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Table of contents

AI in Management Decision-Making: Benefits, Challenges, and Future Perspectives

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Abstract

One of the indispensable topics of today is almost every one of those which mentions artificial intelligence. It occurs in all aspects of human life such as health, sports, entertainment, education, art, culture, business, etc. Since it has already become an indispensable part of business, the question arises as to how much artificial intelligence (AI) helps the management of organizations in making business decisions. The role of artificial intelligence (AI) in management is becoming increasingly more important due to its ability to analyze large amounts of data, predict trends, optimize resources and automate processes. The mentioned activities save a lot of active time for managers and provide quality information for making the best business decisions. Using AI tools, managers can model complex business scenarios and enable strategic planning based on precise data. The use of AI tools for decision-making is associated with certain challenges, which are mainly reflected in the lack of quality data, resistance to changes, ethics and transparency of data, as well as the constant upgrading and improvement of new technologies. AI does not replace managers, but supports them, enabling better, more informed and faster decisions. The key to success is the integration of AI technologies with the business strategy, vision, mission and goals of organizations.

Keywords: management, decision making, artificial intelligence

JEL Classification: O32, O33, M15, L86

1. Introduction

One of the essential topics of today undoubtedly includes artificial intelligence (AI). AI now appears in almost every aspect of human life—from healthcare, sports, entertainment, education, art, and culture, all the way to business. Given that it has already become a crucial element of the modern business environment, the question

arises: to what extent does artificial intelligence contribute to organizational management in business decision-making?

The role of artificial intelligence in management is becoming increasingly significant thanks to its capabilities, such as analyzing large volumes of data, predicting trends, optimizing resources, and automating processes. These activities save managers time and provide them with high-quality information necessary for making strategic and operational decisions. By using AI tools, it is possible to model complex business scenarios and enable strategic planning based on accurate and timely data.

However, along with numerous advantages, the implementation of AI in management also brings certain challenges. Among them, the most notable are the lack of quality data, resistance to change, questions of ethics and transparency, as well as the need for continuous employee training and adapting organizational culture to new technologies.

It is important to emphasize that artificial intelligence does not replace managers but rather supports them in making faster, more informed, and higher-quality decisions. The key to success lies in integrating AI technologies with the business strategy, vision, mission, and goals of the organization.

2. The Fundamentals of Artificial Intelligence and Its Impact on Management Through Digitalization

Over the past few decades, the business world has undergone rapid and profound changes due to digitalization, which has sparked a revolution in management. The introduction of digital technologies has transformed the way organizations manage data, processes, employees, and customers. Traditional management models, which relied on experience, intuition, and linear information processing, have gradually been replaced by data-driven approaches that enable faster, more precise, and more rational decision-making.

Digitalization has paved the way for the development and application of artificial intelligence, which represents one of the key tools of the new digital era. According to one of the founders of the concept of artificial intelligence, it is "the science and engineering of making intelligent machines, especially intelligent computer programs" (McCarthy, 2007).

AI entails the ability of computer systems to mimic human intelligence, including learning, reasoning, pattern recognition, and decision-making. The development of technologies such as machine learning, deep learning, natural language processing (NLP), and computer vision has further expanded the scope of AI applications in a business context.

In the context of management, AI emerges as a powerful tool that enables the analysis of large volumes of data in real time, the automation of routine tasks, the prediction of market movements, and the adaptation of business strategies in line with environmental changes. This significantly alters the role of managers, who are increasingly transitioning from operational roles to strategic ones, relying on intelligent systems as decision-making support.

This transformation is not only technical but also organizational and cultural in nature. The introduction of AI requires new skills, a shift in mindset, and a strong focus on change management to ensure the successful integration of these technologies into everyday business practices.

3. The role of artificial intelligence in modern management

Modern management faces challenges such as rapidly changing market conditions, increasing volumes of available data, and rising customer expectations. In this context, artificial intelligence (AI) has become a key tool for enhancing efficiency, flexibility, and the quality of managerial decision-making.

AI enables organizations to analyze vast amounts of data (so-called Big Data) in real time, identify patterns, and make evidence-based decisions rather than relying solely on intuition or experience. This approach significantly improves the accuracy of assessments and predictions, reduces risks, and allows for faster responses to environmental changes. Perkov (2019) notes that digital transformation affects five key areas: distance, communication, environment, work, and mobility—all of which are closely tied to daily management activities. Furthermore, according to Ezell (2018), digitalization in production today is understood as the integration of artificial intelligence, interconnected communication, digitalization, robotics, and the automation of entire business processes.

One of AI's primary roles in management is the automation of routine and repetitive tasks. Through advanced algorithms, many administrative, analytical, and operational processes can be automated, freeing up managers' time for strategic thinking and creative decision-making. For example, AI already has a significant impact in areas such as automated reporting, candidate screening in human resources, and financial transaction processing. As Burilović (2020) points out, digital transformation is not just a technical change but a fundamental reorganization of the business model.

AI also enables personalized customer interactions and a deeper understanding of their needs through behavioral analysis, preferences, and feedback. This approach not only enhances customer satisfaction but also fosters long-term loyalty and competitive advantage in the market.

Beyond operational benefits, AI has a strategic dimension—it allows managers to make long-term decisions based on simulations and predictive analytics. By applying

scenario modeling and predictive algorithms, businesses can test different strategic options before implementing them in the real world.

It is precisely this ability to connect data, processes, and objectives that makes AI an indispensable partner for modern managers. However, to fully leverage AI's potential, a shift in mindset, investment in employees' digital competencies, and an adaptation of organizational structures to the demands of the new digital reality are essential.

3.1. Classification of artificial intelligence by functionality

Artificial intelligence (AI) encompasses a broad spectrum of technologies that enable computer systems to perform tasks traditionally requiring human intelligence. Based on capability levels and application domains, AI systems are most commonly classified into three fundamental functional categories: narrow AI, general AI, and artificial superintelligence (ASI).

- Narrow AI: Specialized for executing specific tasks within clearly defined domains (e.g., chatbots, facial recognition systems, market analysis tools)
- General AI: A theoretical form of artificial intelligence that could understand, learn, and apply knowledge across any context, similar to the human mind. This form of AI has not yet been developed.
- Artificial Superintelligence (ASI): A hypothetical form of AI that would surpass human intelligence in all aspects - including creativity, social intelligence, and decision-making.

Beyond functional classification, artificial intelligence can also be categorized according to operational methods or technological foundations. As Marcus and Davis (2023) emphasize, "the modern AI landscape requires nuanced categorization that transcends the narrow/general AI dichotomy," including hybrid approaches such as neuro-symbolic and generative systems. These classifications are becoming increasingly important in business contexts as they enable more precise understanding of the potential and limitations of different AI solutions.

The following sections will provide more detailed presentations of key types of artificial intelligence that are directly applied in management and business decision-making.

3.2. Narrow Domain AI

Narrow AI, also known as specialized or weak AI, represents the most widely used form of artificial intelligence application in business, technological, and everyday environments today. Unlike general artificial intelligence (AGI - Artificial General Intelligence), which could theoretically replicate human reasoning across multiple

domains, narrow AI is developed to perform specific, clearly defined tasks within a particular domain.

This type of artificial intelligence operates within predetermined frameworks and possesses neither consciousness nor the ability to transfer knowledge from one domain to another. Its effectiveness is based on processing large amounts of data and applying machine learning algorithms for decision-making, prediction, and process optimization. In a business context, narrow AI is used in a wide range of applications: from automated customer service via chatbots, through market trend analysis systems, to intelligent tools for recruitment and personnel selection.

Precisely because of its specialized nature, narrow AI achieves a high level of accuracy and reliability within its application domain. Examples of such systems include applications like Motion, Lattice, Rescopera, as well as virtual assistants such as Siri, Alexa, or Google Assistant, which, while appearing versatile, still operate within limited functional frameworks.

In the management context, narrow artificial intelligence represents a key tool as it enables the integration of advanced analytical capabilities into specific business functions without the need to develop complex and comprehensive systems. Such tools contribute to better resource allocation, faster decision-making, and increased operational efficiency, while not replacing managers but rather providing support in performing complex tasks.

Understanding the concept of narrow AI is crucial for analyzing the real and available possibilities of artificial intelligence application in contemporary management, as this very form of AI currently constitutes the core of digital transformation in most organizations.

3.3. Reasoning AI

Reasoning artificial intelligence represents an advanced form of AI systems that not only analyze data but also draw conclusions based on logical reasoning, deduction and abstract interpretation of information. Unlike traditional models based exclusively on patterns and predictions (such as many machine learning systems), reasoning AI attempts to replicate human reasoning capabilities through formal logical methods, symbolic knowledge representation and cognitive models.

The foundation of reasoning AI is its ability to connect different information, discover cause-and-effect relationships and make decisions based on understanding context, not just statistical correlations. Such systems often include mechanisms of symbolic reasoning, ontologies and rule-based systems that enable explicit explanation of how a particular decision was reached.

In a business context, reasoning AI is used in situations requiring complex data processing with multiple variables and vaguely defined outcomes. For example, in strategic management, reasoning AI can help analyze market risks, develop multi-

scenario business models or make decisions under uncertain conditions. In finance, such systems are applied in regulatory compliance analysis, assessment of complex investment risks or forensic auditing. In human resources, they can be used for ethically based decision-making in employee selection and evaluation processes.

One of the challenges in developing reasoning artificial intelligence is the need for deep understanding of context and complex relationships, which requires sophisticated combination of symbolic methods and modern machine learning models. In this sense, there is increasing talk about neuro-symbolic artificial intelligence, which combines the best characteristics of deep learning and logical reasoning.

Reasoning AI is particularly valuable in management because it enables not only automation, but also reasoned and transparent decision-making. This not only increases efficiency, but also trust in the decisions proposed by such systems, which is crucial in environments that require responsibility, ethics and high level of complexity.

3.4. Generative AI

Generative artificial intelligence (eng. Generative AI) represents a contemporary and exceptionally dynamic form of artificial intelligence that has the capability to create new content - whether it's text, images, sound, code or structured data - based on patterns learned from large amounts of data. Unlike traditional AI which is primarily used for classification, analysis or prediction, generative AI actively produces new information that didn't previously exist, thereby opening completely new possibilities in management, creative industries, education and many other sectors.

At the heart of generative AI are deep learning models such as generative adversarial networks (GANs), variational autoencoders (VAEs) and transformer models like GPT (Generative Pre-trained Transformer). These models are trained on massive datasets and are capable of creating convincingly new content that maintains the structure, style and semantics of original samples.

In the context of management, applications of generative AI can be seen in various business functions. In marketing, it is used for automated creation of promotional texts, content personalization and development of visual materials. In finance, it enables generation of realistic scenarios for stress-testing and risk modeling. In human resources, it is used for creating customized job descriptions, automated writing of performance evaluations or interview simulations. In strategic planning, generative AI can help in modeling market trends, creating alternative business models and innovative solutions based on analysis of previous patterns of consumer behavior and competition.

Some of the key advantages of generative artificial intelligence are speed and scalability, which enable managers to obtain a large number of quality proposals, ideas or solutions in a very short time. This significantly increases the creative capacity of

the organization and enables more informed decision-making. However, with the development of this technology, numerous ethical and legal questions are also opening up, including issues of authenticity, intellectual property, privacy protection and potential misuse of generated content.

Thanks to its versatility and value creation capability, generative artificial intelligence is becoming an indispensable tool in digitally transformed organizations. Its implementation into business strategies requires careful planning, ethical framework and continuous monitoring to ensure responsible and useful application in managerial decision-making and innovation.

3.5. Neuro-symbolic AI

Neuro-symbolic artificial intelligence represents a hybrid approach in AI system development that combines the advantages of symbolic reasoning and neural networks, or deep learning. This method seeks to connect the logical precision and transparency of symbolic models with the flexibility and data-learning capabilities characteristic of deep neural networks. In this way, neuro-symbolic AI aims to overcome the limitations of both approaches and create systems that can learn, understand, and interpret complex information in ways closer to human reasoning.

Symbolic AI is based on rules, logic, and knowledge representation through symbols, which enables clear explanation of decisions and inference rules. On the other hand, neural networks learn from large amounts of data and make predictions, but often without interpretability (the "black box" problem). The combination of these approaches in neuro-symbolic AI enables systems to be both accurate and explainable, which is particularly important in business and management contexts where decision-making process transparency is crucial.

In the field of management, neuro-symbolic systems enable the application of AI tools that can learn from data while also following business rules, ethical standards, and regulatory frameworks. Such systems can be particularly useful in strategic decision-making, market analysis, risk assessment, and human capital management. For example, in HR systems, candidate behavior analysis (through neural networks) can be combined with clearly defined selection rules and legal frameworks (through symbolic logic).

The advantage of neuro-symbolic artificial intelligence lies in its ability to connect data with knowledge domains and context. This enables not only accurate and tailored recommendations but also explanations for why particular decisions were made, which is extremely important for organizations seeking to increase trust in AI systems while ensuring their ethical use and accountability.

Although the development of neuro-symbolic AI is still in its early stages, its potential for improving complex management processes is significant, particularly in

environments that require high levels of responsibility, oversight, and a combination of structured and unstructured data.

4. Application of artificial intelligence in various management functions

Artificial intelligence brings significant changes to all key management functions. Its ability to collect, analyze and interpret data in real time enables process optimization and better decision-making in various organizational sectors. Vasilj, Vučić and Matković (2024) in their work "Application of artificial intelligence in the economic and legal affairs of companies" as concluding remarks state that the potential impact of AI on business models and legal practice is undoubtedly significant. They believe that companies that strategically adopt artificial intelligence technologies can increase their competitiveness by creating innovative products and services, personalizing user experience and opening new revenue streams. Similarly, legal professionals who use AI-based tools can benefit from increased efficiency, accuracy and access to relevant information, which ultimately improves the quality of legal services provided.

4.1. Human resources (HR)

Artificial intelligence is playing an increasingly important role in human resource management, particularly in recruitment, selection, and employee retention processes. By using machine learning algorithms, AI systems enable automated resume analysis, identification of relevant qualifications and experience, as well as ranking candidates according to their match with the desired profile. These tools significantly accelerate the hiring process and reduce potential biases in candidate selection.

The application of chatbots further enhances the candidate experience by enabling quick responses to frequently asked questions and facilitating basic communication during the application process. In addition to increasing efficiency, this approach improves user experience and enhances employer reputation.

AI-based analytics are also used for internal monitoring of organizational climate. AI systems can analyze employee satisfaction, identify causes of dissatisfaction, and predict potential turnover risks. This provides HR managers with tools for timely intervention and workplace improvement.

According to research by Dima et al. (2024), the use of AI in recruitment processes not only shortens selection time but also contributes to objectivity. As Albert (2019, cited in Dima et al., 2024) states: "AI automatically filters resumes and ranks the best candidates," significantly reducing costs and increasing precision. Additionally, Chen (2023, cited in Dima et al., 2024) emphasizes that such systems can "identify even the smallest behavioral patterns that indicate potential leaders or risks of employee departure."

By integrating AI technologies into HR processes, organizations not only increase operational efficiency but also build a sustainable and adaptable work environment that meets the challenges of the modern labor market.

4.2. Marketing and public relations

Artificial intelligence is significantly transforming marketing practices, particularly in content personalization and consumer communication. By leveraging advanced machine learning algorithms, AI enables detailed analysis of user behavior, purchase history, interests, and demographic characteristics, facilitating highly personalized and relevant targeted marketing campaigns. AI encompasses numerous marketing applications, with some of the most important current implementations including user content personalization, chatbot and virtual assistant deployment, and intelligent segmentation.

Galloway and Swiatek in their work "Public Relations and Artificial Intelligence: It's (Not Just) About Robots" (2018) emphasize that as new analytical techniques emerge to assist PR practitioners, AI applications will expand across the entire professional context. AI implementation in public relations is feasible, as in other social domains, primarily because it enables more precise, faster, and easier targeting of strategic audiences while achieving greater media interactivity and attention (Tomić, Volarić, and Obradović, 2022).

Recommendation systems, based on user behavior patterns, have become indispensable tools for digital platforms. These systems automatically suggest products and content matching individual user preferences, thereby increasing customer engagement and loyalty.

Furthermore, AI enables sophisticated social media data analysis through sentiment analysis tools. These tools interpret user communication tone, reactions, and emotions expressed in posts, allowing marketing professionals to rapidly adjust strategies and brand messaging in real time.

In digital marketing, sentiment analysis is gaining increasing importance as a tool for emotional content adaptation. Cannella (2018) highlights that "AI enables analysis of consumer feelings through facial recognition technology," opening new dimensions for deep personalization of marketing approaches. This approach allows companies to not only better understand their customers but also predict their needs and behaviors, thereby enhancing communication effectiveness and business goal achievement.

Thus, artificial intelligence serves not merely as an analytical tool but has become an active co-creator of content and strategies in contemporary marketing, transforming data into tangible business value.

4.3. Finance

Artificial intelligence is increasingly becoming a key tool for improving business processes in the financial sector. It is used in credit risk assessment, fraud detection, cash flow prediction and automation of financial reporting. AI systems enable quick identification of unusual transactions that may indicate potential fraud, which significantly increases the security of financial operations.

Financial managers are increasingly using predictive models to more accurately plan budgets and manage costs more efficiently, resulting in better resource allocation. The cognitive insights obtained through machine learning differ significantly from traditional analytics in three key aspects: they rely on large amounts of data, are based on pre-trained algorithms and have the ability to independently improve over time (Davenport and Ronanki, 2018).

4.4. Logistics and operations

Artificial intelligence is finding increasing application in optimizing logistics processes and operational management within organizations. AI systems enable efficiency improvements throughout supply chain management, from procurement planning and warehousing to distribution and final delivery to customers. The integration of predictive analytics allows for accurate forecasting of market demand, resulting in more precise ordering, reduced inventory levels, and lower storage costs.

By analyzing historical and real-time data, AI systems identify patterns in consumer purchasing behavior and seasonal fluctuations, enabling timely and informed decisions about procurement quantities and timing. This significantly reduces waste, increases profitability, and decreases operational risk. Companies using AI for demand forecasting achieve exceptional results - for example, Amazon employs advanced machine learning algorithms that predict demand with up to 95% accuracy, leading to a 20-50% reduction in excess inventory (Ren, 2023).

Beyond inventory management, artificial intelligence also contributes to predictive equipment maintenance. Sensor-equipped systems continuously collect machine operation data and use AI algorithms to predict potential failures or performance deviations. As Lee et al. (2018) emphasize: "Analytics Technology converts the sensory data from critical components into useful information [...] for asset health prediction, such as generating a health value or a remaining useful life value." This approach enables timely maintenance and reduces unplanned production downtime, thereby increasing overall operational efficiency.

Furthermore, autonomous logistics systems, such as intelligent robotic warehouses and automated transport, are being increasingly adopted by large corporations as well as medium-sized enterprises pursuing digital transformation. The benefits are multiple: reduced labor costs, accelerated processes, and minimized human errors.

Overall, artificial intelligence enables a completely new approach to operations management, where operational decisions are made based on real-time data analysis, thereby enhancing competitiveness and adaptability in dynamic markets.

4.5. Strategic decision making

Artificial intelligence is playing an increasingly significant role in strategic decision-making within organizations, particularly in complex and dynamic market conditions. By utilizing advanced AI models, it's possible to simulate various business scenarios, analyze risks, and predict potential outcomes, enabling managers to make more informed and effective decisions. Processes that traditionally required lengthy analyses and collaboration between multiple departments can now be executed much faster and more precisely thanks to the integration of AI tools with Decision Support Systems (DSS).

These systems employ complex algorithms and large datasets to identify patterns and propose optimal strategic directions. This not only accelerates decision-making but also enhances its quality, as AI enables trend forecasting, risk identification, and strategy adaptation in response to environmental changes.

The practical application of these concepts is particularly evident in the operations of major technology companies like Amazon. Amazon uses advanced algorithmic systems that enable dynamic pricing based on analysis of historical data, geolocation, user behavior, and even time of day. This allows the company to continuously optimize its pricing strategy in real time. As Marwala and Hurwitz (2017) note, such systems enable "the creation of individual supply and demand curves," facilitating personalized and flexible business operations aligned with market conditions.

Vasilj, Stojkić, and Bubalo (2023) conclude in their work that strategic managers must recognize the need to fully leverage the benefits of transforming their companies through artificial intelligence. They also state that there will be no alternative to this transformation. Thus, AI becomes a crucial ally for managers in shaping long-term strategies based on real, accurate, and timely information, thereby enhancing an organization's competitiveness in today's business environment.

5. Examples of application of artificial intelligance

5.1. Application of artificial intelligence in time management: an example of the Motion application

Time and task management is one of the fundamental areas of managerial functions where artificial intelligence shows exceptional potential for increasing efficiency, better work organization and reducing operational stress. The Motion application represents a concrete example of how artificial intelligence can be

implemented in daily business operations with the aim of optimizing time and increasing productivity.

Motion is a digital platform that enables automatic task planning, calendar management and workday organization. Instead of manual planning, the application uses artificial intelligence to analyze tasks, priorities, duration of obligations and available time, and based on this data creates an optimal schedule of activities. The system dynamically adapts to changes in real time - if a meeting is moved or canceled, the schedule is automatically reorganized in the most efficient way, without the need for user intervention.

In the background of this application are sophisticated machine learning algorithms that enable Motion to better adapt to individual work habits of users over time. The longer the application is used, the more accurate it becomes in predicting optimal time slots for individual tasks and recognizing behavior patterns. In addition, the integration of natural language processing (NLP) technologies allows entering tasks in everyday language, which the system automatically interprets and fits into the schedule.

In a managerial context, Motion has multiple values. It enables professionals to shift their focus from operational planning to strategic decision-making, thereby reducing cognitive load and improving management quality. In addition to individual benefits, the application also offers team coordination and collaboration functionalities, which further contributes to effective project and team management.

The application of artificial intelligence through tools like Motion clearly shows how traditional time management is transitioning into a phase of intelligent automation. However, it must be emphasized that lack of knowledge and skills among managers and employees can represent a serious obstacle to successful implementation of such technologies, which may ultimately negatively affect the business climate (Radić et al., 2023).

5.2. Application of artificial intelligence in human resource management: an example of the Lattice application

Human resource management has undergone significant changes through digital transformation, with artificial intelligence being increasingly used to analyze employee behavior, track performance, and enhance organizational culture. One application leading this change is Lattice - a platform that integrates various aspects of employee development, performance management, and team engagement, using AI technologies to support better decision-making in human resources.

The Lattice application uses artificial intelligence to analyze employee data, including feedback, evaluation results, achieved goals, and engagement levels. Based on this data, the platform generates guidelines for performance discussions, suggests

individual development plans, and helps identify high-potential employees or those at risk of leaving the organization.

A key feature of the application is its continuous performance monitoring system, which enables transparent and frequent feedback exchange between employees and supervisors. AI models analyze patterns in this feedback and identify trends, allowing for timely intervention in cases of decreased satisfaction or productivity.

