimanetrimanana, 2019). Moreover, control is a key part of entrepreneurs when they find themselves in difficult positions. Perceived behaviour control refers to the evaluation of a person to perform his attitudes in specific situations. It would mean that access to finance or intention can impact his decision according to an experienced individual (Ajzen, 1991).

3. Methodology

Processing data was conducted with an original basis of entrepreneurship and its components. Questions were constructed with the basics of entrepreneurial intention, access to finance, entrepreneurial education, personal attitudes, social norms, and perceived behavioural control. Topics in the survey covered all areas of research and will be shown in the study through tables, graphs, and figures. The online survey was sent to different universities in Bosnia and Herzegovina and touched different departments. The sample has initiated students from all three study cycles, different generations and even entrepreneurs who tried to become one or already are. Instruction was clear and precise about the topics covered in the research.

A total number of 250 participants from private and public universities expressed their opinions about entrepreneurship and research models. The uni-



HYPOTHESES

H1: Entrepreneurial Education (EE) has a significant influence on Entrepreneurial intention (EI)

H2: Access to Finance (A2F) has a significant influence on Entrepreneurial intention (EI)

H3: Personal Attitudes (PA) has a significant influence on Entrepreneurial intention (EI)

H4: Social Norms (SN) has a significant influence on Entrepreneurial intention (EI)

H5: Perceived Behavioural Control (PBC) has a significant influence on Entrepreneurial intention (EI)

Figure 1. Research model

versities included in the survey were: Private universities (International Burch University (IBU), International University of Sarajevo (IUS), Sarajevo School of Science and Technology (DST), University in Travnik (UNT), Banja Luka College (BLC), College of economics and informatics (VSEIP)). Public universities (University of Sarajevo (UNSA), University of Tuzla (UNTZ), University in Bihać, (UNBI), FINRA University Tuzla (FINRA), and University in Zenica (UNZE)).

After completion of the survey, data was processed with gender percentages and evaluation of all collected information into an Excel file. Demographic measures will be introduced and shown in the research-finding model. Also, all data will be analyzed and any misunderstanding will be fixed. In addition, the evaluation of survey collection will be tested as variables with the Software Package for Social Sciences (SPSS) where we will check the descriptive, correlation, regression, reliability, and validity of all analyses.

4. DATA FINDINGS

Demographic part of the sample was evaluated in the table with gender, age, study program, and university type. We can see results in the table below.

Table 2 clarifies some answers between gender positioning and universities. Since many participants were from private universities in Bosnia and Herzegovina, we can see that private universities invest more into entrepreneurial awareness and intention. However, since 151 students didn't have any touch with entrepreneurship we have to consider that this economic branch needs to be better supported by institutions in B&H.

The questionnaire from the survey shows us that most students didn't have an entrepreneurial experience in any way. Blue colour represents a positive answer, while orange is negative. The conclusion to the next graph is that 66% of 250 students didn't have any previous experience neither with subjects, programs or similar activities about entrepreneurship. The same graph leads us to the attitude that educational institutions and the government have to concentrate more attention on those activities and invest in education about entrepreneurs and their advantages. Question for table 5 was related to the evaluation of the same question: Have you had any entrepreneurial experience up until now? Here is a graphical presentation of the data:

Continuing with the analysis, reliability was tested and the results were mostly positive. Since Entrepreneurial education (EE) was first in line, Cronbach's alpha

Table 1. Demographics of sample

VARIABLE	PERCENTEGES
GENDER	
MALE	48,4%
FEMALE	51,6%
AGE(MEAN VALUE)	26,32
STUDY PROGRAM	
IT	15,4%
ECONOMICS AND MANAGEMENT	18%
PEDAGOGY AND PSYCHOLOGY	20,4%
OTHERS	45,2%
UNIVERSITY TYPE	
PUBLIC	28%
PRIVATE	72%

Table 1. Experience between Gender and University type

Category		Yes	No	Total
Gender	Male	55	66	121
	Female	44	85	129
Total		99	151	250
Type of University	Private	78	102	180
	Public	21	49	70
Total		99	151	250

was 0,518. Even if the score is not above 0,6 this variable is quite questionable and can be used even if it is poor (Remeikiene, 2013) Next in line are personal attitudes (PA) and social norms (SN). PA score was 0,908 which is a perfectly reliable measure and SN was acceptable with Cronbach alpha of 0,740. However, even if the data wasn't excellent, we can use the data as a positive outcome.

Perceived behavioural control (PBC) had a flawless reliability score of 0,900. The same was true with the entrepreneurial intention (EI) 0,958. Confirmed as good data was access to finance (A2F) with Cronbach alpha of 0,706. The measures, even if not in the same shape can be used to interpret the trustworthiness of data. In table 6, we can see the visual reliability of hypothesis items and Cronbach alpha results.

After testing the reliability of variables, a change in items was made. After evaluation of social norms which rate was 0,677, we deleted one Cronbach alpha item to get the best outcome. The question was: Entrepreneurship is more a male than a female thing. Also, the same approach was used with access to finance where one item of Cronbach alpha was deleted so that we can get 0,706 as represented in the table below.

With Table 4 interpretation, a validity test was divided into convergent and discriminant. As we can see, entrepreneurial education has moderate convergent

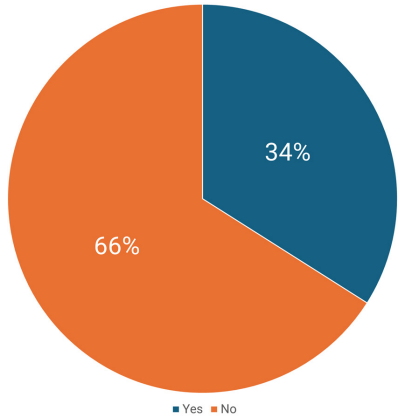


Figure 2. Entrepreneurial experience of students in B&H

Table 3. Reliability construct

Variables	Items	Cronbach alpha
EE	2	0,518
PA	6	0,908
SN	9	0,740
PBC	7	0,900
EI	7	0,958
A2F	7	0,706

with personal attitudes with a 0,454 score. That would mean their relationship is related to each other. Form other side, access to finance and entrepreneurial education are not highly related. Their connection isn't that much close as their score is 0,210. The same is true with personal attitudes and perceived behavioural control or entrepreneurial intention. They are relatively related. Discriminant social norms do not have much of a connection with personal attitudes. However, in the upcoming analysis, more details will be covered regarding correlation and regression and the relationship between all variables.

Table 5 represent us correlation between dependent variable entrepreneurial intention (EI) and other independent variables. With the correlation analysis we can see that all variables are statistically significant with EI, expect social norms which p-value is higher the 0,05 with 0,267. Evaluation of the regression analysis is in the table 6.

As we can see the R-value is 0,821 which indicates that 82% of the variance

Table 4. Validity

Variable	Convergent Validity	Discriminant Validity	Interpretation
EE	PA = 0,454	A2F = 0,210	Solid convergent, good discriminant
PA	PBC = 0,603 EI = 0,608	SN = 0,140	Good convergent, good discriminant
SN	A2F = 0,271	EI = 0,071	Solid convergent, strong discriminant
PBC	EI = 0,796	SN = 0,134	High convergent, Solid discriminant
EI	PA =0,608 PBC = 0,796	SN = 0,071	Strong convergent, good discriminant
A2F	SN = 0,271 PBC = 0,429 EI =0,430	EE = 0,210	Solid convergent, Solid discriminant

Table 5. Correlation between EI and other variables

		EE	PA	SN	PBC	EI	A2F
EI	Pearson Correlation	.304**	.608**	.071	.796**	1	.430**
	Sig. (2-tailed)	<.001	<.001	.267	<.001		<.001
	N	250	250	250	250	250	250

in the dependent variable is explained by the variance in the independent variables. Therefore, 67% of Adjusted R Square interprets a good relationship between independent and dependent variables, and 67% of the variance in the dependent variable (EI) is explained by the independent variables adjusted for additional added variables. The higher percentage the better. ANOVA model indicates a statistically significant (p< 0,001) model. In the next table, the coefficient will be explained.

If entrepreneurial education changes by one unit, then the dependent variable will increase by 0.005 units. This impact is not statistically significant with a p-value greater than 0,05. If personal attitudes change by one unit then the dependent variable will increase by 0.242, and this impact is statistically significant as indicated by the p–value of 0.001 being lower than 0,05. If social norms change by one unit, then the dependent variable will decrease by 0.144.

Furthermore, going with the perceived behavioural control which changes by one unit, the dependent variable entrepreneurial intention will increase by 0,837. So, when PBC changes by one unit, EI will increase. These two variables are statistically significant as the p-value is 0,001. the same situation is with access to finance. If we increase access to finance by unit, the dependent variable will increase by 0,230 and this impact is statically significant since p<0,003. As shown in the table, (personal attitudes (p<0,001), perceived behavioural control (p<0,001), and access to finance (p<0,003) are statistically significant with the dependent variable EI and we accept them, while SN and EE are rejected. It means as these three variables increase, entrepreneurial intention will increase too. Data from the tables above represent hypothesis testing for five variables from the research model shown previously:

H1: Entrepreneurial Education (EE) is not statistically significant on Entrepreneurial Intention (EI)

H2: Access to Finance (A2F) is statistically significant on Entrepreneurial Intention (EI)

H3: Personal Attitudes (PA) is statistically significant on Entrepreneurial Intention (EI)

H4: Social Norms (SN) is not statistically significant on Entrepreneurial Intention (EI)

H5: Perceived behavioural control (PBC) is statistically significant on Entrepreneurial Intention (EI)

Table 6. Regression analysis

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.821	.674	.667	1.0868983636
a. Predictors: (Constant), A2F, EE, SN, PA, PBC				

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	594.827	5	118.965	100.703	<.001[b]
	Residual	288.249	244	1.181		
	Total	883.076	249			

a. Dependent Variable: EI

b. Predictors: (Constant), A2F, EE, SN PA, PBC

Coefficients[a]

Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-1.157	.411		-2.815	.005
	EE	.005	.049	.004	.092	.927
	PA	.242	.058	.203	4.159	<.001
	SN	-.144	.075	-.077	-1.908	.058
	PBC	.837	.065	.630	12.887	<.001
	A2F	.230	.078	.123	2.955	.003

a. Dependent Variable: EI

5. Discussion

Analysing the hypothesis of entrepreneurial intention, we introduce tables with the connection between hypotheses one, two, three, four, and five. Since all of them want to prove the significance between five variables (EE, PA, SN, PBC, and A2F) and dependent variable EI. Different factors affected the given results. Following the coefficient of Table 6, we noticed statistically significant variables between three out of five. Those three are personal attitudes, perceived behavioural control, and access to finance since their significant level is below 0,05. Entrepreneurial education and social norms are rejected as they are not significant with entrepreneurial intention. Analysing results from the literature, Linan (2009) and Arnaut (2022), show us questions used for the mentioned variables. Entrepreneurial education results were tested by Zhao (2005) and tested by (Remeikiene, 2013). Remeikiene scale results in regression analysis

were slightly better with 0,679 than our Cronbach alpha for EE with 0,518. That leads us to the conclusion that our model can be used even if it is lower than previous research, but the model is questionable between EE and EI. However, the coefficient is not significant as the EE p-value is above 0,05. These factors can seriously affect students in Bosnia and Herzegovina and their approach to this economic branch.

The relationship between personal attitudes and entrepreneurial intention in the regression study proved their statistical significance as the p-value is 0,001. In addition, even if B is 0,242, the impact of personal attitudes has an effect on entrepreneurial intention. Krueger (2000) explains that attitudes have an important effect on entrepreneurial intention. Questions were taken from Linan and Chen (2009) as support between those two variables.

On the other side, social norms have their impact on the hypothesis data with entrepreneurial intention. Following the results of regression analysis, we conclude that social norms are not statistically significant with EI. The results show that if social norms increase their unit by one, the entrepreneurial intention will decrease. The B value is -0,144 and the p-value is 0,058 as we mentioned in the data findings. Krueger (2000) proved the same relationship between those variables. The results of social norms in the article by Tarapuez-Chamorro, Parra-Hernández, & Gil-Giraldo (2020) explain the possibility of influencing intention in the future since society can affect people's approach to entrepreneurship. However, in lower development countries social norms will lose their capacity to explain entrepreneurial intention. This statement is connected with Bosnia and Herzegovina since support for entrepreneurship is not on the wanted level, and our hypotheses proves this relationship. The same results are found in the Teixeira et al. (2018)

Perceived behavioural control was a significant variable with independent entrepreneurial intention. On top of that, if behavioural control increases, Entrepreneurial intention will increase as well. As we found data significance we can confirm a positive relationship between those two variables. The beta value was the best among all variables with 0,837, which indicates a very good explanation of EI. Results were accepted form the authors (Remeikiene, 2013).

The last independent variable was access to finance. Since the p-value in the coefficients table was 0,003 we can say that access to finance significantly influences entrepreneurial intention. even if the B value is 0.230, we can conclude a positive relationship, as we explained in the data findings. Finance is an important part of entrepreneurship and evidence of literature was found in Urban & Ratsimanetrimanana (2019) where we have significance between A2F and EI for both genders' sides. In the model summary table of all six variables, the R-value is 0,821 and indicates 82,1% of the variance in the independent variables which explains the variance of the dependent variable. R Square with 67,4% explains a good relationship between variables and gives us positive insight.

6. Conclusion

The summary of our research model did explain how we used variables as predicted relationships. Entrepreneurial intention as the dependent variable for entrepreneurship as a whole study area is a top variable which defines the rest of the variables and their influence on EI, while access to finance was our main goal to interpret since there are not many financial topics connected to this research in Bosnia and Herzegovina. Moreover, Bosnia and Herzegovina have a lack of information about entrepreneurship among youths and the development of this economic branch. In addition, our research investigated many different areas which contribute to this topic and gathered them as strengths of this model.

Table 7. Summary of tested hypotheses

H1: Entrepreneurial Education (EE) has significant influence on Entrepreneurial intention (EI)	REJECTED
H2: Access to Finance (ATF) has significant influence on Entrepreneurial Intention (EI)	ACCEPTED
H3: Personal Attitudes (PA) has significant influence on Entrepreneurial intention (EI)	ACCEPTED
H4: Social Norms (SN) has significant influence on Entrepreneurial Intention (EI)	REJECTED
H5: Perceived Behavioural Control (PBC) has significant influence on Entrepreneurial Intention (EI)	ACCEPTED

The hypotheses were explained with tables and compared with the results. Walking through the research steps we manage to show the hypothesis acceptance or rejection. As we can see from table 7 entrepreneurial intention had three hypotheses accepted and two rejected. The influence of social norms and entrepreneurial education didn't have statistical significance with dependent variable entrepreneurial intention. The following results of other researchers' social norms didn't match with the intention which indicates that they do not explain each other very well. Also, since more participants from Bosnia and Herzegovina (66%) didn't have any experience or education in entrepreneurship before, we can assume that the need for investing in entrepreneurial activities has to be on a better level. Going through different stages of the requirement for increasing intention among youth, institutions in Bosnia and Herzegovina need to recreate policies and simpler conditions for the future of entrepreneurship. Potential in this economic branch can improve the growth of unemployed people in Bosnia and Herzegovina.

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Nino Alić[1] *Professional paper*

ANALYSIS OF GOOD PRACTICES IN WORKPLACE ATTENDANCE MONITORING SYSTEMS: A LITERATURE REVIEW

Abstract

Workplace attendance monitoring systems have become integral to modern organizational management. While these systems offer potential benefits, their implementation requires careful consideration of various factors: objectives with employee privacy, fairness, and engagement concerns. This literature review synthesizes existing research and best practices for effectively designing and implementing workplace attendance monitoring systems. This literature review aims to provide a comprehensive analysis of good practices for workplace attendance monitoring systems. This literature review employed a systematic search and analysis of existing research on workplace attendance monitoring systems. Databases including Google Scholar, PubMed, and Web of Science were searched using relevant keywords. The findings of the included studies were thematically analyzed to identify best practices and key considerations for effective attendance monitoring systems. The literature review yielded several key findings regarding best practices for workplace attendance monitoring systems: Accuracy and Reliability: Automated systems using technologies like biometric scanning or proximity cards offer superior accuracy compared to manual self-reporting systems, reducing errors and potential fraud. Transparency and Communication: Clear communication of the system's purpose, operation, and privacy safeguards is critical for building trust and acceptance among employees. Privacy Considerations: Organizations must adopt privacy by design principles. Continuous Evaluation: Regular assessment of the system's effectiveness and impact on employees is necessary for improvement. These findings underscore the need for a multifaceted approach to implementing workplace attendance monitoring systems.

Key words: *Workplace Attendance Monitoring, Employee Privacy, Attendance Management Systems, Workplace Surveillance, Organizational Behavior.*

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1. Introduction

Workplace attendance monitoring systems have become integral to modern organizational management, driven by advances in technology and the need to control labor costs, optimize productivity, and ensure compliance with regulations. While these systems offer potential benefits, their implementation requires careful consideration of various factors to balance business objectives with employee privacy, fairness, and engagement concerns. This literature review aims to synthesize existing research and best practices for effectively designing and implementing workplace attendance monitoring systems.

The rapid advancement in technology has revolutionized how organizations monitor workplace attendance. Traditional manual attendance systems have given way to automated and biometric systems, which promise increased accuracy, reduced fraud, and improved compliance. However, the implementation of these systems is not without challenges. Organizations must navigate issues related to employee privacy, data security, and the ethical implications of constant monitoring.

Workplace attendance monitoring is essential for maintaining productivity and ensuring regulatory compliance. Accurate attendance records can help in optimizing labor costs, identifying absenteeism patterns, and ensuring fair compensation. However, the methods and technologies used to monitor attendance can significantly impact employee morale and trust.

The methodological approach is to search databases for matching keywords. The search filters applied are keywords relevant to the topic, and a filter of freely available texts was selected. a filter related to the year of publication 2010 - 2024 was also applied.

This literature review employed a systematic search and analysis of existing research on workplace attendance monitoring systems. Databases including Google Scholar, PubMed, and Web of Science were searched using relevant keywords. Studies examining the design, implementation, and impact of attendance monitoring systems in various organizational contexts were included. Both qualitative and quantitative research were considered to provide a comprehensive understanding of the topic. The findings of the included studies were thematically analyzed to identify best practices and key considerations for effective attendance monitoring systems.

This research aims to identify the key components of monitoring systems. Examine the importance of transparency, privacy, and fairness in system implementation. Explore how attendance monitoring can support employee well-being and engagement. Highlight the need for ongoing evaluation and refinement of attendance monitoring systems.

This literature review aims to provide a comprehensive analysis of good practices for workplace attendance monitoring systems. Specifically, the review aims to:

- Identify the key components of accurate and reliable attendance monitoring systems.
- Examine the importance of transparency, privacy, and fairness in system implementation.
- Explore how attendance monitoring can support employee well-being and engagement.
- Highlight the need for ongoing evaluation and refinement of attendance monitoring systems.

The literature review key findings regarding best practices for workplace attendance monitoring systems:

- **Accuracy and Reliability**: Automated systems using technologies like biometric scanning or proximity cards offer superior accuracy compared to manual self-reporting systems, reducing errors and potential fraud. For instance, the use of biometric systems has shown significant accuracy in capturing attendance data (Verma, Neetu 2016).
- **Transparency and Communication**: Clear communication of the system's purpose, operation, and privacy safeguards is critical for building trust and acceptance among employees. Studies emphasize the importance of informing employees about how their data will be used and protected (Shrivastava, 2023).
- **Privacy Considerations**: Organizations must adopt privacy by design principles, minimizing data collection and ensuring robust security measures to comply with data protection regulations. This approach not only ensures compliance but also enhances employee trust (Vorakulpipat, Chalee 2021).
- **Fairness and Consistency**: Attendance policies and monitoring must be equitably applied across the workforce, with training for managers to address issues constructively. Ensuring fairness and consistency can mitigate feelings of unfair treatment among employees (Patel, Aashish, Ravi 2017).
- **Employee Well-being**: Attendance monitoring should aim to support employee well-being by identifying root causes of absenteeism and promoting work-life balance. Systems that consider employee well-being can lead to improved morale and productivity (Munir, Fehmidah 2008).
- **Continuous Evaluation**: Regular assessment of the system's effectiveness and impact on employees is necessary for ongoing refinement and improvement. Continuous evaluation helps in adapting the system to changing organizational needs and employee concerns (Ardebili, Afshin 2023).

These findings underscore the need for a multifaceted approach to implementing workplace attendance monitoring systems that balance organizational objectives with ethical and employee-centered considerations.

Literature review table (Table 1) is summarizing the key points from each of the mentioned studies.