Additionally, Lattice uses algorithms to analyze organizational climate through employee engagement and satisfaction surveys. Based on these analyses, managers receive recommendations for specific actions to improve team cohesion, motivation, and overall work atmosphere. Here, artificial intelligence serves not just as a measurement tool, but also for strategically shaping human capital management policies.

The particular value of Lattice lies in its ability to foster a culture of trust and open communication, while providing management with tools for personalized approaches to each employee. Automated analyses enable data-driven decision making, increasing objectivity and fairness in evaluation and reward processes.

The use of Lattice in human resources demonstrates how artificial intelligence can play a vital role in developing human potential and shaping organizational culture. Integrating such tools into daily HR processes not only contributes to better efficiency and employee retention, but also ensures long-term growth and organizational stability through strategic human capital management.

6. Challenges of developing specialized AI systems for small businesses: the pursuit of comprehensive models

As artificial intelligence becomes increasingly prevalent in business processes, an important trend is emerging in its development - a shift from narrowly specialized solutions to comprehensive, generalized AI models. This change is particularly evident in the context of small and medium-sized enterprises (SMEs), which often lack the technical, financial, and human resources to develop and implement highly specialized AI systems. In this context, comprehensive models that can adapt to various business scenarios represent a more realistic solution for widespread AI adoption. Bečić (2018) emphasizes that "the impact of digital transformation on the labor market is particularly evident through four segments: transformation of existing jobs, relocation of jobs to the virtual world, job creation, and job disappearance."

While large organizations often develop their own niche-oriented AI systems tailored to specific needs and processes, small businesses face high development and maintenance costs for such technologies. As a result, there is growing interest in using general, scalable AI solutions that can operate in different contexts without requiring extensive customization.

A clear example illustrating this issue can be found in small bakeries that daily face the problem of overproduction. Since it's often unknown what quantity and types of bakery products will be sold during the day, significant amounts of unsold goods accumulate by closing time. Under conventional conditions without advanced analytics, such losses are frequent and difficult to avoid.

However, imagine implementing a generalized AI model that analyzes sales patterns, weather conditions, days of the week, local events, and other factors to provide daily recommendations: what and how much to produce, when to start baking certain items, and how to allocate resources. Such a model would continuously improve itself by learning from new data, becoming increasingly accurate over time. Ultimately, the bakery could achieve greater profitability with less waste, potentially resulting in significant annual savings and more efficient operations.

Unfortunately, developing a specialized AI system just for one small bakery is impractical. The cost of development, maintenance, and adaptation often outweighs the direct benefits the business could gain. This is precisely why the AI industry is trending toward developing modular and scalable AI tools that can be applied in various contexts without requiring highly specialized solutions.

This move toward comprehensive models offers numerous advantages, including affordability, scalability, and faster implementation. However, the challenge remains that generic models often cannot fully accommodate the specificities of each individual business, leading to a compromise between adaptation and efficiency.

For small businesses, the future of AI application lies in developing affordable, flexible solutions based on comprehensive models that offer a certain level of personalization through local data and user context. Such solutions represent a compromise between the high demands of specialization and limited resources, enabling genuine digital transformation even for smaller economic entities.

7. Managerial Dependence on AI: Between Efficiency and Knowledge Stagnation

The role of managers in modern organizations is increasingly being shaped by advancements in artificial intelligence. AI systems are now used to automate data analysis, write reports, respond to emails, suggest strategies, and even manage team communication. While this technology enables significant time savings and increases operational efficiency, questions arise about the long-term consequences of managers' excessive reliance on artificial intelligence.

One of the main challenges is the potential stagnation of knowledge and skills. Traditional managerial competencies include analytical thinking, decision-making, interpersonal skills, and written and verbal communication abilities. If these functions are increasingly taken over by AI - for example, through tools that automatically generate emails, optimize content, or suggest responses - there is a real danger that

these skills will no longer be actively developed. In the long term, this could weaken personal authority, creativity, and independent thinking abilities, which are key qualities of good leadership. As Christian (2020) points out, as AI systems become more capable, the key challenge becomes "alignment" - ensuring these systems understand and follow human goals, which is particularly important in business implementations.

An illustrative example is the growing practice of using AI tools for email communication. Managers increasingly use AI-based systems that analyze communication content and automatically provide ready-made responses, rephrasing, and suggestions. While this is useful for saving time and standardizing business correspondence, over time it may lead to weakened independent expression, nuanced messaging, and interpersonal sensitivity as these functions are completely taken over by algorithms.

This dependence on AI is not necessarily negative in itself, but becomes problematic when artificial intelligence is used as a replacement rather than a complement to human capabilities. The use of AI should strengthen and support managerial functions, not replace them. Managers who rely exclusively on automated systems risk losing deeper contextual understanding, which can lead to superficial decisions and lack of strategic vision.

Therefore, it is crucial to develop a critical approach to AI tools while simultaneously investing in continuous manager education, with the goal of preserving core professional skills. The future of management will not be based solely on technology use, but also on the ability to balance artificial and human intelligence - where AI is not a replacement, but a partner in making quality decisions.

8. The Future of Management with AI: The Human Behind the Tool

As artificial intelligence becomes increasingly integrated into daily business processes, it's clear that its role in management will continue to grow. However, while AI brings numerous benefits in terms of efficiency, speed, and processing large amounts of information, future managers face one crucial question: what remains for humans when everyone has access to the same technology?

In a world where every manager can use the same AI tools for market analysis, process optimization, task automation, and communication, competitive advantage will no longer come from simply possessing AI, but rather from how it's used. In other words, the role of human individuality, creativity, intuition, and strategic thinking becomes even more important. AI can provide data, patterns, and recommendations, but the final interpretation and decision-making remains in human hands.

This new paradigm can be compared to a duel where both sides wield the same sword. Technology as a "weapon" becomes equal for all, and the decisive factor

becomes the skill of the person wielding it. This is where personal competencies become crucial: those who can better recognize context, understand team emotions and dynamics, and think more creatively outside suggested frameworks will gain the advantage.

Moreover, in future business environments deeply permeated by automation and digital systems, the value of human qualities that AI (still) cannot replicate - such as empathy, moral judgment, cultural sensitivity, and inspirational ability - becomes increasingly pronounced. These means future managers will need to develop not only technical knowledge but also so-called soft skills to maintain relevance and authenticity in a digitalized environment. As Smiljanić (2023) notes while analyzing Harari's thesis, artificial intelligence represents a qualitatively new challenge to traditional employment forms because "21st century technologies could reduce and eliminate the need for individuals (humans)." This radical transformation requires thorough re-examination of work and employment concepts in the digital age, where the traditional division between "human" and "machine" jobs is becoming increasingly blurred.

Furthermore, there's a risk of excessive homogenization of business approaches. If everyone uses similar AI systems and algorithms, decisions and strategies could become predictable and standardized. In such an environment, those who succeed in combining AI's power with their own originality, personalized approach, and ability to see the bigger picture - beyond what the data itself suggests - will stand out.

In conclusion, artificial intelligence will shape tomorrow's management, but it won't define it without humans. The human factor - ways of thinking, ethics, creativity, and decision-making ability in uncertain and complex situations - will remain crucial. In an era of ubiquitous technology, the winners won't be those who use AI, but those who use it wisely, responsibly, and authentically.

9. Conclusion

Artificial intelligence is increasingly shaping the business environment and bringing revolutionary changes to how organizations function and make decisions. This paper has analyzed how AI is becoming a key tool in modern management, with emphasis on the opportunities it provides - from analyzing large amounts of data, through process automation, to supporting strategic planning. It is clear that artificial intelligence is not just a passing trend, but a structural change in fundamental business practices.

However, as technology develops, numerous questions arise - from ethical and legal to organizational and social ones. It is particularly important to recognize the risk of excessive reliance on AI, which can lead to stagnation of human skills, loss of individuality and reduced critical thinking among managers. In a time when everyone

has access to similar tools, the decisive role will not be played by the technology itself, but by how it is used - that is, the quality of the human factor behind decisions.

The future of management with artificial intelligence requires a balance between digital efficiency and human authenticity. Organizations that want to remain competitive must proactively invest in digital transformation, while at the same time nurturing creativity, critical thinking and an ethical approach to business.

Ultimately, AI will not replace managers, but will change them - shaping a new generation of leaders who know how to use technology wisely in service of people and organizations.

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Bibliometric and Text Mining Analysis of Metaverse, Augmented Reality, and Virtual Reality Research Trends

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Abstract

The evolving landscape of disruptive digital technologies—the Metaverse, Augmented Reality (AR), and Virtual Reality (VR)—is examined within this research paper through a bibliometric and text mining approach. The Web of Science database was the focus of the search, and a total of 233 peer-reviewed, open-access research articles, published between 2021 and 2025, were systematically analyzed. The analysis occurred in two stages. The first stage incorporated bibliometric approaches to map publication patterns, contributions at the country level, publication venues, and discipline variation. The second stage employed VOSviewer to provide text mining techniques, which identified co-occurrence networks and thematic clusters of keywords. The research results showed that a large proportion of the publications originated from Asian countries, specifically the People's Republic of China, and Computer Science and Engineering emerged as the most fruitful fields. Furthermore, nine clusters were identified in total, with "Virtual Environment" shown to be the most interconnected and most prevalent topic in the research publications. Overall, the findings provide evidence of the key theme in immersive technology research being in a mature state and having emerging significance, while also demonstrating the interdisciplinary breadth of the field. This research paper advances valuable evidence and information for academics, practitioners, and public policy officials interested in the increasing intersection between immersive technologies and individuals' social, commercial, and environmental interactions.

Keywords: Metaverse, AR, VR, text-mining, bibliometric research

JEL Classification: O33, L86, M15

1. Introduction

The accelerating evolution of immersive technologies as the Metaverse, Augmented Reality (AR), and Virtual Reality (VR), is creating a transformative potential across disciplines and sectors. Increasingly, these technologies are becoming an integral part of existing sectors, including education, healthcare, entertainment, and business, giving rise to new modes of interaction, engagement, and simulation (Dwivedi et al., 2022). Interest in these technologies is growing globally, alongside the contribution of academic literature that seeks to examine the development, application, and societal implications of immersive digital technology (Tas et al., 2022).

However, as this evolving sector matures, the vastness and variety of research findings provide difficulties for understanding what is establishing into broader patterns of application, as well as noting emerging forms of study focus. Therefore, a systematic exploration of the research context is needed. This research paper proposes to take such a study approach in two stages; to begin with it will use a bibliometric analysis to understand publishing trends, such as authorship, author-affiliated research domains, and overall geographical connectivity, and secondly through text mining methodology, using VOSviewer software, to conceptualize the structure of technology through a keywords and co-occurrence network to create themes for knowledge structure.

The objective of this study is to systematically map and review the current peer-reviewed research papers on disruptive technologies—specifically the Metaverse, Virtual Reality, and Augmented Reality—published between 2021 and 2025 using Web of Science database. With a combination of bibliometric analysis and text mining techniques, the paper authors aim to show publication trends, research priority areas, and rising knowledge clusters to deliver an open and reproducible picture of this dynamic field.

The article is structured in the following order. After the introduction, the literature review is presented. Followed by the methodology section. Next in line are the research results, followed by a conclusion, where limitations and future implications are shown.

2. Literature review

Disruptive digital technologies such as the Metaverse, Virtual Reality (VR), and Augmented Reality (AR) have attracted considerable academic attention in the last couple of years, particularly following the rapid digital revolution after the COVID-19

pandemic. Not only are these technologies changing the way people socialize and work, but they are also altering value creation in industries such as healthcare, education, retail, gaming, and business management (Dwivedi et al., 2022; Mourtzis, 2023).

The Metaverse, a concept popularized by immersive virtual worlds that combine real and virtual experiences, has been referred to as the future of the internet frontier (Lee et al., 2021). Scholars have explored it for collaborative learning (Radianti et al., 2019), virtual workplaces for remote collaboration (Zhang et al., 2022), and decentralized digital economies through technologies like blockchain (Nambisan et al., 2019). At the same time, VR and AR have become central components of immersive technology ecosystems with applications ranging from virtual simulations and 3D modeling to experiential learning and augmented consumer experience (Marougkas et al., 2023; Chen et al., 2021).

Methodologically, bibliometric and text-mining analyses have also emerged as handy tools for encapsulating and visualizing research trends in large collections of academic publications. Bibliometric analysis also enables the recognition of highly cited authors, organizations, countries, and main research themes (Aria et al., 2017). Text mining, particularly when aided by software tools like VOSviewer, enables the extraction and co-occurrence mapping of keywords, which offers a glimpse into conceptual relationships, knowledge structures, and emerging themes (Van Eck et al., 2010). Studies such as Wang et al. (2021) and Rochman et al. (2023) have shown the usefulness of combining both approaches to obtain macro-level patterns and micro-level semantics in scientific literature.

In this paper, the authors followed a two-stage methodological process. Initially, bibliometric research was carried out with the Web of Science database, limited to English, open-access, peer-reviewed articles from the years 2021 to 2025. The second step involved text mining using VOSviewer, which mapped the semantic relationships between high-frequency keywords based on network and cluster visualization.

Several earlier studies have demonstrated the efficacy of these tools for similar domains. For example, Tan et al. (2022) conducted a bibliometric review of AR/VR applications in education, while Yaseen et al. (2025) used VOSviewer to investigate keyword trends in Metaverse-related business research. These research studies formed the basis of the present research, which is unique in integrating the disruptive technology triad (Metaverse, AR, VR) and extending the time frame until 2025, creating a more recent and future-looking overview of the research landscape.

Utilizing the combination of bibliometric and text-mining methodologies, this paper contributes to a finer understanding of both the structural and thematic evolution of immersive technology research, pointing not only to where research has gone but also to where it is headed.

3. Methodology

The research will carry out the search and evaluation of prior research papers through two stages. A bibliometric analysis, which offers an overview of the current publications on the mentioned disruptive technologies (Metaverse, Virtual Reality, and Augmented Reality), is the first stage. Furthermore, the second stage utilizes a text mining technique to further analyze the unstructured text data for additional insights. For the bibliometric analysis, research authors used the Web of Science database related to "Metaverse", "AR", and "VR" keywords through open-access research papers from 2021 to 2025. The chosen publication type is a peer-reviewed research paper, and the analysis will consist of publication titles, authors' countries (of origin), and the most common research areas for the given topics.

Open-access publications written in the English language with keywords "Metaverse", "AR", and "VR" were found by searching the Web of Science database. The initial search provided a high number of papers (358) published between 2021 and 2025. There were 233 screened papers overall when only research papers were taken into consideration as shown in Table 1. Additionally, this analysis focused exclusively on research papers that have passed peer review.

Table 1. Web of Science search strategy (source: author's work)

Search strategy	**Researched publications**	**Period**
Keywords: „Metaverse", "AR", and "VR" Filtered by: English language, open-access, research papers	233	2021-2025

A bibliometric search in the Web of Science database provided bibliometric information, abstracts, keywords, and references for every article, providing the data from which text mining could be performed for analysis with VOSviewer (Megatama et al., 2022). VOSviewer uses a distance-based model to visualize bibliometric networks (e.g. by keywords, authors, or countries). The process begins by identifying elements (keywords, for example) as nodes; distance is then standardized (using the method as explained in Mahadevan et al., 2021); the nodes are then represented in two dimensions, where nodes with higher co-occurrence will appear at closer distances. From this, clusters are identified using a local movement algorithm (Waltman et al., 2010).

VOSviewer also includes a text mining function that creates co-occurrence networks from English texts (e.g. keywords), which employs the Apache OpenNLP library to perform tasks like tokenization, sentence segmentation, part of speech tagging, and named entity recognition (Jehangir et al., 2023; Jajić et al., 2025).

To improve transparency and reproducibility, authors used Web of Science Core Collection which was searched in May 2025 using the Topic field and string ("Metaverse" OR "Virtual Reality" OR "Augmented Reality"). The results were restricted by English language, open-access, and article type (peer-reviewed research articles), between the years 2021–2025. Editorials, book reviews, letters, and non-research publications were not included. After screening, 233 records were available for analysis. This search strategy and inclusion/exclusion criteria ensure that other researchers can reproduce the dataset. In the subsequent phase, VOSviewer's text mining functions (tokenization, sentence segmentation, part-of-speech tagging, and named entity recognition) were applied on titles and abstracts to construct co-occurrence networks, enabling in-depth analysis of clusters and keywords.

This method encouraged an exploratory analysis of the area of disruptive technologies research. The analysis drew attention to keyword and country analysis of the dataset, and used a full counting approach to achieve reliable results.

4. Results

The first stage of bibliometric analysis involves publication titles, authors' countries (of origin), and research areas being analyzed. Table 2 shows that most of the publications have been published in the IEEE journals (from the data available). It is followed by Electronics (8), Applied sciences (4), and others.

Table 2 Publication titles (source: authors' work)

Publication titles	**# of publications**
IEEE ACESS	10
ELECTRONICS	8
IEE INTERNET OF THINS JOURNAL	5
IEE TRANSACTIONS ON CONSUMER ELECTRONICS	5
APPLIED SCIENCES	4
APPLIED SCIENCES BASEL	4
COMPUTERS	3
EDUCATION AND INFORMATION TECHNOLOGIES	3
IEEE NETWORK	4
ICT EXPRESS	3

When the authors' countries (of origin) were analyzed as shown in Table 3, the majority of the countries were from Asia. The majority of the publications have been published in the People's Republic of China (83), the United States of America (32), and India and South Korea (27 each). Other authors' countries showed a lower number of publications.

Table 3. Authors' countries (of origin) (source: authors' work)

Authors' countries	**# of publications**
People's Republic of China	83
United States of America	32
India	27
South Korea	27
United Arab Emirates	14
Saudi Arabia	13
Germany	13
Italy	12
England	12

The research publication areas show an interdisciplinary approach. Most publications are shown in various fields as they have an impact in various areas, and not only one. Therefore, the majority of publications' research areas are in Computer Science (141), followed by Engineering (97), and Telecommunications (48). Other research areas consist of 32 publications or fewer. The full research area list is shown in Table 4.

Table 4. Research areas (source: authors' work)

Research areas	**# of publications**
Computer Science	141
Engineering	97
Telecommunications	48
Education Educational Research	32
Business Economics	27
Mathematical Computational Biology	22

Physics	19
Health Care Sciences Services	17
Psychology	17
Behavioral Sciences	16

In the second part of the analysis, the research paper authors used VOSviewer's text mining functionality to examine 233 publications that produced relevant keywords from the disruptive technologies topics (Figure 1). Figure 1 captures keywords that appeared at least five times, and the node size indicates the frequency of the keyword, while the line thickness indicates the strength and association of keyword pairs. A Thesaurus file was applied to avoid overlap between synonymous terms (Yu et al., 2020). With the initial analysis, 66 terms were presented with a total of 688 connections across the keywords and an average link strength of 43.9. The keyword map provided a clear illustration connecting disruptive technologies, both as a representation of involved parties relevant to business and consumer behavior.

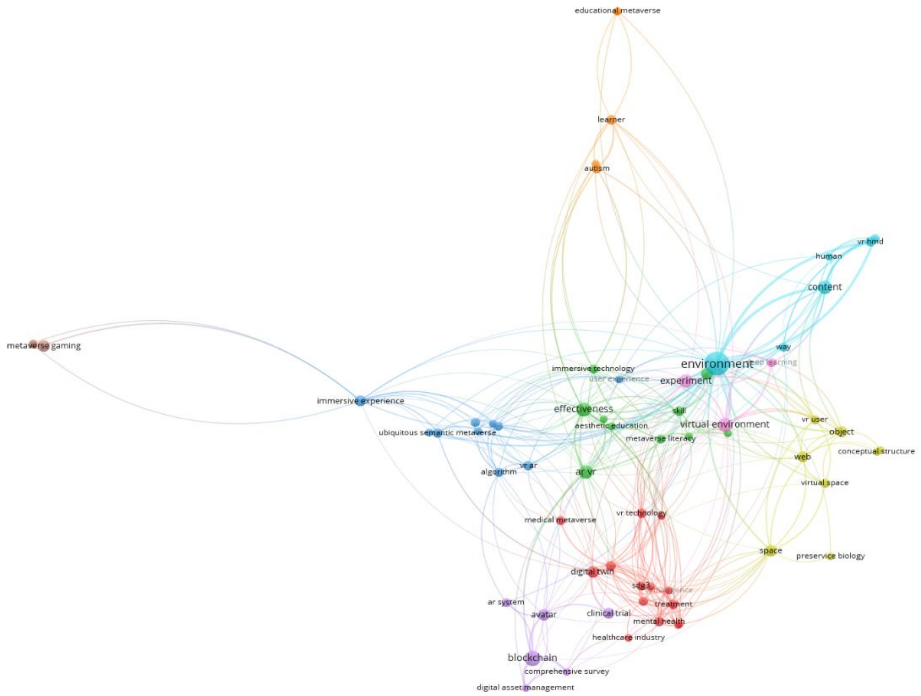

Figure 1. Text mining map (source: authors' work)

The keywords frequency heat map is shown in Figure 2, where color intensity shows the strength of the occurrence. The two main colors, green (low occurrence) and yellow (high occurrence), overlap on the map. There is a connection between technologies, with virtual environment being in the center, with medical usage of VR technology as the second most prominent keyword. This immediately shows that the disruptive technologies have a usage in specific industries and are very much needed for a more efficient approach.