Table 1. Literature review table summarizing the key points

No.	Title	Summary	Source
1.	Design of digital workplace stress-reduction intervention systems: Effects of intervention type and timing	Investigates the effects of different types and timing of stress-reduction interventions in digital workplaces. Found that user preferences for intervention type and timing significantly impact engagement and stress reduction.	Howe, E., Suh, J., Morshed, M. B., McDuff, D., Rowan, K., Hernandez, J., Abdin, M. I., Ramos, G., Tran, T., & Czerwinski, M. P. (2022). Design of Digital Workplace Stress-Reduction Intervention Systems: Effects of Intervention Type and Timing. CHI Conference on Human Factors in Computing Systems. https://doi.org/10.1145/3491102.3502027
2.	The Impact of Biometric Time and Attendance System on Workforce Management	Examines how biometric attendance systems affect workforce management, showing positive impacts on workforce efficiency and reduced absenteeism.	Suale, Yakubu & Mohammed Kamil, Naail & Musah, Mohammed Borhandden & Zakari, Mariama & Farah, Adnan. (2023). The Impact of Biometric Time and Attendance System on Workforce Management Outcomes: The Moderating Role of Managerial Commitment in the Service Sector in Northern Ghana. International Journal of Business and Technology Management. 5. 442-455. 10.55057/ijbtm.2023.5.3.37.
3.	A Comparative Study and Analysis of Various Attendance Monitoring Systems and Technologies	Compares different attendance monitoring technologies (e.g., RFID, biometric systems) and their effectiveness in various settings, concluding that no single technology is superior in all aspects.	Jothi, A. & Satapathy, Sandeep & Shruti, Mishra. (2023). A Comparative Analysis of Various Methods for Attendance Framework Based on Real-Time Face Recognition Technology. 10.1007/978-981-19-7615-5_40.
4.	IoT-Based RFID Attendance Monitoring System of Students using Arduino ESP8266 & Adafruit	Describes the design and implementation of an RFID-based student attendance system using IoT components like Arduino ESP8266 and Adafruit, emphasizing real-time monitoring capabilities.	Shrivastava, Anurag & Prasad, S & Yeruva, Ajay & Mani, P & Nagpal, Pooja & Chaturvedi, Abhay. (2023). Cybernetics and Systems IoT Based RFID Attendance Monitoring System of Students using Arduino ESP8266 & Adafruit.io on Defined Area IoT Based RFID Attendance Monitoring System of Students using Arduino ESP8266 & Adafruit.io on Defined Area. Cybernetics and Systems. 10.1080/01969722.2023.2166243.
5.	Analyzing the Efficiency of Web Tracking Systems in Ensuring Privacy Compliance: A Comparative Study	Evaluates web tracking systems for their compliance with privacy regulations, identifying key strengths and weaknesses in current systems.	Taiwo, Michael & Sakpere, Wilson & Adediran, Emmanuel. (2024). Analyzing the Efficiency of Web Tracking Systems in Ensuring Eprivacy Compliance: A Comparative Study. 06. 312-318. 10.35629/5252-0604312318.
6.	Employee Attendance Management System Using Fingerprint Recognition	Discusses the use of fingerprint recognition for managing employee attendance, highlighting increased accuracy and security over manual systems.	Rivera, Ronald. (2021). Enhanced Attendance Monitoring System using Biometric Fingerprint Recognition. International Journal of Recent Technology and Engineering. 9. 1-4. 10.35940/ijrte.E5070.019521.
7.	Attendance management system for the educational sector: critical review	Critically reviews various attendance management systems used in educational settings, identifying common challenges and proposing improvements.	Arif, Zainab & Ali, Nabeel & Al-Mhiqani, Mohammed & Zakaria, Nurul. (2018). Attendance Management System for Educational Sector: Critical Review. 7. 60-66.
8.	Wireless Electronic Notice Board and Attendance Monitoring System	Proposes a system combining electronic notice boards with attendance monitoring, utilizing wireless technology to improve communication and tracking.	Nivas, D & Kathirvelu, Murugan & Niranjana, M & Krishnaraj, R & Dhanasekar, J. (2022). Wireless Electronic Notice Board and Attendance Monitoring System. 1-6. 10.1109/C2I456876.2022.10051245.
9.	Design of A blockchain-based employee attendance system	Investigates the use of blockchain technology for employee attendance systems, emphasizing transparency and tamper-proof records. Examines the use of blockchain technology to create a secure and tamper-proof employee attendance system. This approach ensures transparency and reliability in attendance records. Revisits the use of blockchain for employee attendance, emphasizing the system's ability to prevent data tampering and ensure reliable attendance records.	Ardina, Hasna & Nugraha, I. (2019). Design of A Blockchain-based Employee Attendance System. 1-4. 10.1109/ICISS48059.2019.8969840.

10.	A comprehensive and systematic literature review on employee attendance management systems based on cloud computing	Reviews cloud-based attendance management systems, discussing benefits like scalability and real-time data access. Provides an extensive review of cloud-based attendance management systems, highlighting their scalability, real-time data access, and overall benefits.	Ardebili, A., Latifian, A., Aziz, C. F., BinSaeed, R. H., Alizadeh, S. M., & Kostyrin, E. V. (2023). A comprehensive and systematic literature review on the employee attendance management systems based on cloud computing. Journal of Management & Organization, 29(4), 679–696. doi:10.1017/jmo.2022.63
11.	Using gamification for solving resource allocation and serving in employee attendance tracking system	Explores the application of gamification in attendance tracking to enhance employee engagement and resource allocation efficiency.	Cheng, C., & Chau, C. L. (2022). Gamification-based intervention for enhancing team effectiveness and coping flexibility: Randomized controlled trial. Frontiers in psychiatry, 13, 941252. https://doi.org/10.3389/fpsyt.2022.941252
12.	Automated Employee Attendance and Tracking System Using RFID in Mobile Phones	Details an RFID-based system for tracking employee attendance via mobile phones, highlighting automation and ease of use.	Ishaq, Kashif & Bibi, Samra. (2023). IoT Based Smart Attendance System Using Rfid: A Systematic Literature Review.
13.	This study paper investigates the role of attendance systems ... employee performance; and positive psychology	Examines the impact of attendance systems on employee performance and positive psychology, emphasizing the importance of regular attendance for organizational success.	Santhose, S. S., & Anisha, B. (2023). Psychological improvement in Employee Productivity by Maintaining Attendance System using Machine Learning Behavior. Journal of community psychology, 51(1), 270–283. https://doi.org/10.1002/jcop.22902
14.	This paper proposes the use of all possible authentication factors, called comprehensive-factor authentication	Proposes a comprehensive-factor authentication system incorporating multiple authentication methods for enhanced security.	Vorakulpipat, C., Pichetjamroen, S., & Rattanalerdnusorn, E. (2021). Usable comprehensive-factor authentication for a secure time attendance system. PeerJ. Computer science, 7, e678. https://doi.org/10.7717/peerj-cs.678
15.	Dynamic monitoring of RN strain could identify when intervention is needed	Suggests that continuous monitoring of registered nurse (RN) strain can help identify when interventions are necessary to prevent burnout and improve patient care.	Womack, D. M., Hribar, M. R., Steege, L. M., Vuckovic, N. H., Eldredge, D. H., & Gorman, P. N. (2020). Registered Nurse Strain Detection Using Ambient Data: An Exploratory Study of Underutilized Operational Data Streams in the Hospital Workplace. Applied clinical informatics, 11(4), 598–605. https://doi.org/10.1055/s-0040-1715829
16.	This work combines masked face recognition with a thermal imaging camera for use as an automated attendance system	Describes a system combining facial recognition with thermal imaging to automate attendance and monitor health metrics like body temperature.	Tsai, T. H., Lu, J. X., Chou, X. Y., & Wang, C. Y. (2023). Joint Masked Face Recognition and Temperature Measurement System Using Convolutional Neural Networks. Sensors (Basel, Switzerland), 23(6), 2901. https://doi.org/10.3390/s23062901
17.	A comprehensive mobile application tool for disease surveillance, workforce management, and supply chain management for Malaria Elimination Demonstration	Discusses a mobile application designed for comprehensive disease surveillance, workforce, and supply chain management in malaria elimination projects.	Rajvanshi, H., Jain, Y., Kaintura, N., Soni, C., Chandramohan, R., Srinivasan, R., Telasey, V., Bharti, P. K., Jain, D., Surve, M., Saxena, S., Gangamwar, V., Anand, M. S., & Lal, A. A. (2021). A comprehensive mobile application tool for disease surveillance, workforce management and supply chain management for Malaria Elimination Demonstration Project. Malaria journal, 20(1), 91. https://doi.org/10.1186/s12936-021-03623-3
18.	The data on absenteeism was collected from the employees' attendance system of the hospital's nursing and staff department	Analyzes absenteeism data from hospital staff, identifying key factors contributing to absenteeism and proposing mitigation strategies.	Sadeghniiat-Haghighi, K., Najafi, A., Eftekhari, S., & Tarkhan, S. (2021). Insomnia and its association with absenteeism: A cross-sectional study among Iranian nursing team. Sleep science (Sao Paulo, Brazil), 14(4), 305–310. https://doi.org/10.5935/1984-0063.20200106
22.	Management, health, and safety management, employee attendance monitoring, automatic border control, and face scan payment	Discusses various applications of facial recognition technology, including attendance monitoring, border control, and payment systems.	Hwang, R. H., Lin, J. Y., Hsieh, S. Y., Lin, H. Y., & Lin, C. L. (2023). Adversarial Patch Attacks on Deep-Learning-Based Face Recognition Systems Using Generative Adversarial Networks. Sensors (Basel, Switzerland), 23(2), 853. https://doi.org/10.3390/s23020853

2. Detailed Discussion

Accuracy and Reliability

Automated attendance systems have significantly improved the accuracy and reliability of attendance data. Technologies such as biometric scanning, RFID, and mobile-based systems have reduced the chances of errors and fraud associated with manual reporting. Biometric systems, in particular, use unique physiological characteristics such as fingerprints, facial recognition, or iris scans to verify identity, making them highly reliable (Verma, Neetu 2016).

Case Study: Biometric Attendance System in a Healthcare Setting

A study conducted in a healthcare setting demonstrated the effectiveness of biometric systems in reducing absenteeism and improving punctuality. The implementation of a fingerprint-based attendance system resulted in a 15% reduction in absenteeism over six months (Howe, Esther, Jina 2022).

Transparency and Communication

Transparency in the implementation of attendance monitoring systems is crucial for gaining employee trust. Clear communication about the purpose, operation, and data handling practices can alleviate concerns about privacy and misuse of data. Organizations should provide detailed information about how the system works, what data is collected, how it is stored, and who has access to it (Shrivastava, Anurag 2023).

Best Practice: Employee Training and Workshops

Conducting training sessions and workshops can help employees understand the benefits of the attendance monitoring system and how it affects their day-to-day activities. This approach has been shown to increase acceptance and reduce resistance to new technologies.

Privacy Considerations

Privacy is a significant concern when implementing attendance monitoring systems. Organizations must ensure that the systems comply with data protection regulations such as the General Data.

Protection Regulation (GDPR) in Europe or the California Consumer Privacy Act (CCPA) in the United States. Privacy by design principles should be adopted, which means integrating privacy into the system's architecture from the beginning (Vorakulpipat, Chalee 2021).

Example: Data Minimization and Security

Data minimization involves collecting only the data necessary for attendance monitoring and implementing robust security measures to protect this data. Encryption, access controls, and regular audits are essential components of a secure attendance monitoring system.

Fairness and Consistency

Fair application of attendance policies is vital for maintaining employee morale and trust. The system should be applied consistently across all levels of the organization, and managers should be trained to handle attendance issues constructively. Inconsistent application can lead to perceptions of favoritism and unfair treatment (Patel, Aashish, Ravi 2017).

Training Programs for Managers

Organizations should invest in training programs for managers to ensure they are equipped to address attendance-related issues fairly and constructively. This includes training on how to use the attendance data to identify patterns and address underlying issues without penalizing employees unfairly.

Employee Well-being

Attendance monitoring systems should not be used solely as a tool for enforcement but also to support employee well-being. Identifying patterns of absenteeism can help organizations address issues such as burnout, work-life balance, and personal problems. Proactive measures to support employee well-being can lead to improved morale and productivity (Munir, Fehmidah 2008).

Initiatives to Promote Work-Life Balance

Implementing initiatives such as flexible working hours, remote work options, and wellness programs can help address the root causes of absenteeism. Organizations that prioritize employee well-being are likely to see a positive impact on attendance and overall productivity.

Continuous Evaluation

Continuous evaluation of the attendance monitoring system is necessary to ensure its effectiveness and address any emerging issues. Regular assessments, feedback from employees, and analysis of attendance data can help organizations refine and improve the system over time (Ardebili, Afshin, 2023).

Feedback Mechanisms

Implementing feedback mechanisms such as surveys and focus groups can provide valuable insights into how the system is perceived by employees and identify areas for improvement. Continuous improvement ensures that the system remains relevant and effective in achieving its objectives.

3. Conclusion

In conclusion, the effective implementation of workplace attendance monitoring systems requires a balanced approach that considers accuracy, transparency, privacy, fairness, and employee well-being. By adopting best practices and continuously evaluating the system, organizations can ensure that these systems contribute positively to both organizational goals and employee satisfaction.

The literature review yielded several key findings regarding best practices for workplace attendance monitoring systems:

Accuracy and Reliability: Automated systems using technologies like biometric scanning or proximity cards offer superior accuracy compared to manual self-reporting systems, reducing errors and potential fraud. Transparency and Communication: Clear communication of the system's purpose, operation, and privacy safeguards is critical for building trust and acceptance among employees. Privacy Considerations: Organizations must adopt privacy by design principles, minimizing data collection and ensuring robust security measures to comply with data protection regulations. Fairness and Consistency: Attendance policies and monitoring must be equitably applied across the workforce, with training for managers to address issues constructively. Employee Well-being: Attendance monitoring should aim to support employee well-being by identifying root causes of absenteeism and promoting work-life balance. Continuous Evaluation: Regular assessment of the system's effectiveness and impact on employees is necessary for ongoing refinement and improvement. These findings underscore the need for a multifaceted approach to implementing workplace attendance monitoring systems that balance organizational objectives with ethical and employee-centered considerations.

Further research is needed to determine which techniques can be applied depending on the work environment. Questions are left open as to what ethical implications monitoring of employees has in practical application.

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COMMERCIAL MEDIATION IS A FAST AND EFFECTIVE TOOL FOR RESOLVING COMMERCIAL DISPUTES

Abstract

Mediation is a negotiation in which the parties, with the help of a trusted third party, look for and find solutions to a conflict or dispute. It is a voluntary, confidential and private procedure. Mediation is a flexible structured procedure. The absence of strict procedures and forms in mediation makes mediation a quick and effective tool for resolving disputes. Subject and aim of the research: Since mediation means participation in a dispute in which one seeks and finds one's own solution. Given that the topic of this work is commercial mediation, commercial companies can participate in a dispute of this type. The procedure is conducted with the help of a third, impartial person trusted by the participants in the dispute. The ultimate goal is to find a satisfactory solution. Results and implications: Concrete cases and concrete solutions are mostly unknown to the general public because mediation is a voluntary, confidential and private procedure. During the proceedings, the parties agree on mutually satisfactory solutions. Mediation is a legal procedure that can help the parties to resolve their disputes if there are justified reasons based on the law.

Key words: *Mediation, Online Mediation, Procedure, Conflict, Dispute.*

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1. Introduction

According to the Cambridge Dictionary, the word "mediation" alludes to "the process by which someone tries to end a disagreement by helping the two sides to talk about and agree on a solution" (Chen et al, 2023). The Singapore Mediation Convention characterizes the conduct of (universal commercial) intercession as "a handle, independent of the expression utilized or the premise upon which the method is carried out, whereby parties endeavor to reach an agreeable settlement of their debate with the help of a third individual or people ("the mediator") lacking the specialist to force an arrangement upon the parties to the dispute". As for commercial intercession, it is an elective debate determination strategy conducted between two parties to resolve commercial debate through transaction facilitated by an impartial third party (mediator). Commercial intervention speaks to a comprehensive debate determination framework comprising of intercession organizations, rules, methods and strategies to resolve commercial disputes.

Mediation is an appropriate alternative as it were when the parties earnestly crave to settle their dispute (Bagley et al., 2010). In the event that they are unwilling to compromise or look for to hurt their rivals, intervention will be a frustrating squander of time. Alternately, parties who wish to protect their relationship may discover that intervention is their best alternative. Case and discretion habitually take off the parties feeling negative about each other.

The more dubious a party's lawful claims are, the more appealing intervention frequently is. If the law is evident and one party's rights are clearly being damaged, compromise may show up pointless. When the law is questionable, intervention permits parties to resolve their contrasts without being subjected to undeveloped, ill-formed, or questionable lawful doctrine.

The require for protection may moreover make a few debate more suitable for intervention. Claims require the recording of open archives and can caution the media to sensitive areas of business. A company may wish to keep exchange insider facts, disputable investigate, organizational structures, and inner preparing archives from the front pages of daily papers. Providers and clients may too gotten to be anxious in case problems that may have been kept secret are detailed within the press. "Keeping it between ourselves" is much more practical in case few untouchables are included.

An expansion of negotiation is mediation. In mediation, the debating parties select a impartial party to assist encourage communication and recommend ways for the parties to illuminate their debate (Kubasek et al., 2016). Therefore, the recognizing include of intercession is that the parties deliberately select a neutral third party to assist them work together to resolve the debate. The impartial third party habitually has mastery within the range of the debate.

Intervention starts when parties select a mediator. Each party at that point ordinarily composes a intervention brief to clarify why it ought to win. An imperative include of intercession is that it permits numerous parties to take part in a debate. The parties take turns clarifying the debate. One of the mediator's primary

objectives is to assist each party listen carefully to the restricting party's concerns. The mediator inquires the partiesto recognize any extra concerns. The parties start producing options or arrangements for the debated focuses. The go between makes a difference the parties assess the choices by comparing the choices with the debated focuses and interface identified prior. At long last, the mediator helps the parties in concurring on a arrangement.

The mediation concludes when the understanding between the parties is come to. The assention is at that point as a rule put into the shape of a contract and marked by the parties. The mediator may take an interest within the drafting of the contract. In case one of the parties does not take after the understanding, that party can be sued for breach of contract. In any case, parties ordinarily tolerate by the agreement because they made a difference to make it.

On the off chance that intervention isn't fruitful, the parties can turn to case or discretion to resolve their debate. In any case, nothing said amid the mediation can be utilized in another debate determination strategy; the mediation process is confidential.

2. Singapore Mediation Convention

In reference to the Singapore Mediation Convention and the later advancement trend, commercial mediation does not include the mediation of adjudicative powers (legal powers) of the courts, whereas the mediator (or numerous mediators) would play the part of making a difference the parties reach a settlement for the common great (Chen et al, 2023). According to article 1.2 of the Singapore Mediation Convention, the commercial debate characterized in the Convention don't incorporate customer, family, legacy and work debate. Settlement assentions affirmed or concluded in legal procedures, as well as those recorded as arbitral grants, are not regarded as commercial intervened settlement understandings as per article 1.3 of the Singapore Mediation Convention. For accommodation to the most recent universal advancement of commercial mediation, this article primarily centers on commercial mediation agreeing to the definition of the Singapore Mediation Convention.

Commercial mediation is respected to be one of the foremost noteworthy parts of expanded debate resolution mechanisms, since it has interesting focal points as compared with "adversarial" debate determination instruments, such as case and discretion, especially in cross-border debate. Particularly, the comparative points of interest of commercial intercession incorporate the taking after aspects. First, compared with the costly costs of worldwide case and assertion, commercial mediation can enormously spare time costs for debate determination. Second, the principle of privacy in commercial mediation can effectively protect the disclosure of exchange privileged insights, whereas the trade notoriety isn't affected by debate determination since the result of intervention isn't open to the open. Third, the agreeable debate resolution environment in commercial mediation would be conducive to keeping up business relations between the disputants and decreasing inside asset utilization due to the debate resolution.

3. Advantages and Disadvantages

The essential advantage of mediation is that it makes a difference the debating parties protect their connections; this can be particularly appealing for businesses with a working relationship they would like to proceed (Kubasek et al., 2016). A moment advantage is the possibility of finding imaginative arrangements. The objective of mediation is to discover a compromise between the requirements of different parties instead of to discover one party right and all the others off-base. A third advantage is the high level of independence mediation gives the participants. Rather than a impartial third party articulating a arrangement, the interested parties work together to make a solution, and this could make them more committed to taking after the agreement a while later.

These benefits can clearly be exceptionally beneficial. In any case, we got to pay consideration to the pundits of the intervention handle. One feedback of intervention is that it makes an picture of break even with parties working toward an evenhanded arrangement and in this manner stows away control imbalances that can lead to the party with more noteworthy control getting an understanding of more noteworthy advantage. A moment feedback is that a few individuals who enter intervention have no purposeful of finding a arrangement but, instead, utilize intervention as a strategy to draw out the debate.

4. ADR

Numerous firms discover that utilizing alternative dispute resolution (ADR) strategies to resolve their lawful issues offers numerous benefits (Kubasek et al., 2016). The term ADR alludes to the determination of lawful debate through strategies other than case, such as arrangement, intervention, intervention, outline jury trials, minitrials, impartial case assessments, and private trials.

Why might a commerce incline toward ADR to case? To begin with, ADR strategies are for the most part quicker and cheaper. According to the National Arbitration Forum, the normal time from recording a complaint to judgment through litigation is 25 months. Since ADR is quicker, it is as a rule cheaper. According to the American Intellectual Property Law Association, for cases esteemed within the $1 million to $25 million run, the normal add up to cost of obvious case for each party through the near of revelation is $1.9 million. 8 Through the end of trial, the normal taken a toll to each party is $3.5 million.

Hence, on the off chance that a party can resolve a debate through elective debate determination, this may spare a significant amount of cash.

Second, a business may need to dodge the vulnerability related with a jury choice; numerous shapes of ADR provide the members more control over the determination of the debate. Particularly, the parties can select a unbiased third party, as often as possible a individual with mastery within the region of the debate, to assist encourage determination of the case. Third, a trade may need to maintain a strategic distance from setting a point of reference through a court choice. Fourth, a trade may incline toward ADR since it is secret. Fifth, since numerous shapes of ADR are less antagonistic than case, ADR permits the parties to protect a commerce relationship.

5. Mediation

In mediation, a neutral third party acts as a mediator and works with both sides within the debate to encourage a determination (Clarkson et al., 2021). The mediator, who require not be a attorney, ordinarily charges a charge for his or her administrations (which can be part between the parties). States that require parties to experience ADR some time recently trial often offer mediation as one of the ADR alternatives or the as it were choice.

During mediation, the mediator ordinarily talks with the parties separately as well as together, emphasizes their focuses of agreement, and makes a difference them to assess their options. In spite of the fact that the mediator may propose a arrangement (called a mediator's proposition), he or she does not make a choice settling the matter.

One of the greatest points of interest of mediation is that it is less antagonistic than case. In intervention, the mediator takes an dynamic part and endeavors to bring the parties together so that they can come to a commonly palatable determination. The intervention handle tends to diminish the hostility between the disputants, permitting them to continue their previous relationship whereas minimizing antagonistic vibe. For this reason, intervention is regularly the favored frame of ADR for debate between trade accomplices, managers and workers, or other parties included in long-term connections.

Mediation is the quickest developing strategy of debate determination within the United States (Beatty et al., 2013). Here, a neutral individual, called a mediator, endeavors to direct the two debating parties toward a intentional settlement. (In a few cases, there may be two or more arbiters, but we'll utilize the solitary.) For the most part, the two disputants intentionally enter mediation, in spite of the fact that a few judges arrange the parties to undertake this shape of ADR some time recently permitting a case to go to trial.

A mediator does not render a choice within the debate, but employments a assortment of abilities to move the parties toward understanding. Frequently a mediator will carry between the antagonists, hearing their contentions, sorting out the serious issues from the less vital, inciting the parties and legal counselors alike to consider modern points of view, and seeking out for zones of assention. Go betweens must win the believe of both parties, tune in closely, attempt to diffuse outrage and fear, and construct the will to settle. Good mediators don't require a law degree, but they must have a sense of humor and low blood pressure.