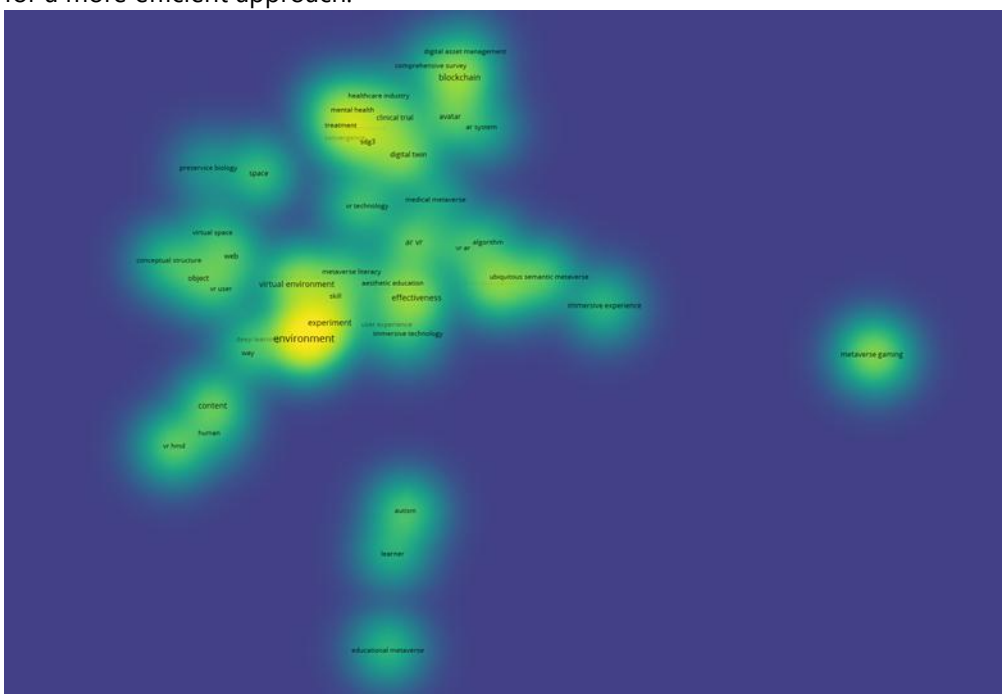

Figure 2 Text mining density visualization (source: Authors' work)

A text-mining analysis involving VOSviewer and recent keyword searches associated with metaverse, AR, and VR, identified nine clusters and a thematic structure of embracing topics and less distinctly related topics. As shown in Table 5, the most connected cluster was Cluster 6 (Environment). With the most links to the general research, the highest average number of links (14.16), and overall total link strength (106.6), papers explicitly referred to discussions underlying virtual environments and sustainability. Furthermore, Cluster 9 (Virtual Environment), which shows sufficient nodes and connectivity (15 average links from a total of 75 link strengths) and peaked in 2025, shows the emerging importance of research in immersive simulation, digital collaboration, and spatial computing in immersive environments. Cluster 1 (Digital Twin) and Cluster 2 (AR/VR) are both established foundational technologies, with clear development over time and moderate-to-high links of connection. Although Cluster 5 (Blockchain) has fewer average links than

others, the strong internal link strength (41.16) indicates a limited but high-impact research stream that connects to security issues, digital assets, and decentralized systems in virtual environments. Cluster 3 (Immersive Experience) stands less alone than the others and may connect and bridge the many areas or themes of user-centric immersion. Cluster 7 (Learner), Cluster 4 (Web) and Cluster 8 (Metaverse Gaming) have lower link connections and could be considered more niche and emerging areas of focus, with more attention having gone to educational technologies and gamified virtual platforms. Overall, the results of this text mining analysis indicate the presence of both emergent and mature fields, while the more interconnected ones are better understood by the discipline of research.

Table 5. Clustering (source: authors' work)

Clusters	**Links (average)**	**Total link strength (average)**	**Highest number of publications (year)**	**Most occurring keywords (more than 5 occurrences)**
Cluster 1	13	41	2023	Digital twin
Cluster 2	10.8	35.2	2024	AR/VR
Cluster 3	12.6	28.3	2023	Immersive experience
Cluster 4	8.25	35.6	2023	Web
Cluster 5	6.83	41.16	2023	Blockchain
Cluster 6	14.16	106.6	2022	Environment
Cluster 7	5.4	27.4	2024	Learner
Cluster 8	3	38.3	2025	Metaverse gaming
Cluster 9	15	75	2025	Virtual environment

Furthermore, these results underscore the important disciplined knowledge of the interdisciplinary nature of studies related to the many aspects of metaverse studies. Suggesting a more likely expansion in other disciplines and contexts to foster research projects that explore the interface of immersive digital environments.

5. Conclusion

The research authors used a two-stage analytical approach, bibliometric analysis, and text mining to explore the evolution of the scholarly landscape of disruptive technologies such as the Metaverse, Virtual Reality, and Augmented Reality between 2021 and 2025. Based on peer-reviewed open-access articles indexed in the Web of

Science database, the bibliometric stage offered a rich insight into patterns of publications, leading contributor countries, and dominating areas of study. The findings show that the majority of contributions were from Asia, primarily the People's Republic of China, and among various interdisciplinary categories, Computer Science, Engineering, and Telecommunications were the top fields.

The second phase, drawn from VOSviewer's text-mining feature, yielded nine thematic clusters in 233 publications. The most well-connected and influential clusters—Environment and Virtual Environment—represent the increasing importance of sustainability and virtual simulations in academic discourse. Key technologies such as AR/VR continue to be prominently focused on, with Blockchain being a specialist but important theme, particularly within security and decentralization debates. As well, clusters such as Metaverse Gaming recognize newer, upcoming fields with room for growth within educational and entertainment environments.

Overall, the analysis portrays mature and upcoming lines of inquiry, evidencing the international and interdisciplinary nature of research with immersive/disruptive technologies. Considering developments over a five-year timeframe (2021–2025), the current paper provides a substantial overview of technological trends and thematic alignment and therefore provides a platform for additional studies connecting digital innovation with social, economic, and academic disciplines.

The research has some limitations as well. First, the data were limited to English-language, open-access research articles from the Web of Science database. Excluding publications in non-English languages, conference papers, and articles published in other academic databases (e.g., Scopus or IEEE Xplore) may have resulted in omitting valuable works. Second, although VOSviewer is an effective bibliometric and text-mining visualization software, outcomes will rely on the caliber and consistency of the metadata, e.g., keywords contributed by authors, that can vary across publications. In addition, synonym coverage and context dependence, while partly controlled through a Thesaurus file, will likely continue to impact keyword relationship interpretation.

Future research should consider the inclusion of various academic databases to provide a wider and globalized perspective. Utilizing advanced machine learning or natural language processing techniques could also serve to further raise text analysis granularity, such as more complex semantic patterns and thematic fluctuations. Finally, examining the application implications of disruptive technologies in specific industries (e.g., healthcare, education, retail) through case studies or qualitative research could yield richer, context-rich findings that complement the bibliometric findings.

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The Impact of Leadership Styles on the Motivation and Creativity of Employees in Non-Profit Organizations

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Abstract

Employees in non-profit organizations often find their motivation in the mission and social impact of their work, rather than financial rewards, which sets them apart from their counterparts in the for-profit sector. Given that the success and sustainability of NPOs depend on the continuous provision of value to users and on attracting donors and partners, it is crucial for NPOs to encourage a high level of motivation and creativity in their employees. In this context, leadership style becomes a vital factor of organizational effectiveness. The purpose of this study is to understand how leadership behaviors influence employee motivation and creativity, especially in the unique environment of Croatian NPOs. Research was conducted on a sample of 179 employees, using a structured questionnaire. The findings show that the democratic style and the transformational style have a significant positive effect on employee motivation and employee creativity, while the transactional leadership style has a moderate positive impact on both variables. Conversely, the autocratic leadership style has a negative impact on employee motivation and creativity, whereas no statistical association was found between the laissez-faire style and employee motivation and creativity. The obtained findings confirm the importance of implementing participative and supportive leadership styles in NPOs to tap into the full potential of employees and achieve an organization's goals.

Keywords: leadership styles, non-profit organizations, employee motivation, employee creativity

JEL Classification: M12, M54, O15, L31

1. INTRODUCTION

Today, non-profit organizations play an essential role in addressing unmet societal needs, particularly where government and market solutions fall short. Unlike profit-focused organizations, whose primary goal is financial gain, NPOs base their activities on their mission, values, and public benefits (Brown and Yoshioka, 2003; LeRoux, 2009). Such a value framework reflects on the motivation of employees, who often look for meaning in their work, in identifying with an organization's goals, and in opportunities for contributing to society, rather than in financial incentives (Word and Park, 2015; Wright and Pandey, 2010). Human potential management in such a setting requires a specific approach to leadership. The leadership style that a leader chooses can greatly impact the level of employee motivation and creative expression, key preconditions to successfully achieving an organization's society-focused goals (Northouse, 2015; Yukl, 2013). Especially in sectors with limited resources and high demands regarding innovativeness and flexibility, leadership style becomes a decisive factor of organizational effectiveness (Bass and Riggio, 2006; Avolio and Gardner, 2005).

Previous studies highlight the transformational leadership style as the style best suited for boosting the intrinsic motivation and creativity of employees in the non-profit sector because it is based on a vision statement, support, emotional intelligence, and on fostering autonomy (Bass and Avolio, 1994; Tierney and Farmer, 2002). Similarly, the democratic leadership style, through participation, dialogue, and mutual trust, displays positive effects on employee engagement and sense of belonging (Moynihan, Pandey and Wright, 2012). On the contrary, autocratic and laissez-faire leadership styles are linked to negative outcomes, such as employees' waning motivation, declining levels of creativity, and emotional distancing (Jaskyte, 2004; Skogstad et al., 2007). In consideration of the above, this study aims to investigate how different leadership styles (autocratic, democratic, laissez-faire, transactional, and transformational) impact employee motivation and creativity in NPOs in Croatia, in order to contribute to a better understanding of the role of leadership within a sector that is increasingly facing challenges pertaining to sustainability, innovativeness, and the recruitment of quality staff.

2. LITERATURE REVIEW

In non-profit organizations, where employees are often driven by values rather than monetary incentives, leadership plays a critical role in sustaining motivation and promoting innovation. Considering that employees in this sector are usually not motivated by financial incentives but rather by an organization's values, by identifying with the organization's goals and by wanting to contribute to society, leadership must focus on boosting intrinsic motivation, engagement, and creativity (Brown and

Yoshioka, 2003; LeRoux, 2009; Word and Park, 2015). In this context, the choice of a leadership style becomes extremely important, in particular in sectors that rely on informal sources of power, team dynamics, and socially meaningful action. The literature typically classifies leadership styles as being either traditional or modern, with regard to differing approaches to employees, focus on structures relative to relationships, and type of decision-making (Northouse, 2015; Yukl, 2013). Traditional leadership styles include autocratic, democratic, and laissez-faire leadership (Bass and Stogdill 1990). The common features of traditional leadership styles are reflected in vertical hierarchy, unambiguous roles, and limited leader-employee interaction. In NPOs, in which flexibility, cooperation, and identifying with the mission are especially important, traditional leadership styles tend to be poorly adjusted to the employees' needs. On the other hand, modern leadership styles include transactional, transformational, and servant leadership (Northouse, 2015). The main characteristic of these styles is that they are based on interpersonal relationships, emotional intelligence, and on building trust, making them particularly suitable for leading in organizations working in a setting of social responsibility and limited resources (Bass and Riggio, 2006; Avolio and Gardner, 2005).

Regarding NPO leadership, studies show that the transformational leadership style is continuously confirmed as the most suitable for strengthening employee motivation and creativity, in particular in sectors in which work is strongly linked to purpose and social outcome. Transformational leaders act by providing a vision, support, individualized consideration, and intellectual stimulation (Bass and Avolio, 1994), thus activating a higher level of employee motivation. In NPOs, this is linked to a sense of meaning, personal importance, and identifying with the mission, which positively impacts motivation and proactive behaviour (Wright and Pandey, 2010; Park and Rainey, 2008). Furthermore, many studies confirm that transformational leaders considerably foster employee creativity by creating a secure climate for expressing novel ideas and by ensuring autonomy in the workplace (Tierney and Farmer, 2002; Gumusluoglu and Ilsev, 2009). This is particularly important in NPOs engaged in dealing with complex social challenges and needing to be innovative in addressing the users' needs. Similarly, the democratic leadership style, promoting participative decision-making, cooperation, and dialogue, has also been shown to be an effective style of leadership in NPOs, as it enhances the influence of employees and gives them a sense of co-responsibility (Moynihan, Pandey and Wright, 2012). The implementation of this leadership style has a positive effect on employee motivation and job satisfaction by encouraging a sense of involvement and respect (Northouse, 2015). It also contributes to fostering team spirit and strengthening organizational belonging, which is important in organizations that are often faced with a shortage of resources and a high turnover of staff (LeRoux and Feeney, 2013). In terms of creativity, democratic leadership builds an environment of openness and security, in which employees are more willing to take risks and share new ideas (Amabile et al., 2004; Bennis and Nanus, 2007). The transactional leadership style, though effective in theory in achieving short-term goals through a reward and punishment system, has limited

use in NPOs. Studies show that this style can be beneficial in structuring operational tasks and setting clear expectations (Bass, 1990), but might not be so effective in encouraging higher levels of engagement and creative contribution (Ismail et al., 2010). Given that rewards are not the primary motivation of employees in the non-profit sector, such an approach often fails to resonate with the employees' values and personal motivations (Wright, Moynihan and Pandey, 2012). Opposite to the above stated, the autocratic style, based on strict control, vertical decision-making, and exclusion of employees from the decision process, demonstrates negative effects on motivation and creativity, in particular in organizations grounded on trust and ethical values (Crosby and Bryson, 2005; Valle and Perrewé, 2000). Employees who feel excluded and surveilled at work rarely tend to take the initiative, are more reluctant to cooperate, and have a weaker emotional bond with their organization (Jaskyte, 2004). In the non-profit sector, both an overly strict approach, such as the autocratic style, and a hands-off approach, such as the laissez-faire style, tend to fail to produce the desired results. Studies also link laissez-faire leadership, characterised by passivity and absence of direction, to negative outcomes such as lack of feedback and reduced productivity (Skogstad et al., 2007). In NPOs that often operate in dynamic and challenging environments, the absence of leadership can lead to loss of focus and to a decline in team effectiveness (Jaskyte and Dressler, 2005).

Accordingly, for the needs of this study, the following research questions were posed:

1. How do employees in NPOs perceive the different leadership styles of their superiors?
2. Which leadership styles have a statistically significant influence on employee motivation in NPOs?
3. Which leadership styles have a statistically significant influence on employee creativity in NPOs?
4. Is there a difference in the influence of traditional leadership styles and modern leadership styles on employee motivation and creativity?

Based on the above research questions, the main hypothesis of the study was formulated:

H1: Transformational, democratic, and transactional leadership styles are positively associated with a higher level of employee motivation and creativity in NPOs, while autocratic and laissez-faire leadership styles are negatively associated with employee motivation and creativity.

3. RESEARCH METHODOLOGY AND RESULTS

3.1. Research methodology

Primary research using a structured questionnaire was conducted to test the formulated hypothesis. The study focused on employees in NPOs. An online survey was conducted in November and December 2024, with participation links sent to respondents via email. Survey invitations were sent to a total of 587 email addresses. By late December, 195 questionnaires were returned, 16 of which were not completely filled, leaving 179 completely filled questionnaires for further analysis.

The questionnaire was made up of four parts. The first part pertained to basic information: type of NPO in which the respondent is employed, educational level, years of service in the NPO, and total number of employees in the NPO. The second part explored the attitudes of employees towards leadership styles, motivation, creativity, and work performance, using a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree). In this part, the respondents were asked to rate 24 statements referring to the leadership style of their superiors. The order of the statements was randomised to prevent participants from recognising the leadership style to which a statement belongs. The third part was dedicated to investigating the level of the employee's motivation in the NPO, using 5 statements which the respondents rated. The fourth part used 8 statements to examine how the employees perceive their own creativity in their jobs.

The variables in the questionnaire were taken from previous studies, as shown in Table 1.

Table 1. Sources of variables in the questionnaire (source: authors' elaboration)

Construct	**Number of items**	**Source of variable**
Autocratic leadership style	5	Northouse, P. G. (2015). *Leadership: Theory and practice*. Sage publications.
Democratic leadership style	6	
Laissez-faire leadership style	4	
Transactional leadership style	4	Bass, B. M. and Avolio, B. J. (2000). MLQ Multifactor Leadership Questionnaire Redwood City: Mind Garden. Ismail, A., Mohamad, M. H., Mohamed, H. A. B., Rafiuddin, N. M., and Zhen, K. W. P. (2010). Transformational and Transactional Leadership Styles as a Predictor of Individual Outcomes. *Theoretical and Applied Economics*, *17*(6).

Transformational leadership style	5	Bass, B. M. and Avolio, B. J. (2000). MLQ Multifactor Leadership Questionnaire Redwood City: Mind Garden. Ismail, A., Mohamad, M. H., Mohamed, H. A. B., Rafiuddin, N. M., and Zhen, K. W. P. (2010). Transformational and Transactional Leadership Styles as a Predictor of Individual Outcomes. *Theoretical and Applied Economics*, *17*(6).
Employee motivation	5	Word, J., and Park, S. M. (2015). The new public service? Empirical research on job choice motivation in the nonprofit sector. *Personnel Review*, *44*(1), 91-118. Farmer, S. M., Tierney, P., and Kung-McIntyre, K. (2003). Employee creativity in Taiwan: An application of role identity theory. *Academy of management Journal*, *46*(5), 618-630.
Employee creativity	8	Farmer, S. M., Tierney, P., and Kung-McIntyre, K. (2003). Employee creativity in Taiwan: An application of role identity theory. *Academy of management Journal*, *46*(5), 618-630. Tierney, P., Farmer, S. M., and Graen, G. B. (1999). An examination of leadership and employee creativity: The relevance of traits and relationships. *Personnel psychology*, *52*(3), 591-620.

3.2. Research results

To gain insight into the extent to which employees in NPOs display creativity in their jobs, the respondents were asked to rate on a scale of 1 (strongly disagree) to 5 (strongly agree) their level of agreement with the statements referring to how they perceive their own creativity in the workplace. The results are presented in the below table.

Table 2. Opinions of respondents regarding their own creativity (source: authors' elaboration)

CREATIVITY	**Average score**	**Standard deviation**	**Min.**	**Max.**
I try to demonstrate originality in my work.	4.31	0.771	3	5
I take risks to generate new ideas at work.	4.22	0.836	1	5
I like trying out new ideas and approaches to problems.	4.29	0.686	3	5
I am able to identify opportunities for new activities in the organization.	4.15	0.690	2	5

I strive to generate new yet functional ideas at work.	4.28	0.615	3	5
I am always thinking of other ways to solve problems when I come across obstacles.	4.33	0.617	3	5
I believe I have fresh perspectives on old problems.	4.22	0.773	3	5
I often deal with several new ideas and problems at the same time.	4.29	0.673	3	5
I help others (colleagues, co-workers) develop new ideas.	4.19	0.684	3	5
My co-workers see me as a creative employee.	3.94	0.891	2	5
My superiors encourage and support creative work.	3.69	1.410	1	5

The results show a high average level of self-assessed creativity among the respondents. The statements "I am always thinking of other ways to solve problems when I come across obstacles" (M = 4.33; SD = 0.617), "I try to demonstrate originality in my work" (M = 4.31; SD = 0.771), and "I like trying out new ideas and approaches to problems" (M = 4.29; SD = 0.686) received the highest average scores, indicating the pronounced willingness of respondents to engage in creative thinking and innovative problem-solving in day-to-day business. The statement "My superiors encourage and support creative work" (M = 3.69; SD = 1.410) has the lowest average score, and also the largest deviation of responses, possibly pointing to differing organizational cultures and leadership styles within the respondents' work environments. This difference suggests that institutional support of creativity is not equally available to all employees, which could be an important direction for further research and organizational development. In addition, the statement "My co-workers see me as a creative employee" also has an average score (M = 3.94; SD = 0.891) that is lower than the score for statements pertaining to the respondents' self-perceived creativity, suggesting there is a certain discrepancy between the respondents' self-evaluation and the perceptions of their colleagues.

The next table presents results pertaining to 9 statements referring to various sources and aspects of the respondents' motivation to work in NPOs, and measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 3. Opinions of employees regarding their own motivation (source: authors' elaboration)

MOTIVATION	**Average score**	**Standard deviation**	**Min.**	**Max.**
I am motivated to work in this NPO because of its overall quality and reputation.	3.56	1.104	1	5

I am motivated to work in this NPO because of the opportunities I have for serving the public and public interest.	3.71	1.061	1	5
Having opportunities for training and career development is very important to me.	3.86	0.880	1	5
I am motivated by job security.	3.55	1.040	1	5
I am motivated by salary and other benefits.	3.41	1.171	1	5
I enjoy finding solutions to complex problems.	3.79	0.872	1	5
I enjoy thinking up new ideas for the programmes and projects we engage in.	3.75	1.022	2	5
I enjoy thinking analytically.	3.88	0.880	2	5
I enjoy making improvements to existing programmes, projects and/or activities the NPO is engaged in.	3.97	0.931	2	5

The results show that the engagement in NPOs of the respondents is, on average, positively motivated, with the statements referring to intrinsic sources of motivations receiving the highest scores. Thus, the statement "I enjoy making improvements to existing programmes, projects and/or activities the NPO is engaged in" (M = 3.97; SD = 0.93) has the highest average score, following by the statements "I enjoy thinking analytically" (M = 3.88; SD = 0.88) and "Having opportunities for training and career development is very important to me" (M = 3.86; SD = 0.88). These results suggest that the respondents consider professional development, intellectual stimulation, and opportunities to creatively contribute to the NPO's activities as being of the highest worth. With regard to extrinsic sources of motivation, the statements "I am motivated by salary and other benefits" (M = 3.41; SD = 1.17) and "I am motivated by job security" (M = 3.55; SD = 1.04) show somewhat lower average scores and greater dispersion of responses, pointing to differing perceptions among the respondents when material benefits and employment stability are concerned. Interestingly, the statement referring to the NPO's public mission, "I am motivated to work in this NPO because of the opportunities I have for serving the public and public interest" (M = 3.71; SD = 1.06), has a relatively high score, indicating that the motivation of a share of the respondents is value-based.