Mediation has a few major advantages. Since the parties maintain control of the method, the two enemies can talk openly. They require not fear conceding as well much, since no settlement takes impact until both parties sign. All dialogs are private, assist encouraging candid conversation. This is especially accommodating in cases including restrictive data that could be uncovered amid a trial.

Of all forms of debate determination, mediation likely offers the most grounded "win-win" potential. Since the objective is deliberate settlement, not one or the

other party has to fear that it'll conclusion up the failure. This is often in sharp differentiate to case, where one party is exceptionally likely to lose. Evacuating the fear of defeat often empowers considering and talking that are more open and practical than transactions held within the middle of a claim. Ponders appear that over 75 percent of interceded cases do reach a deliberate settlement. Such an understanding is especially profitable to parties that wish to preserve a long-term relationship. Consider two companies that have done commerce effectively for 10 a long time but presently are within the middle of a milliondollar exchange debate. A claim may final three or more a long time and crush any chance of future exchange. Be that as it may, in case the parties intervene the contradiction, they might reach an friendly settlement inside a month or two and might rapidly continue their commonly productive trade.

6. Hearing

The intervention hearing will ordinarily take put over one or two days (Bishop, 2009). It is important that the parties each send along a agent who is enough arranged, is able to arrange on their sake, will remain for the whole length of the hearing and is approved to enter into any settlement understanding. Experienced mediators have famous that the failure of the parties to do typically a visit cause of the failure of mediation.

At the hearing, the parties must sign the mediation understanding that was sent to them at the graduation of the method. The mediator is then likely to conversation to the parties independently, at to begin with, and after that hold a joint assembly. They may at that point hold more isolated and joint gatherings in an endeavor to see in the event that a compromise is conceivable. During the whole process, counting the hearing and the lead-up to it, the mediator will be bound by the CEDR Illuminate Code of Conduct for Mediators.

The code requires mediators to act decently, autonomously and impartially. They must unveil any conceivable struggle of intrigued that they may have counting a earlier commerce relationship with one of the parties, a budgetary intrigued within the result, or on the off chance that they have earlier secret data approximately one of the parties. The mediator must withdraw on the off chance that asked to do so by one of the parties since of an charged breach of the code of conduct. On the other hand, the mediator themselves can choose to pull back on the off chance that the parties act in breach of the mediation understanding or act unconscionably or in the event that the go between forms the see that a settlement isn't getting to be conceivable. There's a arrangement within the code that requires a go between not to pointlessly drag out the mediation handle, subsequently making it occupant upon the arbiter to conclusion the intervention on the off chance that it is clear a settlement will not be able to be agreed upon.

7. Procedure

Mediation is a facilitative process by which the parties in debate lock in the help of an impartial third party, the mediator, who makes a difference them to under-

take to reach at an concurred determination of their debate (Spedding, 2009). The mediator has no specialist to create any choices that are official on the parties, but employments certain methods, procedures and abilities to assist the parties to arrange an concurred determination of their debate without settling.

In this way, mediation is very distinctive to arbitration. Not at all like arbitration, mediation does not include making a finding of reality or law or the rendering of a last and authoritative grant. The mediator has no authority to create a binding choice. Not at all like arbitration agreements, an understanding to enter into a mediation prepare will not be upheld. As however there's no considerable body of mediation law, but which will alter in time. The rules of normal equity likely have small or no application to mediation.

Mediation takes put when the parties concur to undertake to resolve their contrasts by mediation or, maybe more commonly, when during the course of case (or indeed discretion) the parties are empowered to undertake to reach a settlement by mediation. This applies similarly to commercial debate as, for illustration, family things. The UK courts empower mediation by permitting suspension of procedures for that reason. The court may require the attorneys for the parties to affirm that they have brought the plausibility of intercession to the consideration of their clients.

Mediation will not work in the event that there's no will to settle the expertise of the mediator lies in making a difference both sides to reach understanding almost how a debate ought to be settled. Now and then the parties will figure it out that at least some of the issues between them can be settled, clearing out less or shorter issues for the court to resolve a short time later.

There are no difficult and quick rules. Diverse mediators have distinctive ways of working. What frequently happens is that everybody included meets in a room within the nearness of the mediator. The mediator clarifies how the matter will continue. It is up to the parties to choose whether they need their attorneys to go with them. The parties at that point take it in turns to outline what their case is approximately and to state what they are seeking out for. A time constrain may be forced. At that point the parties go to isolated rooms where they will be gone to, likely a few times, by the go between who will talk about the case and attempt to decide where the common ground may lie or what are the basic deterrents to settlement. The mediator will not disclose to the other party what has been examined but to the extent that he or she is particularly approved or asked to do so. The mediator will carry forward thoughts, recommendations and, ideally, offers. The parties are likely to be subjected to a due date for completion of the method to create beyond any doubt that theirminds are concentrated on bringing the matter to a conclusion.

8. Online Mediation

Online assisted mediation may be a handle wherein neutral third parties are included in empowering the debating parties to reach a settlement (Yuthayotin, 2015). The help from the neutral third parties can be given in different forms. Beginning with helped negotiation, it points to increment the opportunity for

communication between debating parties through the help of the third party. For a more complicated prepare, the utilize of the administration abilities of a third party in empowering the debating parties to come to an friendly understanding are added within the conciliation and mediation forms. Conciliation is nearly indistinguishable to mediation, but the conciliator more often than not proposes certain solutions for thought by the disputing parties.

A dealer or a buyer can begin the method by recording a complaint. The inverse party is informed and inquired to intentionally join the method by an e-mail. In hone, the parties are cheerful to take an interest in the handle since "this was the as it were way by which the buyer seem get redress and the dealer positive feedback". Once the other party chooses to take portion within the handle, he or she records a reaction and chooses one or more worthy arrangements from the proposed conceivable arrangements. In case the offer and choice are coordinated, the debate is settled. On the off chance that not, the parties are welcomed to go to a arrangement with the help of a go between. With e-communication, a arbiter can effortlessly and quickly survey the nature of the strife and encourage the parties in their require for settlements. In expansion, the internet and computer program were planned to outline a helpful and neighborly environment for negotiation, in this way empowering settlement. Agreeing to past experience, online mediations were accomplished utilizing innovative instruments that "limited the free content space, empowered the suggestion of agreements, set due dates and even formed the tone of exchange".

9. Disputes

The rate of take-up isn't especially high this may be the blame of legal counselors new with its conceivable outcomes and concerned that it might show up as well delicate or casual to their commercial clients (Spedding, 2009). Indications are that when attorneys are show at the intervention, the success rate is lower. Maybe this will alter in time. Mediation is especially fitting where no point of guideline is included or where the parties may wish to do business together within the future.

Mediation ought to be kept in intellect for all commercial debate, in case not at the starting at that point during the course of case or discretion. It costs small, arrangements can ordinarily be made for mediation to require put rapidly and there's really nothing to lose (other than its shared cost) on the off chance that it does not work since not one or the other party is prejudiced. Moreover, a recent High Court choice made it clear that the courts will penalise on costs, those parties who, having been advertised intervention, deny it and after that go on to win. Where customarily they would get their costs, on the off chance that they have denied the utilize of intercession they will not naturally get their costs back typically a effective weapon for getting the parties to intervene.

The introduction of the CPR (The Civil Procedure Rules) has demonstrated that the taken a toll of court case will stay tall at slightest for the predictable future which there's a genuine require for options. While there's a solid convention of assertion in Britain, other nations are well ahead in taking up the preferences of intercession which is sweet news for the attorneys. Taking after the CPR

reform there was a boom in meditation according to experienced mediators. This was since there was a formal acknowledgment that mediation was here to remain and due to it being made a formal portion of the framework. In comparison with court procedures, the apparent preferences of mediation are that it is:

- quicker;
- relatively cheaper;
- can enable the resolution of disputes without damaging the commercial relations between the parties.

A few specialists see intervention as a apparatus to be utilized in conjunction with "rather than as an elective to litigation". In any occasion, intervention does in fact appear to be on the increment at the side the number of associations giving intervention administrations.

10. Conclusion

Mediation is a method for constructive, structured and voluntary resolution or avoidance of conflicts or disputes. The parties in conciliation want to reach an acceptable agreement that is in accordance with their needs and interests with the help of a third impartial person (mediator). Mediation in its current form has evolved from the practice of out-of-court dispute resolution. In addition, it includes insights from the fields of conflict science, communication science and psychology, so that the basics of mediation are based on interdisciplinary. The features of mediation are cost savings, confidentiality of the procedure, the impossibility of using evidence presented in mediation in other disputes, voluntariness and a procedure in which the goal is for each party to leave satisfied. No one can force either party to agree to what violates its interests.

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Professional paper

IT IS NOT AN EU LAW: THE CRITICAL OVERVIEW OF THE DRAFT LAW ON THE INTERNAL TRADE OF THE FB&H

Abstract

In December 2023, the Federation of Bosnia and Herzegovina (FB&H) Ministry of Trade, initiated proposing the new Law on Internal Trade in FB&H. The FBiH Government accepted this Ministry's initiative and put forward the draft Law on Internal Trade of the FB&H to the parliamentary procedure. The FB&H Government, namely, intends to replace the current Law on Internal Trade from 2010 and introduce this new Law that brings novelties regarding trade in the FB&H. The novelties interesting in the context of this text are Internet sales, bearing in mind its growing share in total retail sales. The evolution of Internet sales has brought certain deviations in FB&H's internal trade market due to the imprecise legal solutions and even so unregulated matters regarding the electronic business market in FB&H. This study critically overviews this draft Law from the legal and economic perspectives. Using comparative methods, this paper argues the draft Law does not significantly match European Union requirements regarding Internet sales. In addition, this paper argues the changes in the draft Law are not suitable to the contemporary requirements of the market regarding Internet sales. Therefore, this paper suggests what changes should be made, instead of the changes proposed in the draft Law, to make Internet sales regulations, legally and economically suitable to the contemporary requirements of the EU and the market in the FB&H.

Key words: *Internet Sales, Federation of Bosnia and Herzegovina, European Union Internet Sales Market, EU Integration.*

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1. Introduction: legal and economic background of electronic commerce

1.1. Economic background

The first form of shops operated according to the principle of barter, but with the emergence of money and new consumer needs, people created permanent places for the exchange of goods, which we now consider as the first stores. Further development of stores largely depends on technological advancements, particularly noticeable in communication and information technology (Pleša Puljić, Celić, Puljić, 2017), also referred to as the fourth disruptive innovation (Kozák, 2019). Information and communication technologies form the foundation of modern economies (Mešić, 2022), and online shopping is arguably the fastest and most cost-effective method of purchasing (Babić, Krajnović, Radman Peša, 2011), bridging geographical trade barriers (Miljelja Žaja, 2022). Nowadays, information technologies play a crucial role in everyday life, particularly in the business sphere. It would be barely impossible to imagine successful business operations and establishing connections with partners, in a domestic and international sense, without the Internet. The advantages of this business approach are best reflected in the speed of response and the ability to communicate with potential partners around the globe. However, there are challenges such as a lack of information about clients, their business reputation, and their ability to fulfill agreed obligations, as well as legal issues related to contract conclusion. Internet trading or e-commerce is increasingly prevalent, growing each year (Mandušić, Markić, Grbavac, 2004). The rapid pace of development sometimes makes regulation challenging (Trivun and Mahmutćehajić, 2008). Unlike traditional stores that require significant investment in infrastructure, staff, and equipment, organizing an online shop (often called an online store) is much more cost-effective. It is typically launched alongside a physical store but can also operate independently (Perenda, 2017). On the other hand, successful e-commerce requires investment in virtual environments, their maintenance, swift order processing to warehouses, and expedient customer delivery (Dunković et al, 2010). In terms of appearance in e-commerce, one can identify: B2B (business-to-business), B2C (business-to-consumer), and categories involving internet use by companies, governments, and other organizations for selling and purchasing (Ružić et al, 2014).

1.2. Legal background

In the early stages of information society development, at the time of the Internet's emergence as a technical solution comprising a network of interconnected global computer networks exchanging data based on standardized protocol, there was a belief that legal regulation of this area was almost impossible to achieve. However, less than two decades later, the Internet has become an integral part of the lives of more than a quarter of the world's population, including legal relationships, given the development of legislation regulating its various forms or activities conducted electronically (Uzelac and Protić, 2011, p. 101). Electronic commerce (e-commerce) represents one of the most significant forms of commercial internet use. Since its emergence in its current form in the mid-1990s, electronic commerce has experienced exceptional expansion, si-

multaneously with the digitalization process of communication that necessarily accompanied internet development, as well as other forms of data exchange electronically (Uzelac and Protić, 2011, p. 102). Electronic commerce is a set of procedures and technologies that automate financial transaction processes using electronic means. Furthermore, according to some authors, electronic commerce is defined as a new concept that is developing and encompasses the process of buying and selling or exchanging products, services, or information over computer networks, including the Internet. Electronic commerce is not limited solely to buying and selling, but it encompasses all pre-sale and post-sale activities along the supply chain (Đerić, 2016, p. 133). Legal transactions in electronic commerce may involve various material and immaterial goods, as well as data or information. In electronic commerce, there is no physical point of sale, but rather an abstract web location. In this sense, it follows that the seller is invisible to the buyer, and the buyer to the seller. The goods being sold are often also invisible, sometimes not yet even existing. The technical capabilities of the Internet, as a highly liberal technical communication platform, have become the foundations upon which an exceptionally broad, rich, and liberal market platform has been built, facilitating intensive trade in a wide and deep assortment of goods and services. In addition, the cost-effectiveness of electronic communication, alongside the aforementioned technological and demographic prerequisites, has enabled the intensification and diversification of specific services offered by the information society (Uzelac and Protić, 2011). In connection with this, in electronic commerce, consumers need to trust that by entering their purchase requirements on an abstract web location (e.g., an internet sales page) and paying (e.g., using a credit card), they will receive purchased products delivered by mail within a few days (Vančina, 2000, p. 110). Several elements help strengthen consumer confidence in electronic commerce, such as: - Emphasizing the physical existence of the trading enterprise, achieved today through the construction of websites and mandatory provision of essential company information (address, phone numbers, key characteristics of managers, list of employees, etc.); - Demonstrating professionalism, which implies that websites should be professionally designed, and their content tailored to target consumers, e.g., by language, design, price, interest, etc.; - Demonstrating a visible intention to build a professional relationship such as offering free services, sending interesting information to former and potential customers via email, creating their own "internet communities," etc.; - Maintaining business promises, which includes efficiency in terms of promptly and regularly responding to customer inquiries via email (Vančina, 2000, p. 110).

2. International legal framework of electronic commerce

2.1. UNICITRAL - Model Law on Electronic Commerce

The need to define the legal dimension of relationships established through electronic communication, primarily on the Internet, was recognized early on. In the context of electronic commerce, this need took on specific regulatory

outlines through the UNCITRAL Model Law on Electronic Commerce.[1] The United Nations Commission on International Trade Law (UNCITRAL) proposed this Model Law on Electronic Commerce in 1996.[2] The United Nations General Assembly adopted this proposal as a resolution, offering it to UN member states for their national codifications of electronic commerce as an alternative to traditional paper-and-ink methods. This Model Law aims to provide national legislators worldwide with a functional set of rules adapted to the needs of seamless international trade, creating legal certainty and a conducive legal environment for the development of electronic commerce and the unhindered conclusion of electronic contracts (Trnavci, 2009, p. 452). In other words, this law aims to eliminate potential legal obstacles in various national legislations that could question the legal validity of exchanging legally relevant data without written documents or other forms of written evidence, thereby ensuring legal certainty in electronic commerce. This goal was to be achieved by transposing the principles and standards established in this document (Uzelac and Protić, 2011). This foundational regulatory model in the field of electronic commerce gained particular importance in the legal domain of the European Union with the adoption of Directive 2000/31/EC on electronic commerce, which structurally, conceptually, and in terms of most regulatory solutions, is based on the Model Law (Uzelac and Protić, 2011).

2.2. Directives of the European Union on Electronic Commerce

In the legal system of the European Union, two directives have been enacted: the Directive on Electronic Signatures from 1999 (Directive on Electronic Signatures)[3] and the Electronic Commerce Directive of the European Union from 2000 (Electronic Commerce Directive).[4] These directives aimed to create a unified legal framework for electronic commerce within the common market, ensuring legal certainty for both business entities and consumers (Trnavci, 2009, p. 452). According to Article 5 of the Treaty on European Union[5], which establishes the principle of subsidiarity in EU law, this goal is achieved through the technique of harmonizing national regulations concerning the conclusion and legal effects of electronic contracts. These directives cover a wide range of activities involving the electronic distribution of goods and services, such as online book purchases, booking of tourist services, provision of banking services, access to newspapers, downloading music, etc. (Trnavci, 2009). The Directive on Electronic Signatures aims to recognize the validity of contracts

1 United Nations Commission on International Trade Law, UNCITRAL Model Law on Electronic Commerce, with Guide to Enactment, 1996: with Additional Article 5 Bis as Adopted in 1998. New York: United Nations, 1999.

2 The UNCITRAL Model Law on Electronic Commerce with Guide to Enactment was adopted at the 29th session of that body on June 12, 1996, and accepted by Resolution 51/126 of the UN General Assembly on December 16, 1996. Article 5 bis was subsequently adopted in 1998, so the document now appears under the full title UNCITRAL Model Law on Electronic Commerce (1996) with added Article 5 bis adopted in 1998 and Guide to Enactment.

3 Directive, 1999/93/EC

4 Directive, 2000/31/EC

5 Article 5 of the Treaty establishing the European Economic Community signed on March 25, 1957, in Rome.

concluded in electronic form and to equate their evidentiary value with those concluded in traditional written form. It is important to note that the Electronic Commerce Directive encompasses both gratuitous contracts (gifts) and onerous contracts, concluded between civil law entities as well as commercial law entities. Following the principle of proportionality, the measures provided for in Directive 2000/31/EC are strictly limited to the minimum necessary to achieve the goal of proper functioning of the internal market[1], taking into account different national legislations and internal regulations, as well as legal barriers to the development of the information society within all member states (Trnavci, 2009. p. 456). Furthermore, Directive 2000/31/EC also refers to the principle of the internal market clause, which implies that if a business entity starts electronic commerce activities in accordance with the regulations of the member state where it is registered, the member state where the service or product is distributed through electronic commerce cannot prohibit or restrict such distribution in any way.[2]

3. Economics aspects of Electronic Commerce in Bosnia and Herzegovina

In Bosnia and Herzegovina, online sales or e-commerce is a significant segment of the economy, although comprehensive and accessible data are lacking due to its mostly informal nature (Ziegler, 2024). Therefore, e-commerce initiatives are driving innovations in tax models and collection methods (Berzjak, 2012). Similarly, as observed worldwide, e-commerce in Bosnia and Herzegovina has significantly evolved, especially during the COVID-19 pandemic in 2020. Online shopping and card payments have been on the rise in BiH over the past four years, according to research by the eCommerce Association. Through a survey consisting of 30 questions, responses from over 1,700 participants were analyzed. The research indicates that over 60% of customers have made at least one online purchase in the last three months. This demographic primarily includes individuals aged 25 to 45 years (Kerezović, 2024), which is expected given that younger generations are more inclined to share information online (Strugar, Knežević, Jaković, 2011). In contrast to these findings, according to research by Valicon/Market Makers, only 0.8 million citizens in Bosnia and Herzegovina make purchases online. However, when it comes to the use of bank cards, a prerequisite for online shopping, Bosnia and Herzegovina is not lagging behind. According to data from the Central Bank of BiH, there were a total of 2.3 million active cards in 2022. In 2022, over 448 million BAM was transacted online, compared to 265 million BAM in 2021 (Musić, 2023). Research presented by the eCommerce Association of Bosnia and Herzegovina shows that a significant 83.4% of e-commerce transactions are conducted via mobile phones (Kucukalić, 2021). This highlights the need to invest in and develop appropriately mobile-optimized websites and mobile applications for e-commerce purposes. Despite challenges, there is an annual upward trend in online transactions. After a comprehensive analysis of the e-commerce market in Bosnia and Herzegovina, the eCommerce Association recently presented more detailed research, indicating a noticeable growth in trust in the online

1 The Preamble of Directive 2000/31/EC, point 10.
2 Article 5 of Directive 2000/31/EC

market, with nearly 60% of surveyed customers making between 2 and 5 online purchases in the last three months (Vukadin, 2024). A 2011 study by Peštek et al. revealed that 55% of citizens in Bosnia and Herzegovina did not engage in e-transactions, citing reasons such as lack of security in payments, security threats (e.g., personal data), poorly organized and overly complicated websites, lack of face-to-face interaction, and inability to physically inspect products before delivery, alongside a general lack of information. Distrust is a key barrier preventing significant development of e-commerce in Bosnia and Herzegovina. Operating in the new economy hinges on trust, long-term partnerships, innovation, and enhancing societal well-being (Šarenac, Rebić, 2011). Hence, adopting necessary legislative regulations, as pursued through specific provisions in the Law on Internal Trade of the Federation of Bosnia and Herzegovina, is crucial. That question, therefore, will be discussed in the next section.