Table 4 provides descriptive data on perceived leadership styles in the NPOs, based on the responses of the participants in assessing the behaviour of their immediate superior (leader). Results are presented for each statement, grouped according to the five leadership styles: autocratic, democratic, laissez-faire, transformational, and transactional. The statements were jumbled, so the respondents could not tell which statement belonged to what type of leadership style. All responses were measured using a Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 4. Opinions of employees regarding leadership style in the NPO where they work (source: authors' elaboration)

Your leader (superior, manager) in the NPO:	**Average score**	**Standard deviation**	**Min.**	**Max.**
AUTOCRATIC LEADERSHIP STYLE (total average score 3.07)				
thinks that employees need to be closely monitored, otherwise they are not likely to do their jobs.	3.02	1.22	1	5
believes that most of the employees in the general public are lazy.	2.98	1.23	1	5
believes that rewards or punishments motivate you to achieve organizational goals.	3.19	1.13	1	5
thinks that most employees feel insecure regarding their jobs and need to have work guidelines.	3.11	0.94	1	5
thinks that he/she alone has the right to judge the achievements of individual members of the organization.	3.06	1.05	1	5
is effective because he/she gives orders and explains procedures.	3.11	1.13	1	5
DEMOCRATIC LEADERSHIP STYLE (total average score 3.35)				
involves you in the decision-making process.	3.33	1.28	1	5
gives you guidelines without any pressure.	3.28	1.10	1	5
promotes frequent and supportive communication.	3.32	1.20	1	5
encourages you to take responsibility for the completion of your own work.	3.65	1.06	1	5
has helped you (or at least has tried to help you) find "passion" for your work.	2.94	1.22	1	5
thinks employees are competent, and if given an assignment, they will successfully complete it.	3.30	1.03	1	5
LAISSEZ-FAIRE LEADERSHIP STYLE (total average score 3.30)				
in complicated situations, allows you to resolve problems by yourself.	3.56	1.02	1	5
does not interfere with how you do your job.	3.55	1.06	1	5
lets you self-assess your work.	3.30	1.17	1	5

gives you complete freedom to resolve problems by yourself.	3.41	1.03	1	5
thinks that in most situations in their jobs, employees prefer receiving few guidelines from the leader.	3.17	0.90	1	5
thinks that it is best to leave employees alone to do their jobs independently.	3.12	1.09	1	5
TRANSFORMATIONAL LEADERSHIP STYLE (total average score 3.71)				
looks beyond personal interest for the benefit of the entire group.	3.47	1.29	1	5
considers moral and ethical consequences before making a decision.	3.20	1.31	1	5
speaks about the future with optimism.	3.48	1.17	1	5
helps others to develop their "strengths".	3.43	1.17	1	5
invests considerable time in mentoring and coaching others.	2.98	1.25	1	5
TRANSACTIONAL LEADERSHIP STYLES (total average score 3.22)				
clearly makes it known what benefits individuals will receive providing organizational goals are achieved.	3.15	1.19	1	5
supervises my work and monitors my mistakes.	3.22	1.16	1	5
clearly makes it known what is expected of individual employees.	3.25	1.15	1	5
will take action before problems become entrenched.	3.26	1.27	1	5

An analysis of the total average scores of each leadership style provides insights into how employees perceive the NPO's leadership. Transformational leadership style is the predominant leadership style of the surveyed NPOs and has the highest average score (3.71), suggesting that employees see their superiors as being inspiring leaders, who foster development, consider the ethical aspects of decisions, and act in the interest of the collective. Of the statements referring to transformational leadership, the respondents gave the highest average score to the statement that their leader "speaks about the future with optimism" (M = 3.48; SD = 1.17) and "looks beyond personal interest for the benefit of the entire group" (M = 3.47; SD = 1.29). However, mentoring and coaching, a major determinant of the transformational leadership style, received the lowest score, as evidenced by the low average score of 2.98 for the statement "the leader invests considerable time in mentoring and coaching others" (generally, this is one of the lowest average scores for any of the leadership styles). The democratic leadership style has an average score of 3.35, pointing to the presence

of a participative approach to leadership. These NPO leaders tend to partially involve employees in decision-making, provide support, and seek to build trust through open communication. Although not predominant, this style resonates positively with employees. Of the statements pertaining to the democratic leadership style, the statement that the leader "encourages you to take responsibility for the completion of your own work" has the highest average score (M = 3.65; SD = 1.06), whereas the statement that the leader "has helped you (or at least has tried to help you) find "passion" for your work" (M = 2.94; SD = 1.22) has the lowest average score. The laissez-faire leadership style has an average score of 3.30, suggesting that leaders often allow their employees a high level of autonomy and independence. Of the statements measuring the application of this leadership style, the statements that the leader "in complicated situations, allows you to resolve problems by yourself" (M = 3.56; SD = 1.02) and "does not interfere with how you do your job" (M = 3.55; SD = 1.06) have the highest average scores. The statement that the leader "thinks that it is best to leave employees alone to do their jobs independently" (M = 3.12; SD = 1.09) has the lowest average score. In comparison with the previous three leadership styles, the transactional leadership style has a relatively low average score (3.22). The statement that the leader "will take action before problems become entrenched" (M = 3.26; SD = 1.27) has the highest average score, suggesting that employees recognise their leader's proactivity in resolving any potential difficulties. The statement that the leader "clearly makes it known what benefits individuals will receive providing organizational goals are achieved" (M = 3.15; SD = 1.19) has the lowest score, indicating that there is room for improving employee motivation through rewards or recognition. The autocratic leadership style has the lowest average score (3.07), indicating that employees recognise this authoritarian and strictly controlling style in their superiors only in the smallest extent. Although this style is present, the score suggests there is a tendency within the NPOs towards applying more modern and participative forms of leadership. The statement that the leader "believes that rewards or punishments motivate you to achieve organizational goals" (M = 3.19; SD = 1.13) has the highest average score, confirming a key characteristic of the autocratic approach – reliance on extrinsic motivational mechanisms. The statement that the leader "believes that most of the employees in the general public are lazy" (M = 2.98; SD = 1.23) has the lowest average score).

To conclude, the results show that employees in NPOs mostly perceive the presence of transformational leadership style, which is consistent with the values and mission of organizations that operate in the interest of the community and highlight collective wellbeing. The high average score of this style suggests that the superiors in NPOs are successful in acting as inspiring leaders, focused on ethics, optimism, and employee empowerment. Nevertheless, the relatively low score of the statement regarding mentoring indicates that there is potential for strengthening individual development through guided learning, vital in the non-profit sector that often depends on the motivation and professional growth of employees. The democratic and laissez-faire styles are also moderately expressed, reflecting openness, trust, and granting

employees autonomy, which is particularly important in organizations, the purpose of which is social engagement and participation. The lower scores for transactional and, in particular, autocratic leadership style suggest that leaders in the non-profit sector tend to have little preference for formal control, supervision, and extrinsic motivation, further confirming the tendency towards more modern, participative leadership models. Overall, the results suggest that leadership in NPOs is based on values, involvement and trust.

Pearson's correlation analysis was carried out to test the association between the different leadership styles and employee motivation and creativity in NPOs. The following variables were analysed: autocratic, democratic, laissez-faire, transactional, and transformational leadership styles, and employee motivation and creativity. The results are presented in Table 5.

Table 5. Results of correlation analysis between leadership styles and employee motivation (source: authors' elaboration)

Variable	1	2	3	4	5	6
1. Autocratic style	1					
2. Democratic style	-0.25**	1				
3. Laissez-faire style	-0.12	0.10	1			
4. Transactional style	-0.18*	0.30**	0.05	1		
5. Transformational style	-0.22**	0.45**	0.15	0.32**	1	
6. Employee motivation	-0.21*	0.38**	0.08	0.29**	0.56**	1

* 5% level of significance ($p<0.05$)

**1% level of significance ($p<0.01$)

The results show that democratic, transactional, and transformational leadership styles are positively associated with employee motivation. The strongest correlation is seen between transformational leadership style and motivation ($r = 0.56$, $p < 0.01$), suggesting that the greater the application of transformational leadership, the higher the level of employee motivation. Further, positive correlations were also found with regard to democratic leadership style ($r = 0.38$, $p < 0.01$) and transactional leadership style ($r = 0.29$, $p < 0.01$). On the other hand, autocratic leadership style was shown to have a weak negative correlation with employee motivation ($r = -0.21$, $p < 0.05$), suggesting that autocratic approaches may decrease motivation. Laissez-faire leadership style shows no statistically significant association with motivation ($r=0.08$, $p>0.05$). These findings confirm that leadership styles that involve support, involvement, and inspiration have a positive effect on employee motivation, whereas an authoritarian approach is demotivating.

Table 6. Results of correlational analysis between leadership styles and employee creativity (source: authors' elaboration)

Variable	1	2	3	4	5	6
1. Autocratic style	1					
2. Democratic style	-0.20*	1				
3. Laissez-faire style	-0.05	0.12	1			
4. Transactional style	-0.15	0.28**	0.08	1		
5. Transformational style	-0.18*	0.42**	0.14	0.35**	1	
6. Employee creativity	-0.17*	0.47**	0.10	0.31**	0.55**	1

* 5% level of significance ($p<0.05$)

** 1% level of significance ($p<0.01$)

The results of correlation analysis show that the democratic ($r = 0.47$, $p<0.01$) and the transformational leadership styles ($r = 0.55$, $p<0.01$) are positively associated with employee creativity. The transactional leadership style is also shown to have a moderately positive correlation with creativity ($r = 0.31$, $p < 0.01$). The autocratic leadership style has a weak but significantly negative association with employee creativity ($r = -0.17$, $p < 0.05$). The laissez-faire leadership style does not show any significant association with creativity ($r = 0.10$, $p > 0.05$). To conclude, it can be said that participative and inspiring leadership styles contribute towards increased employee creativity, while an authoritarian style may have a negative effect.

4. DISCUSSION AND CONCLUSION

The aim of this study was to explore the ways in which different leadership styles affect employee motivation and creativity in NPOs. Unlike profit-focused organizations, NPOs are primarily based on social mission, values, and public interest rather than on financial gain. In such a context, employees are often motivated by intrinsic values, by their need to contribute to society, and by the fact that they identify with the organization's mission. Hence, it is of key importance to understand how different leadership styles contribute towards sustaining and strengthening the intrinsic motivation and creative engagement of employees.

The results of the conducted study show that leadership styles have a statistically significant effect on the level of employee motivation and creativity in NPOs in Croatia, with the transformational and democratic styles demonstrating the most positive effects. These findings are consistent with those of previous studies that emphasise the importance of emotional intelligence, a visionary approach, and participative

decision-making, as key factors in fostering intrinsic motivation and creativity in employees (Bass and Avolio, 1994; Tierney and Farmer, 2002). Bass and Riggio (2006) also confirm the positive impact of transformational leadership on motivation, underlining that leaders, who inspire and provide intellectual stimulation and individualised support, contribute towards strengthening the employees' sense of purpose, which is particularly important in the non-profit sector. Further, Jaskyte (2004) points out that transformational leadership has a positive effect on organizational innovativeness, consistent with the findings of this study showing that employees working under this leadership style display greater creativity. Similarly, the democratic leadership style, involving participation, open communication, and joint decision-making, is also identified as a significant predictor of higher levels of motivation and creativity. This finding is consistent with the study of Moynihan, Pande and Wright (2012), which shows that participative leadership positively impacts the way in which employees perceive the autonomy and relevance of their own work. On the other hand, the autocratic and laissez-faire leadership styles demonstrate negative or neutral effects on employee motivation and creativity, consistent with previous findings (Skogstad et al., 2007; Jaskyte and Dressler, 2005). The autocratic style, characterised by control over and limited autonomy of employees, tends to demotivate individuals and stifle creative expression. The laissez-faire style, though allowing greater freedom, often results in a lack of guidelines, a sense of being neglected, and low employee engagement. This finding is congruent with that of Ismail et al. (2010), stating that transactional leadership can be effective in assignments with clearly defined objectives, but fails to foster creative thinking because of its focus on short-term rewards and strong structure.

Despite providing valuable insights into the association of leadership styles and work outcomes in NPOs, this study has some limitations. The sample is limited to employees in Croatian NPOs, which could affect the possibility of generalising findings across other contexts. Also, the self-assessment method used in the study can be susceptible to subjectivity. Future studies could include a longitudinal approach, data referring to the employees' superiors, as well as additional organizational variables such as organizational climate and organizational culture.

The scientific contribution of this paper is that it expands the existing theoretical bases of the influence of leadership styles on employee motivation and creativity, applying them to the context of the Croatian non-profit sector, which has been poorly researched in the literature up to date. The study confirms the relevance and effectiveness of transformational and democratic leadership styles in environments based on values and social mission, thus contributing to the development of a specific leadership model adapted to NPOs. In terms of application, the paper's contribution is that its findings can be applied in practice in NPO management. The obtained findings provide concrete guidelines to NPO managers and leaders regarding the choice of suitable leadership styles, capable of encouraging a high level of employee motivation and creativity, key factors in achieving the organization's mission.

Furthermore, this research points to the need of strengthening the institutional support of creativity, in particular through mentoring and employee development, which can serve as a basis for designing educational and development programmes. Thus, the paper contributes to the better understanding and more effective management of human potential in the non-profit sector, especially in terms of limited resources and growing demand for innovativeness and sustainability.

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These and the Reference headings are in bold but have no numbers. Text below continues as normal.

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Mind the Implementation Gap: A Case Study of ERP Theory vs. Practice in Microsoft Dynamics 365 F&O

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Abstract

A company's competitiveness and capacity to adapt to organizational and market changes rely on effective management of both financial and non-financial resources. To improve operations through advanced data processing, reporting, and system integration, enterprise resource planning (ERP) solutions offer integrated support for various corporate processes. This paper employs a case study approach to analyze the implementation of Microsoft Dynamics 365 Finance and Operations. It compares theoretical ERP implementation frameworks with actual practices. The study explores internal and external factors that motivate companies to adopt ERP solutions, and highlights key features, installation requirements, and process aspects. It also details the responsibilities of key stakeholders at each stage of the project lifecycle. Particular attention is paid to the ERP vendor's consultants and their efforts to meet client expectations. Industry expert insights facilitate a critical comparison between prescribed implementation models and the more flexible, hybrid approaches often used in practice.

Keywords: ERP, implementation, case study

JEL Classification: O32, O33, M15, L86

1. INTRODUCTION

Nowadays, the corporate environment is changing quickly. Increased competition, broader markets, and rising customer expectations are issues that companies face (Osman et al., 2006). This emphasizes how companies must lower overall supply chain costs, speed up delivery, drastically cut inventory, increase product offerings, improve customer service and delivery reliability, boost quality, and more effectively manage

global demand, supply, and production (Umble, Haft, and Umble, 2003). For companies to stay competitive in this market, they must improve their operations and business procedures (Osman et al., 2006).

By leveraging technology to automate tasks, reduce waste, and optimize resource use, companies can strategically allocate resources, invest in growth initiatives, and improve their bottom line. There are many technologies that help businesses run smoothly and promote growth and innovation (Ziemba, 2019; Yunis, Tarhini, and Kassar, 2018; Anaya and Qutaishat, 2022). Enterprise Resource Planning (ERP) systems are one of the most important uses for these technologies. Demand for them is growing steadily and often exceeds market expectations (Anaya and Qutaishat, 2022). This demand is probably because ERP systems are better for companies than smaller information systems when it comes to strategy, helping them use best practices and make sure their operations are top-notch (Seddon, Calvert, and Yang, 2010; Anaya, Dulaimi, and Abdallah, 2015; Sumner, 2018; Pohludka, Stverkova, and Ślusarczyk, 2018; Anaya and Qutaishat, 2022).

The goal of this paper is to compare the officially defined phases of ERP implementation with the phases that actually happen on a project. So, this paper looks at the ERP implementation process through the eyes of a case study of a company in the Republic of Croatia that has gone through it.

To achieve the goal of this research, this paper is divided into several parts. After the introductory part, a theoretical background is provided in the first part of the paper, defining the ERP system and describing its role and the importance of implementation in companies. Next, a methodological part that describes the applied methodology, namely, a case study chosen as a research method to achieve the goal of this paper, is given in the second part of the paper. The third part of the paper presents the results of the case study conducted through the phases of ERP system implementation in the observed company. In the fourth part of this paper, an analysis of the results and a discussion comparing the results obtained from the case study with the theoretically defined phases of ERP system implementation in companies has been given. Finally, this paper ends with the concluding remarks, limitations of the paper, and recommendations for future research in the field of this topic, as presented in the fifth part of the paper.

2. THEORETICAL BACKGROUND

In today's business world, an increasing number of companies are using ERP software (Ahmed and Ayman, 2011). According to Oracle (2025), ERP systems serve as comprehensive, integrated platforms, whether deployed on-premises or in the cloud, overseeing all facets of a production-oriented or distribution enterprise. Moreover, ERP systems facilitate comprehensive support for various domains, including financial

management, human resources, supply chain management, and manufacturing, all integrated with the fundamental accounting function (Oracle 2025). The term ERP was initially used by Wylie in 1990 (Jacobs, 2007; Vukman et al., 2024) as a continuation of older terminology like Material Requirements Planning (MRP) and Manufacturing Resource Planning (MRP II). Nowadays, many businesses use ERP systems to make their business operations successful and more efficient overall. There are many ways to measure business success, including gaining profits, improving operations, and giving the company intangible benefits (Ahmed and Ayman, 2011).

Namely, ERP solutions facilitate the seamless integration of information flows and business activities across many functional areas within an organization. They facilitate information exchange throughout a company's value chain and contribute to operational efficiency (Law and Ngai, 2007). Most ERP solutions, such as those from SAP, Baan, JDE, SSA, JBA, Oracle, and PeopleSoft, are made up of a group of functional parts that are all connected to an enterprise data warehouse (Krasner, 2022). These components provide automated support for traditional business process areas, such as inventory management, material requirements planning, and order processing (Krasner, 2022). Similarly, authors Scheer and Habermann (2000) emphasize in their paper how ERP systems are tools designed to enhance company processes, including manufacturing, procurement, and distribution. Consequently, ERP adoption and business process reengineering (BPR) operations must be intricately linked (Scheer and Habermann, 2000). The deployment of ERP should entail a review of existing business processes and the potential for reengineering, rather than merely developing an application system that optimizes flawed processes (Scheer and Habermann, 2000).

Microsoft Dynamics 365 Finance and Operations is one of Microsoft's most popular ERP solutions. It uses cloud technology and is meant to connect important business tasks like sales, finance, purchase orders, inventory, production, and distribution. Dynamics 365 Finance and Operations consists of two parts: Dynamics 365 Finance and Dynamics 365 Supply Chain Management. Using AI and process automation, Dynamics 365 Finance makes it easier for medium-sized and large businesses to keep track of their money. This leads to more growth and efficiency. Dynamics 365 Supply Chain Management provides insights into how your warehouse works and how much stock you have. This helps you make better predictions, save money, and develop new products. Artificial intelligence, machine learning, and mixed reality all work together to make supply chain processes faster and better. Also, businesses can change their ERP systems by using the two apps separately or together (Rand Group, 2023; Microsoft, 2025).

Still, the choice to use an ERP system is often based on a mix of needs within the organization and pressures from outside. Companies base their choice of software solution on the availability of resources, including time, financial capital, and qualified personnel. Additionally, an information system (IS) project must stay within its budget and schedule while also delivering strategic value for information technology (IT)/IS spending (Anaya, Flak and Abushakra, 2023). Staehr et al. (2012) say that the

complicated process of implementing an ERP system often makes it hard to get the most out of it. This necessitates substantial alterations to employee operations and organisational functioning, which can be challenging to oversee.

The Sure Step methodology is the official Microsoft software guide for Dynamics projects. It is a complete, detailed, and accurate set of information, procedures, and documentation that makes it more likely that an implementation project will be successful. The Sure Step method makes it very clear what the steps of an implementation project are by breaking them down into: (i) The diagnostic phase, which includes figuring out what the system needs, testing the old system, and finding the main users. The goal is to find out what the organisation is like now and where it can get better. (ii) During the analysis phase, you look at the business needs, come up with a solution design, make a project plan, set roles and responsibilities, and figure out how much the project will cost. (iii) The Design phase includes coming up with the solution, writing down the functional requirements, making a test plan, figuring out what training is needed, and finding ways to improve things. The Development phase is when the solution is built, improvements are made, the test plan is carried out, and the solution is checked to make sure it meets business needs. (v) The Implementation phase includes installing the solution, moving data, doing user acceptance testing, following the training plan, and finishing the final solution, which is ready to go live. (vi) The Operations phase includes ongoing support, maintenance, and improvement of the solution (Sure Step Methodology, 2023).

3. METHODOLOGY

To achieve the objectives of this paper, a case study analysis was employed as the methodology. The case study of Microsoft Dynamics 365 FandO implementation was carried out on Company X, which operates in an industry classified in the Republic of Croatia as other manufacturing industries (Government of the Republic of Croatia, 2025). The observed company is regarded as a process-mature organization that consumes large quantities of raw materials through operational processes, with several high-tech plants, machines, workers, and supporting infrastructure responsible.

Company X is a strong candidate for ERP software deployment due to its transparent processes, experienced users, and established IT infrastructure. Accordingly, the case study investigates the implementation steps, noting the tasks and responsibilities of the team. It also tackles challenges, client needs, and the application of agile methods, drawing on interviews with different stakeholders.

An ethnographic perspective is employed to comprehend the interaction between human factors and technology during the ERP implementation. The study uses Microsoft's Sure Step (2023) guide for Dynamics projects to compare what

companies do to what they plan to do. The Business Process Catalogue (2024) is also used to compare suggested practices with actual practices. It gives information about operations and what needs to be done at four levels: patterns, specific processes, business process domains, and end-to-end processes. It also has links to documentation and other resources.

4. RESULTS

4.1. Presale phase and diagnostics

A thorough and high-quality pre-sales and diagnostics phase is vital for the project's success. This stage includes initial contact with clients and an early assessment of their readiness to start the implementation process. In this section, a representative from the sales team, a consultant, and a project manager answered questions.

The data collected during the pre-sales and diagnostics phase helped Company X assess its maturity and determine if it was suitable for ERP implementation. The consultant role was observed, which showed that they recognize the processes that will be covered by the new system and understand the expectations of management and users. They work closely with sales to demonstrate the essential processes, building trust and helping users make decisions. The result is a preliminary document with a list of processes, without detailed methods, and examples of supported processes relevant to the user's activities. It is suggested to use Unified Modeling Language (UML) process diagrams with clear logic. The goal of pre-sales is to assess the appropriateness of the client, collect detailed requirements for the solution, and inform about products, alternatives, and implementation methods. The service provider collects information to prepare the final offer. The business process analysis includes one workshop per area, where key users identify the key processes. The workshops with key users facilitated the assessment of the tasks, including setup, testing, data migration, and training, expressed in Man/Day (M/D). High-level diagnostics confirmed the client's suitability before moving on to the analysis phase.

4.2. Analysis and design phase

Within the second phase, called the analysis and design phase, additional respondents were involved in the case study, specifically the project manager and the programmer.

This phase lasts more than three months, often exceeding the planned timeframe, to cover the requirements and documentation processes. Moreover, during this phase, regular team meetings are held and SCRUM tools such as Jira are applied to track, organize tasks, plan sprints and support later phases. Communication takes place via

email and mailing lists. Also, during this phase, the company's FIT/GAP document is prepared, including license offers and functional requirements. In addition, for the functionality specifications, the presence of defects is determined, and the feature development document specifies the system modifications for Company X. Furthermore, during the analysis and design phase, the integration of the system with external services is identified, while data exchange diagrams are provided. Also, the project manager mediates between the client and the team, monitoring the schedule and satisfaction.

4.3. Development phase

Company X's implementation project aimed to customize software to meet specific needs through analysis, process development, and system improvements. As a result, changes were made to logistics and manufacturing, and detailed documentation, like manuals, was made to test and meet specific needs. Due to limited resources, users rarely tested features, so this was delegated to a consultant. Yet, user testing was conducted over several days to observe the system's performance under load. Additionally, within the development phase, time estimates for new features are given in the M/D units, and technical documentation for small features is typically provided only in code comments. Also, during this phase, a shorter training session is provided, with recordings of key user training sessions. Within the development phase, the consultant's role includes preparing a comprehensive FDD, assisting developers, creating examples, and developing test cases in coordination with or training users.

4.5. Education phase

Before training, it is crucial to establish the test environment that should resemble the production environment as much as possible. Furthermore, it is best to start the training early with detailed planning for specific user groups. The consultant conducts the training by setting parameters, introducing the system, assigning rights, and presenting the planned processes to the users of Company X. Therefore, the consultant must have a good understanding of the client's concepts and business units. The training is repeated two or three times, with notes on topics and questions after each session. Also, the workshops are divided based on the complexity of the processes. Basic and simple processes are covered in the first workshops, and more sophisticated and complex features are encompassed in later workshops. In this phase, the project manager coordinates the consultants and users, schedules meetings, and monitors the users' progress to determine when to move forward.

4.6. Support phase

The support given to Company X can be divided into two categories: passive support, where users receive help with navigation and daily operations, and active

support, where they get assistance with complex user questions. When entering the support phase, the consultant steps back from the client and hands over to a team of consultants who were not involved in earlier stages of the project. During this phase, the Jira tool is also used, enabling clients to submit specific support requests. The need for support from consultants and programmers is highest during the initial work on the system, which usually lasts about 45 days or until the first VAT submission. Afterward, the client is offered the option to sign a support contract, ensuring that a team of consultants will be assigned to the project after implementation to handle any issues that arise from using the system. In this phase, the project manager prepares the documentation needed for submitting the completed project, including any open questions or features that still need improvement.

5. ANALYSIS OF RESULTS AND DISCUSSION

The Sure Step methodology has clearly defined phases, where the next phase cannot start before the last process of the previous phase is completed. This makes the methodology rigid and less adaptable to the rapidly changing environment of the company's implementation projects. In reality, phases can start regardless of the status of the previous one if the indicators are met that ensure the subsequent and complete completion of the last phase. Accordingly, the user education phase of Company X started during the development phase to avoid user overload and reduce the pressure on the consultants. In addition, in practice, two or more phases often overlap due to the presence of several different departments. However, this deviation can be attributed to the need of the organization to efficiently use its resources in delivering software as a service, and not to an attempt to deviate from the recommended process due to a unique approach to the implementation of Company X.

The deviation occurs during the implementation methodology selection for Company X's project. According to Kuhrmann et al. (2018) three main frameworks can be identified: the waterfall approach, the agile framework, and Scrum. The waterfall approach is linear and covers the phases from initiation to maintenance. Agile frameworks include strategies such as Scrum, XP, DSDM, and SureStep, which are suitable for agile environments. Scrum operates in so called sprints, typically 30 days long, that are visualized as cycles and covering phases from analysis to user review. According to the results of conducted case study in this paper, hybrid approach was adopted for Company X, combining the best practices of these methodologies. So, it began with defining and prioritizing requirements, followed by conceptual design. Also, sprints focused on refining the design, building, testing, and gathering feedback were present. Moreover, the interviewed experts considered this hybrid approach to be optimal for project management.

Another major departure from SureStep guidelines is the lack of process documentation. The defined methodology requires detailed documentation of each

step, which is time-consuming and increases costs for the client. In this case study, documentation hierarchy was agreed upon with Company X, outlining the essential processes that need to be documented and those that can be skipped. Accordingly, Company X's management prioritized reporting on user training, new functionality, and localization specifications, while documentation of standard system operations was deprioritized and not regularly updated.

Other deviations are evident in comparison to the Business Process Catalog, which served as a rigid framework for the implementation team, requiring a lot of additional information for end users. In Company X's implementation project, descriptive documentation for standard processes was omitted. Namely, UML diagrams can be very useful when both parties can display and interpret them. However, it was not the case for Company X's users. In this case study, detailed UML diagrams proved unprofitable, as clients often did not have enough knowledge to interpret them, and creating such diagrams was time-consuming.

A final major difference is evident in the way of communication, both within the implementation team and in interactions with Company X. Virtual meeting technology, especially screen sharing, was used at every stage of the project for Company X. An additional benefit that developed as a result of virtual meetings is the shift to digitizing user manuals. Therefore, detailed instructions, manuals, and processes were created for Company X's users in the form of videos that are more concise, clear, and better aligned with industry standards.

6. CONCLUSION

This paper examines the relationship between formally defined ERP implementation phases and actual practices in the field of ERP implementation projects within companies.

The research identified four main areas where deviations from the recommended implementation methodology occur: methodological, process, technological, and social. Methodological deviations most frequently happen early in the project, when organizations choose hybrid implementation approaches aimed at balancing flexibility and operational needs. These methods help optimize resources, reduce costs, and improve customer satisfaction. Process deviations mainly occur during the analysis and design phases, especially in choosing which business processes to analyze and how deeply to analyze them. These deviations often depend on the importance of a process to the user, the availability of standard ERP solutions for that process, and the involvement of key stakeholders. Technological deviations are seen throughout all phases of implementation and are especially noticeable in areas that can be automated, sped up, or skipped without hurting the final result. The use of various

technologies such as cloud computing, virtual meetings, and video documentation has greatly changed the social aspect of ERP implementation.

Although this research offers valuable insights into the specific context and dynamics of an implementation through a case study and its comparison with the prescribed implementation methodology, it is important to highlight the limitations of this work. The main limitation of this research concerns the sample size, as the case study analysis was conducted on only one company undergoing the ERP implementation project. Therefore, future research should include a larger number of companies from different industries to compare and validate the findings.

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The Financial Challenges of ESG Implementation: Examining Costs Estimations for SMEs in the Slovak Republic

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Abstract

Integrating Environmental, Social, and Governance (ESG) principles into corporate strategies has become increasingly important for businesses striving to remain competitive and attract investment. This article shifts its focus to examine the costs associated with introducing ESG practices into Small and medium-sized enterprises (SMEs) operating in the Slovak Republic, analyzing their financial, operational, and strategic implications. Using a mixed-methods approach, we evaluate financial data, ESG implementation expenses, and insights from industry stakeholders to assess the challenges businesses face during this transition. The findings reveal that while ESG integration offers long-term benefits such as enhanced investor confidence, improved access to capital, and financial stability, the initial costs can be significant. These include regulatory compliance expenses, investments in new technologies, staff training, and the development of sustainable supply chains. SMEs face particular hurdles, including limited resources and low awareness of ESG principles. This article contributes to the broader discussion on sustainable business practices in emerging economies by highlighting the financial barriers to ESG adoption and offering policy recommendations to mitigate these challenges and support businesses in the Slovak corporate sector.

Keywords: ESG; implementation costs; sustainable business; Slovak Republic; SMEs

JEL Classification: G31, M14, Q56

1. Introduction

Environmental, Social, and Governance (ESG) criteria have become pivotal in shaping global investment flows and corporate strategies (Marie et al., 2024). Investors increasingly seek transparent, responsible, and future-proof companies, pressuring firms—large and small alike—to align with sustainability standards (Friede, Busch, and Bassen, 2015). In the European context, the rapid evolution of regulatory frameworks, such as the Corporate Sustainability Reporting Directive (CSRD), compounds this imperative. While large corporations often possess the resources to absorb ESG-related costs, small and medium-sized enterprises (SMEs) typically operate under tighter financial constraints (Gjergji et al., 2020). In Slovakia, SMEs form the backbone of the economy, contributing over 55 percent of total employment (Lesáková, 2019). Understanding the financial implications of ESG adoption is therefore critical to safeguarding the competitiveness of this sector.

This article investigates the magnitude and structure of ESG implementation costs for Slovak SMEs. By synthesising theoretical insights and empirical evidence, we aim to: (i) delineate major cost categories, (ii) estimate typical expenditures based on current benchmarks, and (iii) propose policy and managerial recommendations that lower financial barriers while preserving scientific rigour.

Recent policy developments in the European Union, notably the Corporate Sustainability Reporting Directive (CSRD; European Commission, 2022) and the EU Taxonomy Regulation (European Commission, 2021), have amplified pressure on enterprises to disclose sustainability information with the same rigour as financial statements. Although mandatory reporting currently targets large public-interest entities, phased-in thresholds will soon encompass medium-sized companies, while SMEs in the supply chains of multinational corporations already face indirect reporting duties (Ministry of Economy of the Slovak Republic, 2024). According to the Slovak Business Agency's 2024 SME Report, only 18 percent of Slovak SMEs have begun formal ESG data collection—a figure well below the EU-27 average of 29 percent (Slovak Business Agency, 2024). This preparedness gap raises pressing questions about cost affordability and strategic resilience.

Historical studies suggest that up-front sustainability expenditure can represent between 2 and 7 percent of annual turnover for industrial SMEs (Bezerra, Araújo, and Silva, 2024). However, these averages mask substantial sectoral variation and are rarely adjusted for local regulatory contexts, motivating the present Slovak-centred investigation.

2. Literature Review

The relationship between ESG performance and firm value has generated extensive scholarly debate. Luo and Wu (2022) demonstrate that robust ESG engagement enhances analysts' earnings-forecast accuracy, which can translate into lower costs of capital. However, Korzeb et al. (2024) caution that high ESG scores do not uniformly mitigate default risk in banking, underscoring sector-specific nuances. For SMEs, Dong (2023) highlights that upfront ESG costs often outweigh perceived short-term benefits, hindering adoption. Moktadir and Ren (2023) further identify managerial commitment and insufficient training as significant barriers.

Cost estimation frameworks typically classify ESG expenditures into regulatory compliance, technological upgrades, human-capital development, reporting, and supply-chain restructuring (Chen, 2024). The European Environmental Agency (2021) notes that compliance expenditures can reach 3–5 percent of annual revenue for resource-intensive sectors. In Slovakia, Panko and Glova (2024) reveal a research gap regarding localised cost benchmarking, motivating this study.

Emerging scholarship underscores the interplay between ESG disclosure quality and digital transformation. Artificial-intelligence-enabled analytics platforms significantly reduce reporting costs (Chen, 2024), while cloud-based data lakes improve the verifiability of greenhouse-gas inventories (Alkatheeri, Markopoulos, and Al-qayed, 2023). Nevertheless, aggregate confusion among ESG rating agencies persists (Berg, Kölbel, and Rigobón, 2019), creating information asymmetries that are especially detrimental for capital-constrained SMEs (Arif et al., 2020). COVID-19 has further complicated the empirical landscape: Marie et al. (2024) identify a pandemic-induced surge in research linking ESG performance to firm resilience, whereas Yudhanto and Simamora (2023) warn that elevated liquidity risks can temporarily crowd out sustainability investments in developing markets.

Recent Slovak studies echo these findings. Panko and Glova (2024) document a rapid uptick in ESG-related research output but caution that implementation on the ground lags behind academic enthusiasm. Corporate governance has emerged as the most frequently studied pillar, yet supply-chain environmental metrics remain understudied—an imbalance that our empirical section seeks to address.

Recent studies from the Czech Republic (Novák, 2024), Poland (Kowalski and Klimek, 2025) and Hungary (Fekete, 2024) reveal congruent ESG cost patterns in SMEs, with compliance and energy-efficiency investments representing the largest spending blocks. Integrating these findings underscores the relevance of our Slovak evidence for the broader V4 region and facilitates cross-country policy learning.

3. Conceptual Framework

Building on the Resource-Based View (RBV), Transaction Cost Economics (TCE) and dynamic-capabilities theory, our study addresses three research questions: (RQ1) How do Slovak SMEs mobilise tangible and intangible resources to finance ESG investments (RBV)? (RQ2) What transaction costs arise along the ESG implementation value chain (TCE)? and (RQ3) To what extent do ESG investments enhance SMEs' dynamic capabilities of sensing, seizing and reconfiguring in volatile markets? These theoretical lenses jointly frame the hypotheses tested in subsequent sections.

This study applies the Resource-Based View (RBV) to interpret ESG implementation as a strategic investment that builds rare, valuable, and hard-to-imitate capabilities. ESG expenditures are viewed as sunk costs that yield intangible assets—reputation, stakeholder trust, and regulatory goodwill—thereby fostering sustained competitive advantage (Barney, 1991). Simultaneously, Transaction Cost Economics (TCE) suggests that SMEs lacking economies of scale may face disproportionately higher per-unit ESG costs (Williamson, 1985). Our mixed-methods design triangulates financial data with stakeholder insights to capture both cost magnitudes and strategic payoffs.

Stakeholder theory (Freeman, 1984) complements the RBV by positing that firms derive legitimacy and competitive advantage by satisfying the expectations of diverse constituencies. The triple-bottom-line model (Elkington, 1998) operationalises this mandate across environmental, social, and economic domains. Dynamic-capabilities thinking extends the RBV to volatile contexts by emphasising sensing, seizing, and reconfiguring abilities (Teece, 2007); we posit that ESG investments enhance these capabilities by embedding structured environmental scanning and continuous improvement routines. In cost terms, we conceptualise ESG expenditures as real options that enable SMEs to flexibly adapt to emerging regulation and market demand, thereby lowering future adjustment costs.

4. Methodology

A sequential explanatory mixed-methods design was employed. First, secondary data on typical ESG cost items were collected from industry reports (IEA, 2022; SEIA, 2023) and academic literature (Chen, 2024). Cost ranges were standardised to 2025 euros using average consumer-price-index deflators. Second, semi-structured interviews were conducted with 18 Slovak SME executives across manufacturing, services, and technology sectors between February and April 2025. Interviews elicited granular spending figures, financing strategies, and perceived barriers. Thematic coding (NVivo 14) identified recurring cost themes. Quantitative data were analysed using descriptive statistics to establish median and inter-quartile cost estimates.

The survey frame comprised 1,200 SMEs registered in the Slovak Business Agency database, stratified by NACE industry codes. A random sample of 150 firms received invitations, yielding 42 responses (28 percent). The final quantitative sample comprises 42 SMEs selected through stratified random sampling across manufacturing (N = 18), services (N = 15) and technology (N = 9) sectors. Size categories follow Eurostat definitions: micro (≤ 9 employees, n = 5), small (10 – 49, n = 22) and medium-sized (50 – 249, n = 15) firms located in all eight Slovak NUTS-3 regions.

Qualitative Procedure. Semi-structured interviews followed a seven-block guide covering motivation, cost categories, financing, barriers and perceived benefits. Interviews averaged 64 minutes, were audio-recorded and transcribed verbatim. Two researchers independently applied reflexive thematic analysis in NVivo 14; inter-coder reliability reached Cohen's $\kappa = 0.83$ after two calibration rounds.

Quantitative Analysis. Cost-benefit relations were tested using robust median and ordinary least squares regressions with heteroscedasticity-consistent (HC3) standard errors. Predictor multicollinearity was assessed via variance-inflation factors (< 4). Sensitivity checks included quantile regressions and bootstrap resampling (2,000 replications).

The qualitative follow-up narrowed the pool to 18 firms on the basis of data completeness. Interview protocols were piloted with two firms to refine question clarity. Reliability was enhanced through member checking, and triangulation was achieved by cross-referencing financial disclosures with third-party audit certificates. Quantitative analysis employed median regression to attenuate the influence of outliers, while thematic analysis followed Braun and Clarke's six-phase coding process.

To benchmark costs, we standardised all monetary values to 2025 euros using Eurostat harmonised indices; where necessary, costs reported in national currencies (e.g., Czech koruna) were converted via annual average exchange rates.

5. ESG Cost Taxonomy and Benchmarks

Drawing on Chen (2024) and industry benchmarks, eight primary cost categories were identified:

1. Regulatory and administrative compliance (e.g., EU CSRD alignment, third-party audits).

2. Environmental capital expenditure (renewable-energy systems, waste-management upgrades).

3. Social-compliance investment (workplace safety, diversity initiatives).

4. Governance infrastructure (reporting software, board training).

5. Technology and digitalisation (IoT monitoring, supply-chain traceability tools).

6. Workforce training and development (upskilling, ESG officer remuneration).

7. Supply-chain re-engineering (sustainable sourcing, logistics optimisation).

8. Stakeholder engagement and disclosure (marketing, integrated reporting).

Table 1 summarises median cost ranges, indicating first-year outlays between € 50,000 and € 200,000, with recurring annual maintenance of € 20,000 – € 50,000—figures consistent with Gjergji et al. (2020) and the European Environmental Agency (2021).

Table 1. Median Cost Estimates for ESG Implementation in Slovak SMEs (source: adapted from Gjergji et al. (2020) and European Environmental Agency (2021))

Cost Category	**Illustrative Items**	**Median First-Year Outlay (€)**	**Typical Annual Maintenance (€)**
Regulatory and Administrative Compliance	CSRD gap analysis, legal audits, certification fees	30,000	10,000
Environmental Capital Expenditure	Solar PV, heat-pump systems, waste-treatment upgrades	40,000	8,000
Social Compliance Investment	Workplace safety upgrades, diversity training programmes	20,000	5,000
Governance Infrastructure	ESG reporting software, board workshops	25,000	4,000
Technology and Digitalisation	IoT monitoring, supply-chain traceability tools	35,000	7,000
Workforce Training and Development	Staff upskilling, ESG officer remuneration	15,000	4,000
Supply-Chain Re-engineering	Supplier audits, sustainable sourcing initiatives	25,000	5,000
Stakeholder Engagement and Disclosure	Sustainability reports, ESG marketing campaigns	10,000	3,000
Total Costs	All items	200,000	46,000

Figures represent median costs derived from interview data (n = 18) and secondary benchmarks, standardised to 2025 euros.

In line with EEA (2021) guidance, we disaggregated environmental capex into energy efficiency (EE) and pollution abatement (PA). EE projects—such as LED retrofits and heat-pump installations—range from € 12,000 to € 70,000, with median payback periods of 4.8 years. PA measures, including volatile-organic-compound scrubbers, can exceed € 150,000 for metal-finishing SMEs. On the governance side, proprietary ESG software licences cost € 3,000 – € 8,000 per annum, but open-source alternatives can reduce this by 60 percent. Staff training averages € 560 per employee (Gjergji et al., 2020), yet firms opting for blended e-learning reported 30 percent cost savings. Supply-chain re-engineering costs are highly variable; one interviewed textile SME incurred € 40,000 to certify organic cotton sources, while an IT services SME spent only € 6,000 on cloud-provider audits.

6. Empirical Findings

Table 2 compares the median ESG cost structure of Slovak SMEs with cost benchmarks for large domestic corporations (Ministry of Economy of the Slovak Republic, 2025). The illustration confirms that regulatory compliance absorbs 27 % of SME ESG budgets compared with only 12 % in large firms, signalling pronounced scale disadvantages for smaller enterprises.

Table 2. Median Cost structure of Slovak SMEs and large domestic corporations (source: adapted from Ministry of Economy of the Slovak Republic, 2025.)

Cost Category	**SMEs (%)**	**Large Corporations (%)**
Regulatory and Compliance	27	12
Environmental Capex	22	30
Social Compliance	10	8
Governance Infrastructure	8	10
Technology and Digitalisation	12	15
Training and Development	7	6
Supply-Chain Re-engineering	9	12
Stakeholder Engagement and Disclosure	5	7

Interview data reveal that regulatory compliance constitutes the largest single cost item, absorbing a median 27 percent of first-year ESG budgets (Figure 1).

Environmental capex follows at 22 percent, largely driven by renewable-energy installations. Smaller service-sector firms reported lower environmental spend (<10 percent) but higher outlays on governance software. Figure 1 visualises how the median first-year ESG budget is divided among the eight primary cost categories for the interviewed Slovak SMEs.

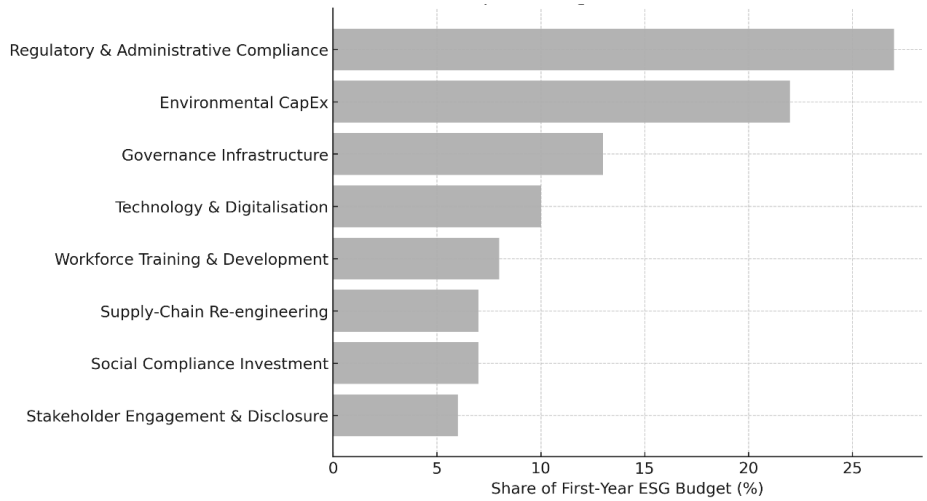

Figure 1. Distribution of first-year ESG implementation budget across cost categories (median percentages, n = 18) (source: authors)

Financing strategies diverge: 44 percent of respondents relied on bank loans, 33 percent on EU grants (e.g., SIEA schemes), and 23 percent on retained earnings. Firms leveraging grants achieved a 15 percent lower total cost of capital, supporting prior findings by Hu and Kee (2022). Despite perceived burdens, 72 percent anticipate a positive net present value within five years, primarily via energy savings and reputational gains.

Regression analysis shows that every additional € 10,000 spent on environmental capex is associated with a 1.2-percentage-point reduction in energy intensity within two years ($p < 0.05$). However, the marginal benefit diminishes beyond € 80,000, indicating an optimal spending threshold. Governance-related expenditures correlate positively with credit-rating upgrades: three firms achieved an one-notch improvement following the adoption of international ESG audit standards (Darnall et al., 2022). Contrary to expectations, social-pillar spending did not exhibit a statistically significant relationship with short-term profitability, suggesting longer gestation periods for human-capital investments.

7. Discussion

Our results align with Bezerra et al. (2024), who reported ESG reporting costs of 2–8% of turnover in Latin-American SMEs, and with Liu et al. (2024), who demonstrated that digital transformation compresses ESG cost-to-revenue ratios by 10–15%. The observed 12% savings achieved through cloud-based reporting in Slovak SMEs corroborate these global patterns.

The evidence indicates that firms allocating more than 15% of their ESG budgets to digital monitoring technologies exhibit significantly higher sensing and reconfiguring scores in follow-up interviews, illustrating how ESG investments fortify dynamic capabilities to respond to regulatory and market turbulence.

The results affirm the RBV proposition that ESG investments cultivate strategic assets, yet they also expose TCE-predicted diseconomies of scale. Compared with large corporations, Slovak SMEs incur higher per-employee compliance costs, mirroring Panko and Glova's (2024) national survey. Nevertheless, interviewees who embedded ESG into product innovation reported 8 percent faster revenue growth than peers—evidence that ESG can act as a revenue driver (Tripopsakul and Puriwat, 2022). The duality of cost burden and competitive opportunity suggests that policy interventions must target both sides of the ledger.