4. Legal Framework of Electronic Commerce in Bosnia and Herzegovina

Electronic commerce in Bosnia and Herzegovina is regulated by a total of two provisions in the entity's laws. In Republika Srpska, the field of electronic commerce is regulated by the provisions of Article 61 of the Trade Law of that entity, norming that electronic commerce constitutes a part of distance selling, where goods or services, i.e., the subject of sale, are ordered and sold via the internet.[1] Furthermore, the use of electronic commerce in the same law is envisaged to be conducted through electronic stores, representing the primary form of electronic commerce, as well as through electronic platforms connecting consumers and producers, namely sales via e-commerce platforms, and finally, sales through social networks and drop shipping.[2] In the Federation of Bosnia and Herzegovina, electronic commerce is more narrowly regulated compared to the Republika Srpska entity. In the Federation of Bosnia and Herzegovina, electronic commerce constitutes a form of retail trade in goods and services offered by the manufacturer or trader to the consumer through various means of communication, where the direct presence of the consumer is not necessary in order to fulfill the conditions for concluding distance contracts.[3] Furthermore, it is regulated that a distance sales contract is concluded in accordance with the provisions of the law regulating consumer protection in Bosnia and Herzegovina.[4] For such a contract to be valid, it can only be organized by a trader registered for distance selling. In addition to these entity laws, Bosnia and Herzegovina adopted the Law on Electronic Signature[5] in 2006 and the Law on Electronic Legal and Business Transactions[6] in 2007 at the state level. Through the Law on Electronic Legal and Business Transactions, the Bosnian legislator regulates the methods of concluding electronic contracts and contracts via the Internet. According to international sources present in Bosnian law, an electronic con-

1 Article 61 of the Trade Act of Republika Srpska, Official Gazette of RS, No. 105/2019

2 ***Ibid***. Article 61, paragraph 7

3 Article 47 of the Law on Internal Trade of FBiH, Official Gazette of the Federation of Bosnia and Herzegovina, No. 40/2010 and 79/2017

4 The Law on Consumer Protection in Bosnia and Herzegovina, Official Gazette of BiH, No. 25/2006 and 88/2015

5 The Law on Electronic Signature in Bosnia and Herzegovina, Official Gazette of BiH, No. 91/06

6 The Law on Electronic Legal and Business Transactions, Official Gazette of BiH No. 88/07

tract may be concluded in any manner that manifests agreement, explicit offer and acceptance, the conduct of negotiating parties (implied actions), or the operation of electronic intermediaries (Trnavci, 2009, p. 461). Under the Law on Electronic Signature of Bosnia and Herzegovina, the electronic form of contracts is equated with traditional written form in situations where written form is a requirement for the validity of the contract, even in cases where a handwritten signature is required (Trnavci, 2009). Based on these provisions at the state level, which form the basis for the functioning of electronic commerce in terms of contract conclusion, it can be concluded that the legislator aims to align with the social changes brought about by digitalization, intending to provide appropriate protection to the information society in Bosnia and Herzegovina.

5. Novelties in e-commerce according to the Draft Law on Internal Trade of FB&H

Regulating Internet commerce holds economic significance for institutional trade development, essential for creating conditions for a stable market with predictability in transactions and outcomes. Legislative regulation paves the way for further development of Internet commerce. As stated by the relevant ministry, the Ministry of Trade of the Federation of Bosnia and Herzegovina "Distance selling requires specific regulation, as it involves transactions where the buyer cannot negotiate face-to-face with the seller or physically inspect the offerings in real space and time." This lack of trust can lead to reluctance to conduct e-transactions. European Union's rules on consumer protection ensure that when purchasing goods and services within the European Union, you receive clear information about the product or service, its price, delivery costs, and your rights in case of issues. Transparency on the internet means you have the right to know the status of every online seller. Online marketplaces must specify whether the seller is a trader (registered company or sole trader) or an individual. This distinction is crucial because, under the European Union consumer protection legislation, you are only protected when purchasing from a trader. If you choose an offer from an individual, the online marketplace must alert you to this fact (You Europe, 2024).

The House of Representatives of the Parliament of FBiH adopted the Draft Law on Internal Trade of FBiH in April 2024, and the House of Peoples of the Parliament of FBiH adopted the same draft in May 2024. In general, the draft aims to enhance trade as a significant economic activity within the entity of FBiH. In addition to its general objectives, the draft also specifies goals, notably the regulation of new forms of trade and combating the informal economy in the trade sector, both of which are directly related to the operation of electronic commerce in the FBiH entity. Considering the favorable legal framework for electronic commerce in Bosnia and Herzegovina, the draft introduces changes aimed at establishing more suitable and secure electronic trading in the Federation of FBiH. Article 1 of the draft Law on Internal Trade of FBiH explicitly lists European Union directives adopted by this law into the legislation of the Federation of FBiH, including Directive 2011/83/EU on consumer rights, which regulates consumer protection in contracts concluded using distance commu-

nication means (Petrović, 2015, p. 133). Directive 2011/83/EU defines distance contracts as contracts concluded between a trader and a consumer based on an organized system of sales or service provision at a distance, which does not require simultaneous physical presence of the trader and the consumer, exclusively using one or more means of remote communication.[1] Under the term "organized system of sales or service provision at a distance", European legislation encompasses systems used by traders offered by third parties other than the trader, such as online platforms.[2] Considering that the current Law on Internal Trade of FBiH does not currently foresee organized systems of sales or service provision at a distance leading to the conclusion of such contracts, the proposer of the draft introduces for the first time into the legislation of the Federation of FBiH legally defined terms such as "electronic platform"[3] and "electronic store"[4], which are aligned with the definition of organized systems of sales or service provision at a distance under European legislation.

The Draft introduces the concept of electronic commerce into the legislation of FBiH as a form of distance selling where goods or services are offered, ordered, and sold via the Internet.[5] The proposer emphasizes the distinction between electronic commerce and other forms of distance selling (such as catalog sales, radio, and TV sales) in the Draft Law on Internal Trade of FBiH. The current law regulates distance selling broadly without delineating different forms and methods of conclusion. Highlighting electronic commerce concerning other forms of distance selling represents an innovation aligned with the trend of digitization and rapid technological changes. Given that electronic commerce operates via efficient and fast internet services, it is realistic to expect that with further internet development, electronic commerce will establish itself as the dominant form of distance selling, displacing other forms. In addition to introducing the concept of electronic commerce into FBiH legislation, the draft proposer lists three specific methods through which electronic commerce can be conducted:

1. Sale of goods or services through an electronic store, representing the primary form of electronic commerce;
2. Sale of goods or services through an electronic platform, and;
3. Drop shipping.[6]

1 Article 2, point 7 of Directive 2011/83/EU

2 The Preamble, point 20, Directive 2011/83/EU

3 An electronic platform is a tool through which a person, at the request of the user, usually for remuneration, provides a service of connecting parties engaged in electronic commerce, and manages the electronic platform, and may also carry out the sale of its own goods or services through that platform. Article 2, point m) of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina.

4 An electronic store is an online store through which a merchant offers goods or services. Article 2, point n) of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina.

5 Article 48, paragraph 6 of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina.

6 Sale of goods through an online store or electronic platform, where the trader does not have the goods in stock but orders them in their own name and on their own account from a third party, manufacturer, or trader, who then directly delivers the goods to the consumer. Article 49,

Such detailed regulation of electronic commerce could undoubtedly result in increased consumer trust in online commerce in Bosnia and Herzegovina. According to the provisions of the Law on Consumer Protection of Bosnia and Herzegovina, a trader is obliged to inform the consumer, before concluding a sales contract, primarily about general information regarding the trader, such as the name, registration number, full address of the trader and supplier, tax number, as well as telephone numbers, fax, and email addresses.[1] This obligation to provide such general information, i.e., information about the trader's identity, is also envisaged by Directive 2011/83/EU. This directive exhaustively regulates all obligations of the trader to inform the consumer when concluding distance sales contracts.[2] Directive 2000/31/EC, on the other hand, expands the list of obligations, i.e., information that the trader must provide to the consumer in cases of electronic commerce.[3] In the draft Law on Internal Trade of the Federation of Bosnia and Herzegovina, although not explicitly stated in the preamble that the adoption of this law includes Directive 2000/31/EC on electronic commerce into the legislation of the Federation of Bosnia and Herzegovina, Article 50 regulates the obligations of the trader to provide information to the consumer and competent inspection authorities, corresponding to the obligations envisaged by the Directive on electronic commerce. Thus, the draft requires the trader to provide information about the name under which it is registered in the appropriate register, as well as the registered office address, the name, and number of the register in which the trader is registered if a taxpayer, then also the VAT number, and other data based on which the consumer or competent inspection authorities can quickly and unhindered contact the trader.[4] Compared to the currently valid law, the draft provides a higher level of consumer protection, especially considering the obligation to inform competent inspection authorities about the aforementioned information. Referring to the provisions of the Law on Consumer Protection of Bosnia and Herzegovina, as is the case in the Law on Internal Trade of the Federation of Bosnia and Herzegovina in force, without emphasizing the obligations that the trader has towards the consumer, does not provide a good basis for gaining the trust of consumers, and certainly does not comply with the minimum standards set by European directives regulating distance selling. Furthermore, Directive 2011/83/EU, as well as the Law on Consumer Protection of Bosnia and Herzegovina, regulates that the consumer, before concluding a distance sales contract, must be informed about the total price of the goods or services, including taxes, transportation costs, and all additional costs. The current Law on Internal Trade of the Federation of Bosnia and Herzegovina is not detailed in this regard but refers to the provisions of the Law on Consumer Protection of Bosnia and Herzegovina. On the other hand, the draft specifies that the distance sales contract must obligatorily include the price and other terms of sale. It is emphasized that prices must be clearly and

paragraph 7, point c) of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina.

1 Article 44, paragraph 1, point a) of the Consumer Protection Act of Bosnia and Herzegovina, Official Gazette No. 25/2006 and 88/2015.

2 Article 6 of Directive 2011/83/EU

3 Article 5 of Directive 2000/31/EC

4 Article 50 of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina

unambiguously indicated, including all costs that could in any way affect the displayed price.[1]

The draft aims to protect consumers from unwanted consequences regarding sudden and unexpected prices, but it cannot be concluded that the draft has aligned these provisions with the requirements of the Directive and the Law on Consumer Protection of Bosnia and Herzegovina in this regard. Namely, legal acts provide for the obligation to form the final price together with all costs, as well as the obligation to inform consumers about the same price before the conclusion of a distance sales contract. In the draft law, the proposer explicitly states that the distance sales contract must obligatorily include the price and other terms of sale.[2] Given that without a specific, or at least determinable price, the sales contract will not have legal effect[3], this provision will not provide legal security to consumers, which is why it should be revised to align with the requirements set out in the Directive and the Law on Consumer Protection of Bosnia and Herzegovina because only in this way will the proposer's intention to obligatorily form and inform consumers about the final and total price truly make legal sense and as such produce legal effects. A positive aspect of the draft is that it envisages a sanction for failure to provide information to the consumer in accordance with Article 51 of the Draft. Namely, in case the trader fails to inform the consumer about general information about the trader, they will be fined with a monetary penalty ranging from 3,000.00 BAM to 30,000.00 BAM.[4] With this penal provision, the proposer has tightened the sanctions against traders, increasing the amount of the monetary fine compared to the current Law which ranges from 2,000.00 BAM to 10,000.00 BAM.[5] The proposer clearly emphasizes the weaker contractual position of the consumer by providing protection in case of misinformation, but in addition to the information provided by Article 51 of the Draft, it was necessary to oblige the trader to provide information to the consumer regarding the terms for fulfillment and termination of the contract, the right and period for withdrawal from the contract, rights in case of disproportionality or damage to the goods, etc., as envisaged by the Law on Consumer Protection of Bosnia and Herzegovina[6] and Directive 2011/83/EU. In this way, absolute protection would be provided to both contracting parties in distance contracts. Namely, the trader would be informed about all the information they are obligated to provide before concluding a contract with the other party, thus avoiding a situation in which the trader could be held liable for non-compliance with regulations of stronger legal power compared to the Law on Internal Trade of Bosnia and Herzegovina. On the other hand, the con-

1 Article 49, paragraph 5, of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina

2 *Ibid*.