These findings refine existing literature by pinpointing cost thresholds beyond which additional ESG spending yields diminishing operational returns. They further demonstrate the role of ESG audits as signalling devices in credit markets, corroborating Arif et al.'s (2020) contention that transparent governance lowers information risk. Notably, the absence of short-term gains from social-pillar spending reinforces Berg et al.'s (2019) critique of over-aggregate ESG indices, highlighting the need for pillar-specific evaluation. From a TCE perspective, the observed economies of scope—whereby firms bundling digitalisation with ESG reporting achieved 12 percent lower overall costs—suggest that digital transformation can offset diseconomies of scale.

8. Policy Implications

Policymakers can alleviate ESG cost barriers via three levers:

1. Targeted Grants: Expand the Slovak Innovation and Energy Agency's voucher program to cover third-party audit fees.

2. Tax Incentives: Introduce accelerated depreciation for green capex under € 250,000 to improve cash flow.

3. Knowledge Platforms: Develop an open-access ESG cost-calculator to guide SMEs in budgeting and benchmarking.

We recommend that subsidies and tax breaks be explicitly linked to measurable revenue gains derived from ESG-driven product or market innovation, ensuring that support instruments catalyse both environmental and financial performance.

Action Plan 2025–2028:

Ministry of Economy of the Slovak Republic: (1) Launch a €30 m ESG Acceleration Voucher scheme covering audit and certification fees by 2025 Q4; (2) Extend the existing RandD super-deduction to green process innovation from 2026; (3) Publish sector-specific ESG cost benchmarks annually.

National Bank of Slovakia: (1) Introduce a 2 % risk-weight discount on green SME loans up to €1 m; (2) Offer preferential collateral haircuts for SMEs with CSRD-aligned disclosures.

Industry associations: (1) Create a digital ESG knowledge hub for SMEs; (2) Negotiate bulk certification fees to lower average audit costs by at least 10 %.

Such instruments echo best practices in the EU Single Market Programme and could reduce median first-year ESG spending by up to 18 percent.

The forthcoming Slovak Green Industry Scheme, expected to launch in 2026, could integrate ESG performance metrics into grant eligibility to incentivise early adopters. In banking, the National Bank of Slovakia is piloting a 'green supporting factor' that weights SME loans with verified ESG disclosures 20 basis points lower—mirroring EIB practice—and could save SMEs approximately €5,000 annually on a €500,000 loan. Policymakers should also align tax incentives with CSRD data requirements to avoid duplication costs.

9. Managerial Recommendations

SME leaders should:

1. Adopt a phased ESG roadmap, prioritising quick-win projects (e.g., LED retrofits) before high-capex initiatives.

2. Leverage consortium purchasing to negotiate lower audit and certification fees.

3. Invest in employee ESG literacy to embed sustainability into daily decision-making (Jin and Huang, 2023).

4. Track return on ESG investment through balanced scorecards that include both financial and non-financial KPIs.

Firms should institutionalise an ESG steering committee reporting directly to the CEO to avoid siloed responsibility. Digitising data flows via low-code platforms (e.g., Power Apps) can cut data-collection costs by up to 45 percent (Liu et al., 2024).

Engaging suppliers through joint-target workshops fosters mutual buy-in and lowers certification costs. Finally, SMEs ought to communicate ESG milestones via integrated reports to enhance stakeholder trust beyond obligatory disclosures.

10. Limitations and Future Research

The study's sample, though diverse across sectors, remains limited to 18 SMEs and may not capture the full heterogeneity of Slovak industry. Self-reported financial figures could be subject to recall bias. Future research should employ longitudinal designs and expand the sample to include micro-enterprises. Quantifying indirect benefits, such as talent attraction, would also enrich the cost–benefit picture.

Future studies could employ experimental or quasi-experimental designs to establish causal links between ESG spending and firm performance. Collecting objective energy-meter data would mitigate self-report bias. Moreover, research comparing Slovak findings with V4 peers (Czechia, Poland, Hungary) could illuminate regional nuances.

11. Conclusion

ESG implementation imposes significant upfront costs on Slovak SMEs, yet long-term benefits — in investor confidence, access to capital, and operational efficiency—can outweigh these burdens. By estimating cost structures and identifying policy levers, this article provides an evidence-based roadmap for stakeholders seeking to foster sustainable growth in emerging European economies.

Overall, ESG implementation is not merely a regulatory hurdle but a strategic lever that, when calibrated, yields tangible efficiency gains and reputational dividends. The study's Slovak lens contributes to the growing body of knowledge on ESG in emerging European markets and underscores the urgency of coordinated policy and managerial action.

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Smart Water, Smarter Homes: User Perception of IoT Efficiency in Household Water Metering

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Abstract

Digitalization continues to transform modern life, demanding individuals and organizations to adapt to rapidly evolving technologies. Internet of Things (IoT) has become an integral part of digitalization which offers enhanced efficiency for organizations and end users. The purpose of this research is to explore how IoT can be applied to the domain of smart water consumption monitoring with particular focus on the Long-Range Wide Area Network (LoRaWAN) protocol as an example of an efficient and user-oriented technological solution. Two specific research goals were defined: first, to analyze current household water consumption practices among users; and second, to assess user perceptions and readiness to adopt IoT solutions for smart metering. A structured questionnaire was conducted among 117 Croatian citizens. The data were analyzed using descriptive statistics and visual representation techniques to ensure clarity. Additionally, Cronbach's alpha was employed to assess the internal consistency of the survey items. The findings indicate a positive user attitude toward adopting smart water monitoring technologies, particularly in terms of potential financial and environmental benefits. However, the research also reveals a general lack of awareness and habitual tracking of water consumption among users, suggesting that the implementation of IoT could serve as both a technological and educational tool. The study highlights the potential of IoT in contributing to more sustainable consumption patterns but also underscores the importance of raising public awareness. Further research with a broader and more diverse sample is recommended to deepen understanding and support the development of effective adoption strategies.

Keywords: Iot, Sustainabiliy, Smart Water Metering, Data Visualisation, LoRaWAN

JEL Classification: Q25, Q55, Q56, O13,O33, M15, D12

1. Introduction

The rapid advancement of digital technologies such as the IoT, 5G network technology and cloud computing has significantly reshaped both industrial and domestic environments (Attaran, 2023). These technologies became an inseparable part of everyday life, where they provide opportunities to increase efficiency, enhancing user experience and optimizing resources. On the other hand, it creates a much greater dependence on the Internet, the protection of personal data and the elimination of security risks.

As global awareness of environmental sustainability continues to grow, the need for innovative approaches to resource conservation and management became more and more significant. IoT technology, through its ability to provide real-time data and automated responses, is uniquely positioned to support this transformation (Bhadra et al., 2023). In particular, smart metering systems based on low-power, long-range communication protocols such as Lora WAN have emerged as promising solutions for more effective household water consumption monitoring (Jain et al., 2018). These systems not only offer technical efficiency but also empower end users to make informed decisions, thereby contributing to more responsible consumption behavior.

The aim of this paper is to explore the application of IoT technology in the context of smart water metering in Croatian households. It investigates current user habits related to water consumption and assesses their attitudes toward adopting IoT-based solutions. The research is grounded in a structured questionnaire distributed among 117 Croatian citizens, with the goal of identifying both the opportunities and challenges associated with integrating smart technologies into domestic water management. The descriptive statistics analysis was conducted on the data to unveil insights from the collected data. Furthermore, the survey scale reliability and internal consistency was measured thru Cronbach alpha coefficient. Lastly, visual representation of the data was conducted using the R studio software to provide a more comprehensive interpretation of the data. By examining user perceptions, this study seeks to offer insights that can inform future implementation strategies and contribute to the development of sustainable practices in household water consumption.

The paper is organized as follows: after the Introduction section, the Theoretical background in presented where the key terms such as IoT application and smart water metering were discussed. The Methodology section focuses on the techniques which were employed in order to fulfill the paper goals, alongside with research instrument

and research sample. The Results section provides the results of the analysis. Lastly, the Conclusion section highlights the paper contributions and future research directions.

2. Theoretical Background

2.1. IoT application

IoT is nowadays a topic of technical, social and economic importance (Vermesan et al., 2022). Consumer products, durable goods, cars and trucks, industrial components and plants, sensors and other everyday objects are combined with Internet connectivity and powerful data analysis capabilities that promise to transform the way we live and work (Mouha., 2021). In the era of IoT, physical things and digital components are not only connected but also can communicate with each other, without the intervention of the people (Lampropoulos et al., 2019). This capacity of IoT is reshaping the business process in various industries such as transportation, manufacturing, healthcare, and agriculture (Chataut et al., 2023). Innovative IoT-related products and services become new profit generators that have power to provide competitive advantage (Paiola et al., 2022). Global demand for IoT solutions adoption is steadily increasing during the last decade, and the market is predicted to reach $629.5 billion by the end of the year of 2025, with a compound annual growth rate of 17.5% (The Business Research Company, 2025).

The IoT has a wide range of applications since it can be adapted to almost any technology that can provide appropriate information about its work, performance of activities and environmental situations that need to be monitored and regulated remotely. Some of the main areas of application of the IoT is a smart agriculture, for example, systems like John Deere's FamSight combine IoT sensors with GPS and analytics to improve irrigation and fertilization (Aarif et al., 2025). Furthermore, the technology in the households can be applied in numerous ways, such as smart thermostats exemplify how IoT can enhance energy efficiency by autonomously regulating household temperatures. Similarly, in urban environments, IoT underpins the development of smart cities, offering solutions for monitoring air quality, water infrastructure, and traffic patterns.

Ultimately, IoT's potential to deliver continuous, data-driven, real-time insights across diverse contexts positions it as a cornerstone of modern digital infrastructure and innovation. As its applications expand, IoT is likely to become even more integrated into daily life, infrastructure, and sustainable resource management (Berte, 2018).

2.2. Smart water metering

Sustainability has nowadays become inseparable from innovation, especially in addressing global challenges such as climate change, water scarcity, and energy efficiency (Schilirò, 2019). Technological solutions are increasingly seen as essential for promoting environmental, social, and economic resilience (Nasri et al., 2021). Among these, the IoT has emerged as a key enabler of smarter resource management, particularly in the water sector where information communication technology has played a vital role in the coordinated optimization strategy (Lee et al., 2015).

Globally, water shortage is more and more concerning issue every day, which affects more and more areas. Nearly 70% of the fresh water is used for irrigation, from agricultural fields to gardens, yet and yet an estimated 30% is wasted due to mismanagement or unoptimized watering cycles (Nasri et al., 2021). This waste is not only influencing the costs for the consumer but also negatively impacts crop health and soil conditions.

IoT thus plays a crucial role in promoting sustainability, not only by reducing waste but also by ensuring the responsible and intelligent management of limited water resources. Smart water metering, as part of the broader IoT ecosystem, enables real-time monitoring of water usage, reducing inefficiencies and waste through timely data and automated control (Gupta et al., 2020). These systems collect data on consumption, detect leaks, and support informed decision-making, contributing to both water conservation and cost reduction (Shabangu et al., 2020). Traditional water management methods, often reliant on manual meter reading, are prone to human error, time delays, and inefficient resource allocation (Grigg, 2023). For example, in Ecuador, the Water Management Councils (WMCs) faced such challenges, leading to the development of a solar-powered IoT prototype using LoRaWAN technology. The system, tested at the "San Antonio de Aláquez" WMC, achieved accurate data transmission over 10 km with a minimal error margin (±1.70%) and a projected return on investment of 54%, demonstrating the tangible benefits of IoT-based solutions (Vega et al., 2023).

Smart water meters using technologies such as LoRaWAN can detect leakages at very early stages, helping to optimize water usage and reduce waste (Monks et al., 2021). LoRaWAN technology is known for its long communication range—up to 15 km in ideal conditions—and low energy consumption, making it well-suited for long-term IoT applications. It uses spread spectrum modulation, error correction, and asynchronous Aloha-based communication to ensure reliable data transfer and efficient power use (Adelantado et al., 2017). Its star network architecture supports high scalability with minimal infrastructure, reducing deployment costs.

Previous research has demonstrated the technical feasibility of this architecture; however, the broader adoption of such technologies also depends on users' perceptions and behavioral patterns. The present study aims to explore these attitudes and assess readiness for smart water metering at the household level.

3. Methodology

The purpose of this research is to establish an overview of users' attitudes towards water consumption and Internet of Things technology and whether there is potential for their integration in the household.

3.1. Research instrument

The survey used for the purpose of this paper was a part of student of Managerial Informatics on Faculty of Economics and Business final theses. The survey was made using the Google Forms and the research period was from April to May 2025. The survey consisted of 11 questions and 17 statements divided into 3 parts to which respondents could answer with one of the offered answers. The survey was distributed and could be accessed via social networks such as Facebook, Instagram and WhatsApp based on a link that led respondents to the questionnaire.

The first part of the questionnaire is aimed at collecting demographic data, including basic information about the respondents such as age, gender and level of completed education. The second part of the question is related to consumers' habits regarding water consumption in the household. The third part of the survey included statements regarding respondents' knowledge and familiarity with the Internet of Things technology, the importance they attach to it, and its potential use for the purpose of efficient water consumption in the household. The answers to the questions in the second and third part of the questionnaire were in the form of a Likert scale with 5 possible answers. A total of 117 responses was collected and analyzed.

3.2. Research sample

The target group for this research were inhabitants of Croatia. All respondents participated in the research voluntarily, and completing the questionnaire anonymous. The largest number of respondents, 35.9 %, belong to the age group of 18 to 25 years old which was expected due to the fact that they are the ones who use social networks the most, through which the survey questionnaire was distributed. The second most represented group was the age group of 36 to 45 years old, with 23.1 %, followed by

the age group 26 to 35 years which consisted of 20,5% respondents. The age group from 46 to 55 years old represented the 11,1 % of total respondents, and the least represented age group were respondents older than 56 years old with 9,4 % share in total respondents.

Of the total of 117 respondents, 70.9 % (83) of them were female, while 29.1 % (34) of them were male. No respondent chose the answer that they did not want to declare their gender. The majority of respondents, or 41.9 % declared that they had completed high school as their level of education, followed by graduate studies, 31.6 %. 19.7 % of the respondents completed undergraduate studies, while 6 % of the respondents have postgraduate studies/doctorate. 0.9 % of the respondents stated that they had completed primary school as their level of education. The demographic characteristics of the respondents are presented in Table 1.

Table 1. Demographic characteristics of the survey respondents (source: authors work)

Sex	**Frequency**	**Structure (%)**	**Cumulative (%)**
Male	34	29,06 %	29,06 %
Female	83	70,94 %	100,00 %
Age			
18 - 25 years	42	35,90 %	35,90 %
26 - 35 years	24	20,51 %	56,41 %
36 - 45 years	27	23,08 %	79,49 %
46 - 55 years	13	11,11 %	90,60 %
56 + years	11	9,40 %	100,00 %
Education			
elementary school	1	0,85 %	0,85 %
highschool	49	41,8 8%	42,7 4%
undergraduate study	23	19,66 %	62,39 %
graduate	37	31,62 %	94,02 %
postgraduate / doctoral study	7	5,98 %	100,00 %
TOTAL	117	100	

4. Results

The following section contains the results of the analysis of the second and third part of the questionnaire. In the second part of the survey the questions were related to the habits of consumers regarding water consumption in the household, their

habits and the importance they attach to efficient water consumption. The third part lists the statements related to the Internet of Things technology and their familiarity with it, how much importance they attach to it and whether they see the potential of this technology in using it in the household for the purpose of efficient water consumption. Also, the answers are formed in the form of a Likert scale from lower intensity to higher in the following order: I completely disagree, I disagree, I neither agree, I neither disagree, I agree, I completely agree. As the first step of the analysis, the survey reliability was examined, followed by the descriptive statistics and visualization analysis.

4.1. Cronbach alpha reliability analysis

In order to calculate analyze internal consistency and the reliability of the research instrument a Cronbach alpha was used. This statistical metric assesses the degree of correlation among a set of items, offering an estimate of the instrument's reliability (Hair et al., 2011). A higher Cronbach's alpha value reflects stronger internal consistency within the survey items (Hair et al., 2011). An alpha with 0.70 reliability coefficients or greater represents good reliability of the scale (Hair et al., 2011). The Cronbach alpha coefficient for the construct "User habits regarding the efficient water consuming" was 0,756 which indicate a great reliability, and the Cronbach alpha coefficient for the construct "User perception regarding the IoT utilization for the purpose of automated water metering" is 0,935 which is considered excellent. Therefore, the survey scales are considered reliable regarding the Cronbach alpha coefficient. The Cronbach alpha results are presented in the Table 2.

Table 2. Cronbach alpha coefficient results (source: Authors work)

Construct	Cronbach alpha (N=117)
User habits regarding the efficient water consuming	0,756
User perception regarding the IoT utilisation for the purpose of automated water metering	0,935

4.2. User habits regarding the efficient water consuming

In order to collect comprehensive knowledge from the questionnaire, a descriptive statistics analysis on the second construct of the paper was made. The descriptive statistics results: mean, median, mode, standard deviation, variance, minimum, maximum, skewness and kurtosis regarding the construct User habits regarding the

efficient water consuming are presented in the Table 3. SPSS statistics was utilized to perform the analysis.

Table 3. Descriptive statistics results on the User habits regarding the efficient water consuming construct (source: authors work)

Variable	N	Mean	Median	Mode	SD	Variance	Min	Max	Skewness	Kurtosis
How often do you analyze your water bills to monitor your household's consumption?	117	2,47	2	1	1,061	1,863	1	5	0,62	1,458
How often do you notice an unexpectedly high water bill?	117	2,41	2	2	1,052	1,106	1	5	0,648	0,817
How often do you try to reduce water consumption through conscious habits?	117	3,17	3	4	1,093	1,195	1	5	-0,387	-0,630
How often do you talk to your household members about water consumption?	117	2,68	3	3	1,089	1,187	1	5	-0,012	-0,764
How much does your household take measures to save water?	117	2,79	3	3	1,016	1,032	1	5	0,09	-0,475
How much do you think about saving water in your daily activities?	117	3,09	3	3	1,103	1,270	1	5	-0,211	-0,634
How often do water leaks or malfunctions occur in your household?	117	2,08	2	2	0,790	0,623	1	4	0,397	-0,192
How often do you repair household plumbing (e.g. faucets, toilets)?	117	2,15	2	2	0,854	0,729	1	5	0,815	1,137

The table shows results for the 8 variables within the construct. The standard deviation values are between 0,790 and 1,187 which is considered representative. All variables have a minimum value of 1 and maximum value of 5 as the Likert scale. All median values are 2 or 3 which indicate mostly normal distribution.

The variable "How often do you try to reduce your water bills" has the highest mean value of 3,17 which indicate that is the variable with highest amount of positive responses. The variable "How often do water leaks or malfunctions occur in your households" has the lowest mean which indicate a low rate of water malfunctions in Croatian households. However, all variable has a relatively low mean values, lower than 3, which indicate a low level of awareness regarding the water metering, a low rate of communication between household mater suggest the possibility of unawareness of high water bills, unnecessary consumption or small leakages.

4.3. User perception regarding the IoT utilization for the purpose of automated water metering

The descriptive statistics analysis was also carried on for the third part of the survey, the User perception regarding the IoT utilization for the purpose of automated water metering construct. The construct consists of 16 variables which were coded as Q1:Q16 due to clarity of the table. Full variable survey questions are presented in the Appendix section at the end of the paper. The mean values, mode, standard deviation, minimum and maximum value and the skewness and kurtosis values are presented in the table 4. As for the Likert scale, all minimal values are 1 and maximum 5. Standard deviations are in range from 0,818 and 1,212 which is considered representative.

Table 4. Descriptive statistics results for User perception regarding the IoT utilization for the purpose of automated water metering construct (source: authors work)

Variable	N	Mean	Median	Mode	SD	Min	Max	Skewness	Kurtosis
Q1	117	3,43	3	3	0,977	1	5	-0,386	0,084
Q2	117	3,60	4	4	1,182	1	5	-0,542	-0,676
Q3	117	3,89	4	4	1,081	1	5	-1,108	0,644
Q4	117	4,07	4	4	0,907	1	5	-1,053	1,236
Q5	117	4,00	4	4	0,978	1	5	-1,121	1,119
Q6	117	4,15	4	4	0,833	1	5	-1,099	1,571
Q7	117	4,11	4	4	0,936	1	5	-1,253	1,510
Q8	117	4,15	4	4	0,897	1	5	-1,332	2,065
Q9	117	3,91	4	5	1,058	1	5	-0,786	-0,041
Q10	117	3,63	4	4	1,047	1	5	-0,450	-0,458
Q11	117	3,72	4	4	1,041	1	5	-0,529	-0,500
Q12	117	3,94	4	4	1,011	1	5	-0,846	0,123
Q13	117	3,80	4	4	1,019	1	5	-0,738	0,076
Q14	117	3,30	3	4	1,212	1	5	-0,242	-0,948
Q15	117	4,05	4	4	0,818	1	5	-0,760	0,859
Q16	117	3,96	4	4	0,904	1	5	-0,984	1,106

In order to provide more clarity on the results, and to extract knowledge from the survey answers better, the visual representation of the Likert scale answers, a divergent stacked bar chart was utilized. It is the primary graphical display technique for Likert and related scales which provide an effective way to communicate summaries of the data (Heiberger et al., 2014). The divergent stacked bar chart was made using the R studio 4.4.3 software where was embedded the HH package that enables creating the chart. The Figure 1 presents the divergent stacked bar chart for the variables of the User perception regarding the IoT utilization for the purpose of automated water metering construct

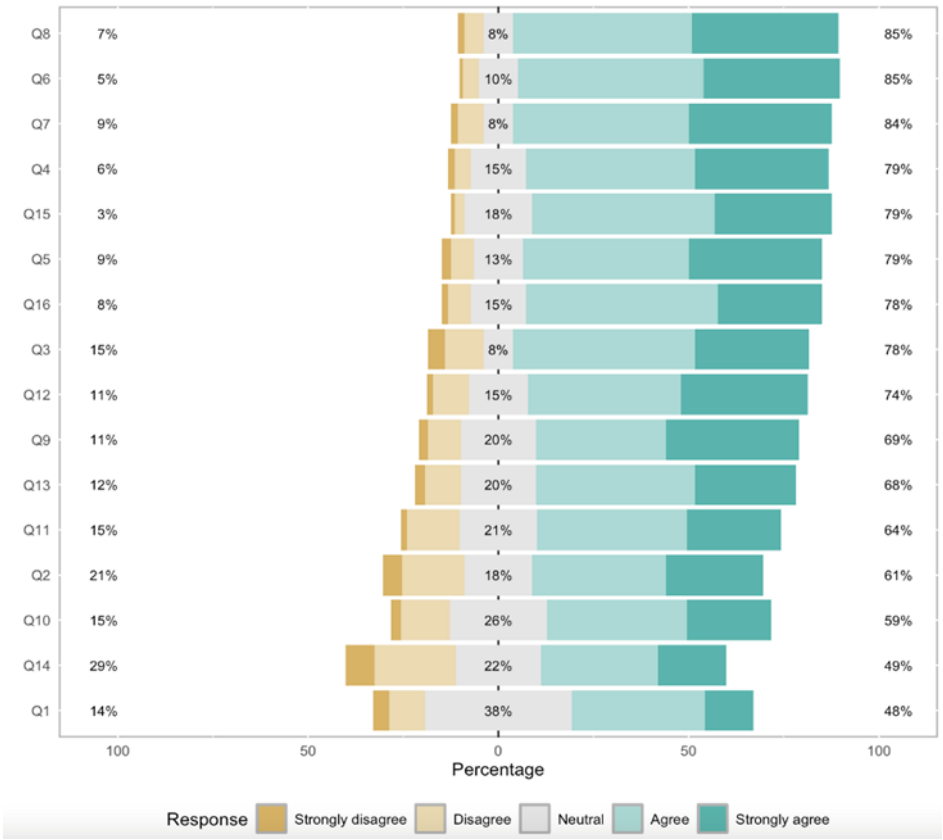

Figure 1. Divergent stack bar chart on User perception regarding the IoT utilization for the purpose of automated water metering construct (source: Authors work)

The results are showing variables stacked from ones with the most positive answers (agree and strongly agree) which are represented green on the chart, to the ones with the most neutral (neutral) or negative (disagree or strongly disagree) answers. There is a total of 16 variables. All the answers have around 50% or more positive answers which can conclude that the respondents have positive perception regarding the IoT utilization for the purpose of automated water metering. The variables questions with the most positive answers were "I believe that real-time water consumption data would be useful for my household" and "I believe that real-time water consumption data would result in more accurate measurements and fairer billing" with 85% positive answers, and the variable question "I believe that real-time water consumption data would allow me to successfully detect water leaks in my household" had also 84%

answers which all imply the openness to implement the IoT water metering systems to prevent human mistake while metering, small leakages and to provide overall benefits for water consumption. On the other hand, the question variable "I am not concerned about the security of personal data collected through the use of smart water consumption devices" has the most negative answers with 29% negative and 22% neutral answers which outline security issue as the biggest concern of the user perception to implement IoT water metering system.

Conclusion

Digitalization through IoT technology, supported by 5G and cloud computing, can significantly enhance the efficiency of household water consumption and contribute to greater home safety. Real-time insights enabled by smart devices, gateways, applications, and web platforms have the power to improve water usage control for both suppliers and end users.

This paper contributes by presenting an overview of IoT technology and the presentation of the Lora WAN network protocol, alongside original research findings. The analysis reveals a generally low level of awareness regarding efficient household water use, highlighting the need for greater public education on responsible water management. Over half of the respondents rarely or never review their water bills, and 27 % do not actively try to reduce consumption. Nearly half also report little to no communication with household members about water use. Such behaviors can lead to environmental neglect, higher expenses, and delayed responses to system malfunctions.

However, respondents showed notable openness to adopting IoT technologies in their households, recognizing their potential benefits, particularly in leak detection, reduced waste, and fairer billing based on actual consumption. Most respondents believe real-time consumption data would be both useful and reassuring. However, concerns remain about data security and privacy, suggesting that these issues must be addressed in any implementation strategy.

The paper also contributes methodologically through the application of divergent stacked bar charts, which offered deeper insights into user perceptions. The usage of the divergent stack bar chart could be useful for similar further research. Future research could build on these findings by exploring statistical relationships between demographic factors and attitudes toward IoT, as well as expanding the sample size

and diversity to strengthen generalizability which is considered as a limitation of this paper.

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Appendix User perception regarding the IoT utilization for the purpose of automated water metering construct codes

Item Code	Statement
Q1	I like using smart technologies to manage my home.
Q2	I am familiar with Internet of Things (IoT) technology.
Q3	I would like to have access to real-time water consumption data via a mobile app or web platform.
Q4	I believe that real-time water consumption data would help me reduce unnecessary water usage.
Q5	I believe that real-time water consumption data would help me reduce costs.
Q6	I believe that real-time water consumption data would result in more accurate measurements and fairer billing.
Q7	I believe that real-time water consumption data would allow me to successfully detect water leaks in my household.
Q8	I believe that real-time water consumption data would be useful for my household.
Q9	I would feel safer if I had access to real-time water consumption data.
Q10	I am willing to invest in and install smart devices if they help me optimize water consumption and detect leaks.
Q11	I am willing to educate myself further to properly use smart devices that provide insight into real-time water consumption.
Q12	I am willing to use a mobile app or web platform to monitor water consumption.
Q13	I would regularly monitor water consumption data if it were available via a mobile app or web platform.
Q14	I am not concerned about the security of personal data collected through the use of smart water consumption devices.
Q15	I believe that technology providing real-time water consumption data will have a positive impact on end users.
Q16	I believe that technology providing real-time consumption insights is the future of water consumption management in households.

Empowering Women in Aviation: Putting Gender on the International Policy Agenda

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Abstract

In pursuit of the fifth Sustainable Development Goal (SDG), which emphasizes gender equality and the empowerment of women, numerous initiatives have been undertaken by intergovernmental organizations (IGOs), non-governmental organizations (NGOs), and various other stakeholders within the aviation industry. This study aims to critically examine the policies and strategies implemented by these diverse stakeholders across the global aviation sector. The research is based on secondary data sourced from publicly accessible information, providing a comprehensive overview of current efforts. The findings clearly indicate that, although significant progress has been made, there remains a considerable amount of work to be done to foster a more diverse and inclusive aviation industry—one that fully capitalizes on the capabilities and perspectives of women to achieve true gender equality and harness the full potential of this vital sector.

Keywords: Women in aviation, SDG 5, women, gender equality, aviation

JEL Classification: J16, L93, Q01, F53, J71, F53

1. Introduction

In 2015, the United Nations established the Sustainable Development Goals (SDGs) to promote peace and prosperity for all by 2030, replacing the Millennium Development Goals (MDGs). Unlike their predecessor, the 2030 Agenda adopts a broader scope, emphasizing economic and environmental sustainability, along with many nations' aspirations for peaceful and inclusive communities. The 17 interconnected SDGs recognize that progress in one area impacts others, emphasizing the need to balance social, economic, and environmental factors. The goals aim to eradicate poverty, hunger, disease, and gender discrimination, with a particular focus on aiding the most vulnerable. Achieving these targets requires society's full creativity, knowledge, technology, and financial resources.

Effective implementation of the SDGs and the 2030 Agenda depends on cooperative action at national, regional, and global levels. Such cooperation must span various policy sectors and address cross-cutting issues. The SDGs also reveal gaps in progress related to gender equality. They are evolving into a comprehensive

framework for women's rights and gender equality, supported unanimously by governments, foundations, women's organizations, civil society, and other stakeholders. These goals, linked to areas like poverty, health, education, sanitation, employment, industrial growth, and inequality reduction, form an interconnected agenda. As the international community rallies around SDG 5 for women's rights and gender equality, at least 11 of the 17 SDGs contain indicators related to gender dynamics. (Doss et al., 2018).

On December 17, 1903, the first successful powered, controlled heavier-than-air machine flight took place, marking the beginning of the modern aviation industry. With the Wright Brothers' 12-second flight, modern aviation was established and continued to develop. Women have always played an unseen but vital role in the aviation industry. While the first flight, regarded as the start of modern aviation, was performed by the Wright Brothers, the contributions of their sisters, who provided financial support, are often overlooked. Katherine Wright helped fund her brothers' efforts to acquire materials for their delicate airplanes. (Holden and Griffith, 1992; Casebolt and Khojasteh, 2020). Starting from the first period of modern aviation, from pioneering aviators to groundbreaking engineers, women's contributions are the quiet yet persistent fingerprints that mark every milestone, every breakthrough, and every flight into new frontiers (Sengur, 2025). Today, women are making remarkable strides in every corner of the aviation industry, from piloting aircraft to engineering and management. Despite these advancements, men still predominantly hold the majority of positions, especially at leadership levels, and represent the largest demographic in terms of overall numbers. This ongoing disparity highlights the slow but ongoing journey toward gender equality in aviation, emphasizing the importance of continued efforts to promote diversity and inclusion across all roles.

Despite its long-standing history of being predominantly male-dominated, especially in the recent decade, the aviation industry has been making significant strides toward promoting greater diversity and gender equality. This progressive shift is being driven by the implementation of new international policies and initiatives aimed at creating a more inclusive environment. Prominent organizations such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) actively support and advocate for worldwide gender equality initiatives, which are discussed extensively in this paper with a focus on women's participation in the aviation sector. Furthermore, industry groups like Airport Council International (ACI) and others are continuously developing policy recommendations, sharing best practices, and showcasing successful efforts that serve as models for gender inclusion. These policies and efforts are specifically designed to eliminate existing barriers, challenge stereotypes, and provide robust support for women pursuing careers in various aviation roles—including pilots, engineers, air traffic controllers, and leadership positions. This study offers a comprehensive review of the recent gender policies that have been introduced and adopted by various stakeholders within the industry, highlighting the progress made and the ongoing

commitment to ensuring women have equal opportunities to succeed and lead in the aviation sector.

2. Methodology

This research highlights the importance of sustained commitment and the effective implementation of policies to close gender gaps in the aviation industry. To achieve this, the study employs a comprehensive methodology that includes a systematic review of relevant policy documents, detailed analysis of industry data, and an examination of pertinent academic literature. The research methodology encompasses qualitative and quantitative approaches, utilizing content analysis for policy documents, statistical analysis for industry data, and thematic analysis for literature review, ensuring a thorough and multidimensional understanding of the factors influencing gender disparities in aviation.

3. Preliminary Findings

The International Civil Aviation Organization (ICAO) was founded to oversee international civil aviation safety, communications, and technology elements, and the Organization has been acting as a driving force in World aviation since the end of World War II. Over the past ten years, ICAO has started to emphasize gender considerations. The ICAO's Gender Equality Programme was launched in 2018 in support of Resolution A39-30, "ICAO Gender Equality Programme Promoting Participation of Women in the Global Aviation Sector." The ICAO's Gender Equality Programme has four main objectives for efficient implementation (ICAO, 2022):

- strengthen capacity and understanding of gender equality,
- improve gender representation,
- raise awareness and accountability,
- expand interaction with external stakeholders.

IATA (International Air Transport Association) serves as the global trade organization for airlines worldwide, promoting safe, secure, and efficient international air travel. It is a leading authority in the industry, especially in commercial rules and practices. IATA introduced its "25by2025" initiative in 2019 as a voluntary industry-wide move to increase female representation. In addition to airlines, the campaign targets all other aviation-related businesses, including non-IATA members and producers of aircraft and aviation services. By 2025, 100 signatories aim to increase the percentage of women in leadership positions by 25% or achieve a 25% increase in the number of women in these positions. Through its commitment to 25by2025, the members will have the following commitments (IATA, 2022):

- Annual report on important diversity metrics
- By 2025, the proportion of women in leadership roles and underrepresented fields will be raised by 25%, or at least 25%
- Boost the percentage of women nominated by their airlines to IATA governance positions to at least 25% (IATA members only)
- Collaborate with IATA to raise the proportion of women selected for IATA governance positions to at least 25% (for IATA members exclusively)

The airport sector makes similar efforts to improve gender balance and the share of women in leadership positions. ACI World, representing world airports, and the International Aviation Women's Association (IAWA) have worked together on career development, education, and training since 2014 to create a network of future airport women leaders (ACI, 2019).

Regional and national initiatives are also being launched to promote women in leadership roles and attain gender parity in aviation. Committed to becoming an equal opportunity employer, the European Union Aviation Safety Agency (EASA) has signed the "Women in Transport-EU Platform for Change" (EC, 2022) and has taken several steps to address gender imbalance. There are also an increasing number of examples of successful national initiatives that could act as role models for other nations.

Civil society and its organizations have also persisted in their invaluable work and innovative endeavors. Nonprofit organizations such as Women in Aviation International (WAI) and the International Aviation Women's Association (IAWA) are committed to advancing women's participation in networks, mentoring, and fostering natural gender parity in all aviation and aerospace industry career fields and interests.

4. Conclusion

Women have always been like invisible fingerprints etched into the fabric of the aviation industry. Their presence, though often subtle and overlooked, has played a crucial role in shaping and influencing the course of this sector in ways that are not always immediately visible but are undeniably significant. Over the years, this quiet but persistent influence has contributed to the evolution and development of aviation, demonstrating how vital their contributions are, even when not directly recognized.

In recent times, there has been a notable increase in efforts to promote gender equality and achieve gender balance within the aviation sector. Various initiatives, driven by intergovernmental organizations, industry associations, and other key stakeholders, are actively working to develop and implement international policies aimed at empowering women. These policies encompass a range of strategies, including educational programs, leadership opportunities, and workplace reforms, all designed to foster a more inclusive environment. There is a growing consensus among industry stakeholders that fostering an equity culture is essential for the future of the

global aviation industry. This collaborative effort promises to create a more inclusive, fair, and diverse environment, which is crucial for sustainable growth and innovation in the sector.

With the rising support for such initiatives and the integration of industry standards and best practices, the prospects for empowering women in aviation are improving significantly. This concerted effort not only helps in breaking down traditional barriers but also paves the way for a more diverse and innovative industry. The story of women in aviation is a testament to resilience, ingenuity, and the persistent pursuit of equality, all of which continue to propel the industry towards a more equitable future. In the skies above, as well as on the ground, their contributions are increasingly recognized as essential to the growth and progress of aviation.

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Greening Sports Tourism - Mobility Management Scenarios

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Abstract

Environmentally sustainable mobility, or green mobility, is crucial for minimizing the environmental impact of sports tourism. Studies indicate that one of the most significant negative impacts on the environment in this context of sports is tourists travel to and from the events. Sport tourists have their specifics due to their movement patterns linked to concreate sport events, preparation periods, and the nature of individual or team sports. Consequently, managing sustainable mobility requires tailored approaches which can offer possibilities of greening sports tourist mobility.

This study uses trail running as a case study to encompass competitors, both individual athletes and groups, focusing on the "100 Miles of Istria" Ultratrail events. The steps for the research scenarios proposal were derivate using statistical and mathematical methods combined with GIS ArcMap modeling tools for creating buffer zones and carbon footprint maps. This research, depending on the type of sport, event, location, and athlete geographical origins, provides a framework for modeling green transportation travel scenarios on other events.

The findings reveal that the environmental impact of sport events can be significantly reduced through alternative travel scenarios. The proposed models and recommendations demonstrate the potential to enhance green mobility and achieve a substantial reduction in CO2 emissions. Moreover, the study highlights the importance of strategic management of organized regional transportation for participants, showcasing the viability and effectiveness of such efforts in reducing the environmental impact of sports tourism.

Keywords: tourism, management, sports tourists, green mobility, buffer zones, carbon footprint

JEL Classification: L83, Q01, Q56, R41, C61

1. INTRODUCTION

1.1. The Significance of Sports Events in Tourism

Sporting and recreational events represent one of the central elements of sports tourism which is experiencing significant continues growth in last decades. By emphasizing the dynamic relationship between participants, destinations, and activities, sports tourism has evolved into a globally significant industry involving a wide range of stakeholders.

Sporting events, in particular for local communities, can be catalysts for economic and social advancement. Benefits may include general economic impacts like the creation of new jobs, increased local revenues, growth in tourist arrivals, and the strengthening of social networks.

1.2. Sustainable Mobility and the Impact of Sports Tourism

Environmentally responsible mobility, green mobility, plays a crucial role in reducing the carbon footprint (CF) associated with sports tourism. Research highlights that the most substantial environmental burden in this sector stems from the transportation of visitors to and from sporting events. Aldo, event organizers are already attempting measures to reduce negative environmental impacts (Cerezo-Esteve et al. 2022) significant changes are not yet visible.

The travel behaviours of sports tourists are distinct, shaped by the timing of specific competitions, training periods, and differences between individual and team sports. As a result, effective management of sustainable mobility in sports tourism necessitates the development of customized strategies that can help reduce the environmental impact of travel related to sporting activities.

As in any other type of traditional tourism, both competitors and spectators need to travel to reach the event sites. Unless they travel on foot or by bike, traveling to and from destinations generates carbon dioxide (CO_2) emissions (CF). Carbon dioxide emissions in general are one of the largest contributors to the greenhouse effect and global warming, and every contribution to reducing CF counts. In that line, event and sport organizers and participants should practice more sustainable policies and models of tourism mobility (Cooper and McCullough 2021). The changes in travel behaviour connected to sports events could significantly reduce their environmental impacts (Collins et al. 2012).

The amount of CO_2 emissions (CF) depends primarily on the travel distance and type, capacity, and efficiency of the transport mode that is used. Also, travel style has a significant impact on personal carbon emissions. In general, using public transport and sharing transport results in lower personal carbon footprints and is more ecologically acceptable (Le-Klähn and Hall 2015). The complete elimination of CO_2

emissions from travelling is far-fetched, but it is important to bring to attention strategies on how to reduce participants' travel CO_2.

The main research question addressed in this article is how sport event managers can influence the CF reduction of their events. To address the research question, the research offers alternative scenarios for sports participants to travel to the events and also proposes a framework with recommendations and directions for reducing the transport carbon footprint for "Greening of Sports Events".

1.3. Travel-Related Emissions in Sports Tourism: Challenges and Managerial Implications

The environmental impact of carbon emissions generated by travel to and from sporting events remains an underexplored area within current research (Wilby et al. 2023; Cavallin Toscani et al. 2024; Xuan et al. 2025). Similar to other forms of traditional tourism, both athletes and spectators are required to journey to event locations. Unless these travels occur by foot or bicycle, they inevitably produce CO_2 emissions, which are among the primary drivers of the greenhouse effect and global climate change. The CF emissions can vary significantly between event locations regarding the spectators' choice of transportation mode and distance of travel (Triantafyllidis et al. 2018).

The volume of CO_2 emissions is largely influenced by factors such as travel distance, mode of transportation, vehicle capacity, and fuel efficiency. Targeting to reduce the number of long-distance travels is the most effective way to reduce CF emissions (Dolf and Teehan 2015). Additionally, individual travel behaviours significantly affect personal carbon footprints. Generally, opting for public or organized transportation travel arrangements tends to reduce per capita emissions and is considered more environmentally sustainable. Sharing a ride is the key feature of transforming linear consumption and its CF to a more environmentally friendly system (Haase 2022). The ride-sharing offers also socializing and have some economic convenience for participants, which can also be part of the motivation for ride sharing (Standing et al. 2019).

While the complete reduction of CO_2 emissions associated with travel is currently hard to achieve, it is critical to emphasize strategies aimed at minimizing the carbon footprint of event participants. Aldo in recent years, a lot of effort has been made in reducing CF of the event industry, additional steps are still needed to reduce environmental impacts (Meza Talavera et al. 2019; Cavallin Toscani et al. 2024). Recent studies like Marrucci et al. 2024, and Cooper 2020, recognized the willingness of sports event participants to adopt green behaviours, which event organizers should support. Tourism must take responsive actions to enable travel and tourism to deliver the experiences that tourists seek with a lower CF (Gossling 2010). Also, external and internal factors influence environmental elements, including mobility issues related to the CF of traveling of sports participants to sporting events (Collins and Potoglou

2019). Organizers of sport tourism events should strive to develop sustainable transport opportunities and improve the availability of information on local and regional transport services, to increase the share of usage of more sustainable modes of transport (Martins et al. 2022). In this light, this study contributes to sustainable managerial insights designed to support sustainable development within the context of sports tourism.

2. METHODOLOGY

Building on previous research by Grofelnik et al. (2023; 2024) in this research the data of CF of trail runners participated on the "100 Miles of Istria" race is used for developing new alternative travel scenarios and editing framework for reducing CF of the sport events. Carbon footprint (CF) data collected in previous research is transformed into specific CO_2 emission values expressed in kilograms (kg CO_2) which are then used to create buffer zones and scenarios for alterative organization of travel to event. The calculation of emissions considered travel distance, type of vehicle, engine characteristics, fuel consumption, as well as travel arrangement (traveling alone or with companions). In the research are used GIS ArcMap tools to analyse and map the spatial distribution of the CF of participants in the "100 Miles of Istria" trail running event. The event's catchment area was divided into geographical "buffer zones" according to varying levels of CO_2 emissions (Figure 1). Based on the travel characteristics of participants within these zones (e.g., mode of transport and travel style), practical recommendations were proposed for event organizers and policy makers.

Spatial analysis using buffer zones is the research methodology employed in this article to assess the environmental impacts, such as the carbon footprint, of sports tourism events. Buffer zones allow researchers to define areas of influence around event locations and to analyse the spatial distribution of impacts. In this study, the carbon footprint (CF) of sport tourists was assessed using spatial analysis based on buffer zones created in ArcMap software.

The methodological steps of the buffer analysis in this research included the following:

1) Data preparation: Spatial data were collected from the case study of the "100 Miles of Istria" trail race.
2) Buffer creation: Features (points) representing the sports event were selected, and the buffer tool in ArcMap was used to create concentric, multi-ring, variable buffer zones.

3) Overlay and impact assessment: The buffer zones were combined with carbon footprint data to calculate the environmental impact of the event within each zone, estimating localized carbon emissions.
4) Visualization and interpretation: Map was exported to visualize the spatial patterns of carbon footprint impact.
5) Impact quantification and scenario development: Data was integrated with buffer zones and subjected to statistical analysis to quantify CF emissions in each zone.

Additionally, the relationship between buffer-based CF and potential new green mobility scenarios for participants traveling to the event was analysed.

3. RESULTS

This research seeks to deliver targeted guidance for event organizers on how to reduce travel-related carbon footprints. The subsequent step involved exploring alternative scenarios for group transportation; including carpooling, vans, minibuses, or coaches are made to recalculate the average carbon footprint per event participant. To do this, buffer zones (Figure 1) are made, and the first two clusters of cities with significant numbers of competitors regarding the case study of the trail race "100 Miles of Istria" event were selected to evaluate the feasibility of shared transport. The first cluster of departure location to the race (buffer within the first 100 km from the event location of the city of Umag) comprises Trieste (Italy), Pula, and Rijeka (both in Croatia). The second cluster (buffer zone from 101 to 300 km away) includes Ljubljana (Slovenia) and Zagreb (Croatia). Recognizing that not every trail runner will opt for organized collective transportation, several scenarios were devised that account for varying levels of vehicle occupancy depending on the location of departure.