3 Article 462, paragraph 1, of the Law on Obligations Relationships of the Federation of Bosnia and Herzegovina, Official Gazette of the SFRY, No. 29/1978, 39/1985, 45/1989 - decision of the Supreme Court of Yugoslavia, and 57/1989, Official Gazette of the RBiH, No. 2/1992, 13/1993, and 13/1994, and Official Gazette of the FBiH, No. 29/2003 and 42/2011

4 Article 125, point f), of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina

5 Article 64, point f), of the Law on Internal Trade of the Federation of Bosnia and Herzegovina

6 Article 44 of the Consumer Protection Law of Bosnia and Herzegovina

sumer, as the weaker contractual party, would be provided with all the information about their rights, thus avoiding the risk that the consumer, due to lack of knowledge, does not invoke the legal rule intended for their protection.[1]

6. The Republic of Serbia as the role model for the Federation of Bosnia and Herzegovina

In the Republic of Serbia, distance selling, i.e., electronic commerce as a form of distance selling, is regulated in the same way as proposed in the Draft of the new law in the territory of the Federation of Bosnia and Herzegovina. Therefore, under the Law on Trade of the Republic of Serbia, electronic commerce represents a form of distance selling conducted via the Internet. The Serbian legislator similarly regulates three forms or methods through which electronic commerce can be conducted (via electronic stores, electronic platforms, and drop shipping), and also distinguishes between electronic commerce and other forms of distance selling.[2] Furthermore, both compared acts prescribe the obligation to keep records of goods transactions based on purchase documents (shipping invoices, invoices, delivery notes, receipt notes, etc.), as well as ensuring the availability of records to competent authorities. One difference compared to the Draft law is that in the Republic of Serbia, the legislator allows these documents, i.e., documents on goods, to take the form of electronic documents[3], whereas the Draft does not specify in which form these documents, may be, implicitly suggesting that the legislator adheres to the traditional physical form of documents. Although this aspect does not warrant extensive discussion in this work, it is necessary to emphasize that while the legislator strives to address the challenges of digitalization, it inconsistently approaches its task and leaves room for slower and more complex action through traditional means, "via a paper". Another difference in this regard is that in the Republic of Serbia, for distance trade, records are kept at the level of the entire distance trade of that trader in the market of the Republic of Serbia or specifically for individual organizational units in accordance with a previously adopted decision of the trader[4], while the Draft specifies record keeping for distance trade in the same manner as for other forms of retail trade, without a specific distinction on the scope and method of trading. The Law on Trade of the Republic of Serbia regulates the internal market of the territory of the Republic of Serbia, as well as cross-border trade. In this regard, the Law generally regulates the manner of conducting distance sales, but the Serbian legislator in 2009 adopted a specific (lex specialis) Law on Electronic Commerce, as an expression of the process of harmonizing Serbian legislation with the regulations of the European Union. By adopting this law, conditions for the legal validity of contracts fully concluded

1 The EU Court has established, based on its established case law, the concept of the consumer as the weaker party in relation to a business entity, both in terms of negotiating power and level of information, and identified a significant risk that consumers might not invoke legal rules intended for their protection due to lack of knowledge. Judgment of the EU Court in case C-497/13, Faber, ECLI:EU:C:2015:357.

2 Article 17 of the Law on Trade of the Republic of Serbia, Official Gazette of RS, No. 52/2019.

3 ***Ibid***. Article 29, paragraph 5

4 ***Ibid***. Article 30, paragraph 4

electronically are provided for the first time in the legal system of Serbia, i.e., in the form of an electronic contract (Uzelac and Protić, 2011, p. 107). The Law represents a complete transposition of the rules of relevant community law, specifically the cited Directive 2000/31/EC on electronic commerce, as well as certain provisions of Directive 98/48/EC amending Directive 98/34/EC (Uzelac and Protić, 2011). The Law on Electronic Commerce of the Republic of Serbia introduces the term "services of the information society" into the legislation of the Republic of Serbia, specifies the obligation of the trader to provide certain information to the consumer and competent authorities, introduces the term "commercial message" as a service of the information society and conditions for its validity, and finally, most importantly, regulates provisions regarding electronic contracts, their validity, duration, termination, etc.[1] All of the above is fully aligned with the requirements of Directive 2000/31/EC on electronic commerce, unlike the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina, where the proposer failed to refer to the adoption of the Directive on electronic commerce in the preamble of the Draft itself, and further failed to introduce provisions into Bosnian-Herzegovinian legislation that are crucial for the validity of electronic contracts, which constitute the foundation of electronic commerce. Considering that the process of harmonizing Bosnian-Herzegovinian regulations with the legal acquis of the EU began before the formal obligation with the signing of the SAA[2] in 2008, it is necessary to emphasize Bosnia and Herzegovina's, or entity's, obligation to adopt Directive 2000/31/EC, both for harmonization with EU community law and for enhanced consumer protection and ensuring a safer market for electronic commerce.

7. Conclusion

With the development of internet sales, certain deviations arise due to the legally unregulated state of electronic business in the Federation of BiH and imprecise legal solutions that minimally regulate this area; hence it was necessary to foresee adequate mechanisms to sanction such behavior. The Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina, adopted in April 2024, marks a significant step towards modernizing and regulating electronic commerce within the entity and filling the legal gap. This law aims to enhance regulation in the trade sector, with a particular focus on electronic commerce as a critical segment of the economy. By aligning with European standards, introducing definitions of electronic commerce, electronic platforms, electronic stores, and comprehensive regulation of distance contracts, the Draft provides a foundation for more efficient business operations in the digital environment. The advantages of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina are numerous. Firstly, compliance with EU standards ensures that Bosnia and Herzegovina keeps pace with the Europeanization of its legislation, facilitating access to the European digital market and reducing administrative barriers for domestic companies. Secondly, the law mandates that

1 Article 9 of the Law on Electronic Commerce of the Republic of Srpska, Official Gazette of the Republic of Srpska, No. 41/2009, 95/2013, and 52/2019.

2 Stabilization and Association Agreement between the European Communities and their Member States, of the one part, and Bosnia and Herzegovina, of the other part, OJ L 164, 30.06.2015.

traders provide comprehensive information to consumers in accordance with European legislative requirements, thereby strengthening consumer trust in online commerce and providing them with necessary protections. Despite these advantages, the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina also has several shortcomings that require attention. The lack of specificity in areas such as data protection, online dispute resolution, and precise alignment with specific European directives like Directive 2000/31/EC poses a significant challenge to fully adopting European standards and ensuring legal certainty for all stakeholders in electronic commerce. In conclusion, aligning with Directive 2000/31/EC is a crucial step for Bosnia and Herzegovina towards creating a stable and prosperous environment for electronic commerce. This is not only a legal requirement but also an opportunity to enhance the business environment, increase the competitiveness of domestic companies in the global market, and improve the consumer experience as they increasingly use the internet as a channel for purchasing goods and services. Moreover, a fundamental drawback of this solution is the lack of a legal definition regarding the return of goods, which is problematic and can contribute to further mistrust (Vukadin, 2024). The Law on Internal Trade also does not recognize social media on the Internet. In addition, practice indicates that a significant number of businesses engage in distance selling via the Internet. What defines Article 2 of the Draft Law is that "Only a trader registered for such type of trade can organize distance selling." This could be problematic as it reduces the number of participants/providers within the e-commerce sector in the FBiH. Articles 4 and 5 of the amendment to the law should follow EU practices, and promote competition and new technologies, including the significant role of social media on the internet. Further development of the Draft Law on Internal Trade of the Federation of Bosnia and Herzegovina should focus on addressing these shortcomings and ensuring that the legal framework supports comprehensive protection and innovation in electronic commerce.

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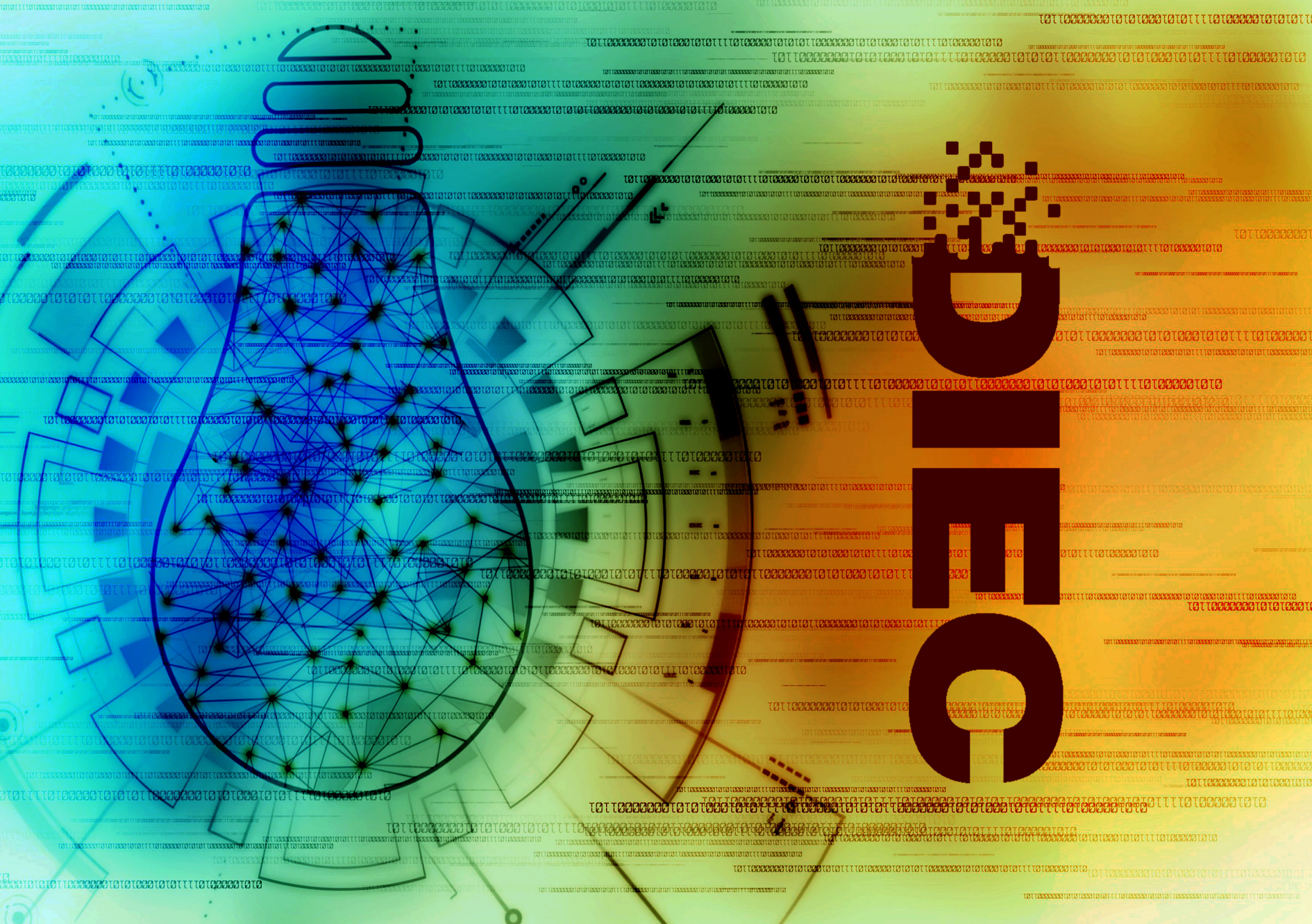
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