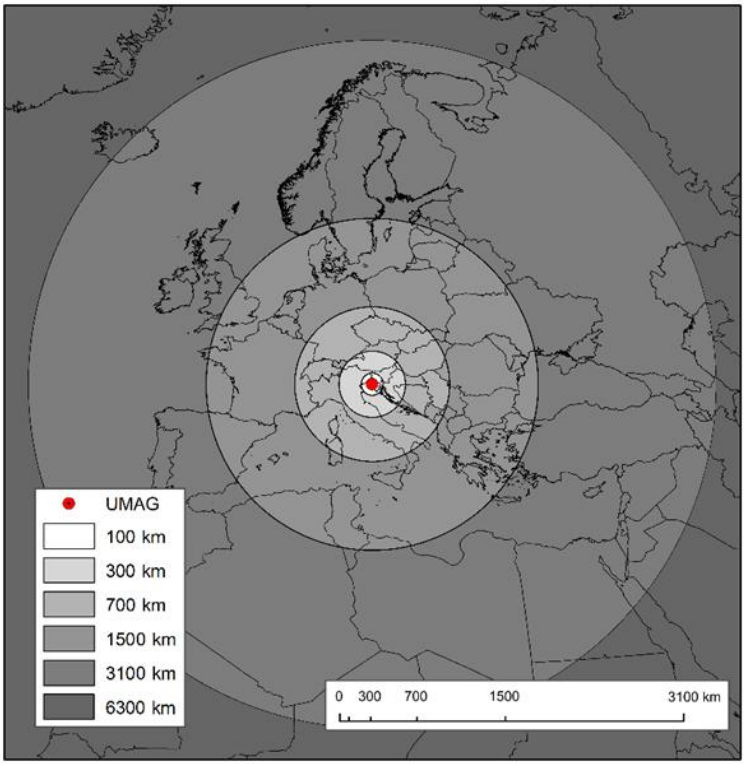

Figure 1 - Map of the buffer zones (source: author)

Table 1. Change of personal CF for sharing ride - study departure locations in first two buffer zones (source: author)

Buffer zone	**Location of departure**	**CF for personal car (kg CO_2)**			
		Number of runners in the car			
		1	2	3	4
0 - 100 km	Trieste	7.791	3.895	2.597	1.948
	Pula	13.924	6.962	4.641	3.481
	Rijeka	16.079	8.039	5.360	4.020
101 - 300 km	Ljubljana	21.715	10.858	7.238	5.429
	Zagreb	46.744	23.372	15.581	11.686

Transport sharing (Table 1) shows a significant impact on the reduction of CF per competitor. This is particularly the case with the first two buffer zones (0 - 100 km, 101 - 300 km), in which are situated major regional cities that generate a significant

number of race participants. The first two buffer zones are at maximum a four-hour drive from Umag (event centre), and it is reasonable to estimate (depending on personal response to ridesharing) that CF can be reduced in the first two buffers from 20 up to 60 %.

The analysis of passenger transport scenarios and associated CF (Table 2) evaluates the carbon footprint (CF, measured in kg CO_2) associated with various passenger transport modes and different occupancy levels across representative regional routes (Trieste, Pula, Rijeka, Ljubljana, Zagreb). For each vehicle type personal car (with two passengers), van, minibus, and large coach bus Table 2 is showing personal CO_2 emissions for a single trip with different % of occupancy. For group transport vehicles, results are presented with scenarios with different rates of occupancy connected with types of vehicles and their passenger capacity.

Table 2. Analysis of passenger transport scenarios and associated carbon footprint (source: author)

		CF per runner (kg CO_2)							
		Personal car (N5)	Group transport vehicles						
		2 runners	Approximate occupancy % (N of passengers)						
		40 %	100 %	85 %	70%	60 %	50 %	35 %	25 %
Van (N8)	Trieste	3.895	1,934 (N 8)	2.210 (N 7)	2.579 (N 6)	3.095 (N 5)	3,868 (N 4)	5.158 (N 3)	7.737 (N 2)
Mini Bus (N22)	Pula	6.962	1.622 (N 22)	1.878 N (19)	2.230 (N 16)	2.745 (N 13)	3.568 (N 10)	5.097 N (7)	7.136 N (5)
	Rijeka	8.039	1.873 (N 22)	2.169 N (19)	2.575 (N 16)	3.170 (N 13)	4.121 (N 10)	5.887 N (7)	8.241 N (5)
	Ljubljana	10.857	2.530 (N 22)	2.929 N (19)	3.478 (N 16)	4.281 (N 13)	5.565 (N 10)	7.950 N (7)	11.130 N (5)
Coach Bus (N48)	Zagreb	23.372	4.464 (N 48)	5.226 (N 41)	6.122 (N 35)	7.652 N (28)	9.739 (N 22)	14.284 N (15)	19.478 N (11)

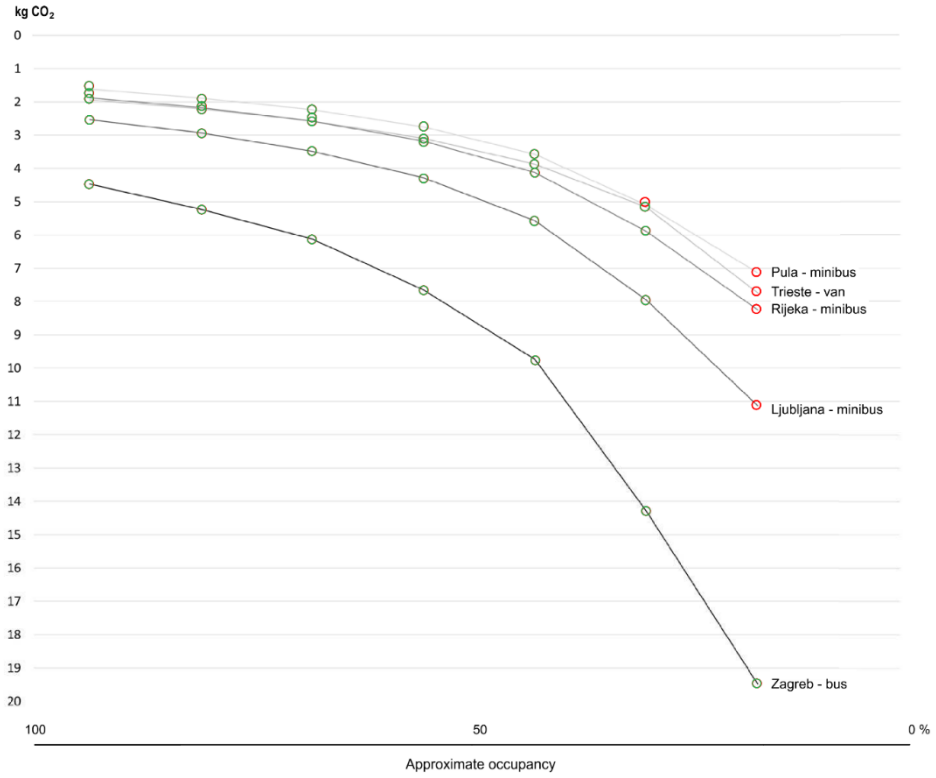

Figure 2. Personal CF values (reduction) in relation to the occupancy rate of organized transport (source: author)

Figure 2 shows personal CF values (reduction) concerning the occupancy rate of organized transport (van, minibus, or bus). The personal CF per runner is dropping with the rise of the occupancy rate of every type of organized transport, especially with the usage of vehicles with large capacity like buses. It is visible that with higher occupancy rates of the vehicles, CF can be diminished up to four times of the starting values of CF.

On Figure 2. are shown green and red circles. The green ones show that the personal CF on organized transport is generally lower than traveling by personal car (one runner). The red circles are showing the case scenarios with so low occupancy rates that usage of organized transport is not environmentally justified, but these occupancy rates are very low (mostly under 25 % occupancy rate). From this analysis, it is visible that the usage of organized transport is environmentally friendly even at half occupancy rates. It remains the question of economic costs and personal attitudes

towards this kind of transportation connecting regional centres with the event location.

4. ALTERNATIVE CASE STUDY SCENARIO FOR REDUCING CF AT REGIONAL LEVEL (first two buffers):

1. Scenario with personal car (1 passengers)

The personal car scenario for results in the highest individual carbon footprint per route. For example, the Trieste, which is the closest point taken in the research reaches 7,79 kg CO_2 for one passenger, and the emissions are rising up to 46,744 kg CO_2 for one way trip from Zagreb.

2. Scenario with personal car (sharing ride, Table 1)

The personal car scenario for multiple passengers sharing rides is very interesting for reducing carbon emissions because the CF is rapidly reduced, with 2 persons reduced by 50 %, for 3 persons reduced by 66,6 % for four persons sharing ride the CF is reduced by 75 %.

3. Scenarios with group transport vehicles (Table 2 and Figure 2)

a) Van Example (Trieste)

The van scenario illustrates a crucial trend: as passenger count increases, emissions per person drop sharply. For example, on the Trieste route, even half occupied van (N=4) has lower emission per passenger than personal car with two passengers.

b) Minibus Example (Pula, Rijeka, Ljubljana Examples)

The minibus scenario illustrates even sharper drop in emissions with higher % of occupancy. For example, on the Pula route, even one third occupied minibus (N=7) has lower emission per passenger than personal car with two passengers. The same rising trend with reduced occupancy is on longer routes (Rijeka, Ljubljana), with absolute emission values increasing with journey distance, but the pattern of lower CF per passenger with higher occupancy remains.

c) Coach Bus (Zagreb Example)

Coaches display the highest seating capacity and greatest potential for low carbon emissions. Fully occupied coach caring 48 passengers from Zagreb has 4,464 kg CO_2 CF per person (one way ride to Umag) which is 19 % of the CF of the car ride with 2 passengers and les then 10 % comparing with the Cf of car ride from Zagreb with one person. Even with a low passenger count, large vehicles can show total emissions greater than those for personal cars. For exempla coach from Zagreb with occupancy

of 11 passengers (of 48 maximum capacity) demonstrates the greener way of traveling then the personal car with two passengers.

Table 3 - Framework for reducing the transport CF, "Greening of Sports Events" (source: author)

	Levels			
	Education and Awareness (Internal Motivation)	**Promotion of Green Practices by Organizers (External Motivation)**		
Guidelines	Behavioural change through targeted education and engagement	Sustainable standards for event planning and management		
Organizers Campaigns	Green Education	Green Transport and Logistics	Green Incentives for Participants	Green Branding, Certification and Promotion
Activities	- multimedia campaigns (flyers, infographics, videos…) on the CF impact of travel; - sustainability tips in registration forms, websites, and social media; - CF online calculator for participants to estimate emissions and explore eco-friendly alternatives	- carpooling platforms: apps to connect participants (e.g., "Ride Together to the Race"); - organized transport: shuttle buses from regional hubs and collaboration with sports clubs; - public transport support; - bike infrastructure	- gamification: "Green Challenge" with points for sustainable travel (with possible discounts…) - sustainable transport discounts (e.g., reduced registration fees for train or carpool users); - recognition: rewards for "green travellers."	- certification and labelling: adoption of standards (e.g., ISO 20121); - green campaigns (carpooling, organized transport utilization…) in environmentally conscious markets; - sponsorships with sustainable brands (e.g., green rewards and discounts…). - influencer collaboration

5. CONCLUSION

If managed effectively, sports events can significantly contribute to the greening of sport tourism. One of the major challenges is reducing the carbon footprint (CF) caused by transportation to and from sports events. Addressing this issue requires the active participation of both organizers and participants in the implementation of alternative travel scenarios. Organizers often face financial constraints, especially when sustainable travel options result in additional costs that may affect event profitability. On the other hand, participants are primarily motivated by personal satisfaction and enjoyment, which can sometimes conflict with picking a greener way of travel.

Spatial analyses, such as buffer analysis, provide a methodology to identify zones around event locations where carbon emissions are concentrated. This spatial approach helps design alternative, more sustainable travel scenarios that contribute to greening sports events.

Research suggests that sports and recreational events should ideally be organized within the first two buffer zones, approximately within 0 to 300 km from participants' places of residence. At these regional events, strategies such as ride-sharing or coordinated collective transport can be rather easily implemented. Beyond ride-sharing, organizers can organize collective transport options like buses, minibuses, or vans. With proper management of participants within the first two buffer zones, travel CF of participants can be reduced by up to 79 %, depending largely on the occupancy rates of organized and shared transport.

The most significant factor influencing per-passenger CO_2 emissions is vehicle occupancy. The fuller the vehicle, the lower the carbon footprint per participant. At higher occupancy rates, larger vehicles such as buses or vans can achieve significant per-person CF emission reductions.

Carbon footprint reduction planning should be undertaken by event organizers, who should encourage participants to share rides and use organized transport options. For example, organizers could develop online platforms enabling participants to coordinate and share transportation more easily. Additionally, organizers can incentivize shared or collective transport by offering promotional discounts, special benefits, or green rewards during the event.

Establishing truly sustainable practices relies not only on technical solutions or regulations but also on environmental awareness, habits, and expectations of all stakeholders. The process of greening of their events, the organizers can use it in environmentally friendly promotion campaigns, especially on the developed markets. So, greening the events is a collaborative process that balances interests and responsibilities. In summary, an integrated approach combining spatial analysis, promotion of shared transport, and digital tools for transport coordination can substantially reduce the travel CF of sports events, resulting in greener, environmentally sustainable events.

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Challenges and Prospects of Woman's Entrepreneurship in the Republic of Croatia

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Abstract

The purpose of this paper is to provide a deeper understanding of the obstacles faced by women entrepreneurs in the Republic of Croatia and to identify the main challenges and motives influencing their entrepreneurial activities. The research findings highlight a strong perception of insufficient financial resources and limited institutional support as key barriers for women entrepreneurs, underscoring the need for more accessible sources of finance and targeted support programmes. Furthermore, the study emphasizes the lack of support networks and mentoring opportunities, pointing to the necessity of developing structured and tailored networks for women in business. Conversely, stereotypes and prejudice were rated as less significant obstacles, suggesting a positive shift towards greater inclusiveness and diversity in entrepreneurship. Results disaggregated by age group reveal notable differences in the perception of barriers and priorities: younger women entrepreneurs most frequently point to the lack of financial resources, while those in mid-career place higher value on career development and work flexibility. Comparisons with EU-level studies confirm the presence of similar challenges, such as restricted access to resources and underdeveloped networks, yet also reveal regional differences in perceptions and policy reach. The scholarly contribution of this paper lies in providing a comprehensive analysis of the specific barriers facing women entrepreneurs in Croatia. Beyond merely identifying constraints-such as limited access to finance, insufficient financial literacy, and underdeveloped support networks-the study offers concrete recommendations and policy guidelines aimed at mitigating these challenges and stimulating women's entrepreneurial activity. These insights may inform policymakers, institutions, and organizations seeking to strengthen the ecosystem for women-led enterprises.

Keywords: women's entrepreneurship, Republic of Croatia, European Union

JEL Classification: L26, L29

1. Introduction

Across all countries, the number of women entrepreneurs remains lower than that of men. A key reason lies in the barriers women face throughout their lives, most notably insufficient financial incentives and, more broadly, unfavorable economic conditions – challenges that also affect their male counterparts.

In the Republic of Croatia, in 2021, the share of enterprises with women as part-owners amounted to 31.7%, while only 27% of companies had women in top management positions (Šajn Rak, 2021). Although the employment rate of women in Europe is 67.3%, in Croatia it stands at just 60%, and only 34.4% of all self-employed individuals in Europe are women.

Major threats to the development of women's entrepreneurship stem from persistent traditional views on the role of women in society, the slow pace of social change, and the limited acceptance of women as equal actors in entrepreneurship (Zirdum and Cvitanović, 2017). Additional obstacles include stereotypes about women in science and technology, restricted access to financial support, underdeveloped entrepreneurial networks, high taxation, and insufficient backing from the business sector, institutions, and government authorities.

Accordingly, the research problem addressed in this study is the still underexplored issue of barriers facing women entrepreneurs in the Republic of Croatia. The focus of this article is therefore on women's entrepreneurship in Croatia, with particular attention to the obstacles encountered when starting and managing a business.

The purpose of this research is to gain a deeper understanding of the barriers faced by women entrepreneurs in Croatia and to identify the main challenges affecting their entrepreneurial activity. In addition, the study seeks to analyze the underlying causes of these barriers and provide insights into potential solutions to overcome or mitigate them, thereby encouraging greater participation of women in entrepreneurship. It also aims to highlight the specific needs and forms of support required to enhance the role of women entrepreneurs in Croatia's business landscape. The objectives of this article are thus to identify the barriers faced by women entrepreneurs when starting and running businesses in Croatia.

The methodology combines secondary and primary data sources. Secondary sources draw on domestic and international scholarly literature, including books, journal articles, publications, and relevant online databases focusing on entrepreneurship and women's entrepreneurship. The primary research involved an adapted survey instrument originally developed by Chinomone and Maziriri (2015), who investigated barriers faced by women entrepreneurs in South Africa. The questionnaire, administered to 150 women entrepreneurs, also included questions

about their motives for engaging in entrepreneurship to assess whether they entered entrepreneurial ventures out of necessity or other reasons. The data were first analysed using statistical methods in SPSS, after which the findings were compared with studies on barriers and motives of women entrepreneurs in European countries to position the Croatian context within broader European trends.

2. Literature Review

Entrepreneurship in the modern era is defined as a specific mindset encompassing the development and creation of various (non-)economic products, whereby entrepreneurs combine resources, assume risk, and add elements of creativity and innovation. Consequently, entrepreneurs think differently from "non-entrepreneurs," and in uncertain environments they are compelled to make rapid decisions.

Women's entrepreneurship is not solely a phenomenon of the modern era. As early as the 17th century, there were women who, in different ways, managed business ventures. Throughout history, women have marked the world with innovations, remarkable entrepreneurial achievements, and success across diverse business fields. However, Miošić Lisjak and Ćurlin (2002) note that it was only at the beginning of the 20th century that feminism began to bring about tangible changes to women's labour-market opportunities. Before that, they argue, women became entrepreneurs primarily out of necessity (predominantly widows and single mothers). Such businesses typically included establishments such as inns, taverns, and breweries. Yet, with the turn of the century, progressive ideals created a social climate more favourable to female business ownership.

Yaday and Unni (2016) add that between 1900 and 1929, feminism, consumerism, and immigration shaped an environment that was not only conducive to women's entrepreneurship but increasingly accepting of it. Like many modern female ventures, their primary markets were often other women. World War II represented a pivotal period in the history of women in business, as it brought large numbers of women into the labour force to fill positions vacated by men serving in the military. Škrtić (2006) observes that from 1940 to 1945, the share of women in employment increased by nearly 10%, with many women even entering wartime industries, including roles such as pilots and aircraft mechanics.

In the early 1960s, shifting social and cultural landscapes offered new opportunities for aspiring female business owners. Yaday and Unni (2016) highlight that rising divorce rates during this period, coupled with single mothers' efforts to balance childcare and work obligations, encouraged many to launch their own enterprises as a means of asserting independence in a "male-dominated" business world. Civil rights and women's movements in the 1960s and 1970s further expanded rights and opportunities for female entrepreneurs.

The late 20th and early 21st centuries were marked by rapid technological innovation, enabling women entrepreneurs not only to enter technology-based enterprises in record numbers but also to leverage technology in establishing and managing firms across virtually all industries. Nevertheless, Vuk (2006) notes that despite unprecedented freedom and institutional support for women's entrepreneurship, women around the world continue to face wage and gender discrimination as well as fewer opportunities compared to their male counterparts.

A growing body of research highlights persistent gender differences in entrepreneurship. Bobera, Hunjet, and Kozina (2015) argue that the business sector itself reveals many such differences. Women in most European countries tend to choose traditional sectors, whereas in the United States they are more concentrated in services and retail. These sectors, typically characterised by intense competition, expose women entrepreneurs to higher risks of business discontinuity.

Bardasi, Sabarwal, and Terrel (2011) observe differences in the entrepreneurial process itself, noting that women typically start ventures with less managerial experience and lower initial capital, partly reflecting lower lifetime earnings. Consequently, female entrepreneurs often adopt more flexible and conservative business strategies, seeking competitive advantage through product or service quality. Finally, Ivanković, Kulenović, and Sudarić (2016) report that in terms of resource acquisition, women more frequently turn to banks and institutional financing for support.

The next section analyses gender-based entrepreneurial differences in greater detail, with Table 1 presenting general distinctions between male and female entrepreneurs.

Table 1. Differences between Male and Female Entrepreneurs (source: Bin Shmailan, A., 2016)

Entrepreneurs (Men)	**Entrepreneurs (Women)**
Easy decision-making	Difficulties in decision-making
Business focused on revenue and profit	Business focused on societal contribution and quality
Willingness to take financial risk	More conservative approach to financial risk
Management oriented towards tasks	Management oriented towards building quality relationships with employees
Greater representation in manufacturing/production	Greater representation in service industries

Table 1 shows that male and female entrepreneurs differ in their decision-making processes. Men tend to make decisions faster and with greater ease, while women are generally more inclined to deliberate before reaching a conclusion. Male entrepreneurs are primarily focused on generating revenue and reducing costs to

maximize profit, whereas women emphasize the broader social contribution and quality outcomes of their entrepreneurial activities.

The table also indicates that men and women differ in the types of businesses they tend to establish. Regarding financial risk, men exhibit greater willingness to assume risk compared to women. Furthermore, male and female entrepreneurs adopt distinct management approaches: men display a stronger task orientation, whereas women prioritize maintaining interpersonal relationships with employees.

Bruni, Poggio, and Gherardi (2004) similarly note that both male and female entrepreneurs often start businesses to achieve greater autonomy and control, as well as personal satisfaction. However, men primarily emphasize economic motives for business ownership, while women frequently seek to make a social contribution through their enterprises.

Shmailan (2016) adds that female entrepreneurs are more likely to abandon business ventures and typically have fewer resources when starting out. Nevertheless, they often adopt innovative strategies to overcome obstacles but display lower risk tolerance compared to men. In this context, Shmailan notes that men are generally less concerned about the dangers associated with risk, whereas women seek to ensure adequate social support before launching their businesses (Table 2).

Table 2. Differences in Risk-Taking Between Male and Female Entrepreneurs (source: Bin Shmailan, A., 2016)

Entrepreneurs (Men)	**Entrepreneurs (Women)**
Less concerned about business risk	More concerned about risks related to business ownership
Believe they have sufficient information about their business	Continuously seek additional information
Require less social support to start a business	Require social support to start a business
Willing to accept business failure	Less willing to accept business failure
More risk-seeking	Less risk-seeking

It should also be noted that "female entrepreneurs tend to be more realistic and cautious, entering high-risk ventures less frequently, which results in more pragmatic projects compared to their male counterparts" (Shmailan, 2016, p. 4). The same author further observes that women prepare business plans more carefully and are less likely to change ideas and strategies once a business venture is underway, compared to men.

The following section, presented in Table 3, illustrates differences between male and female entrepreneurs in terms of financing.

Table 3. Differences in Financing Between Male and Female Entrepreneurs (source: Bin Shmailan, A., 2016)

Entrepreneurs (Men)	**Entrepreneurs (Women)**
Raise larger amounts of capital	Raise smaller amounts of capital
Higher levels of debt	Lower levels of debt
Experienced in seeking financial resources	Lack experience in seeking financing
Enjoy trust from banks	Struggle to gain trust from banks
Easy access to capital	More difficult access to capital

According to Table 3, women typically start their businesses with less capital than men, and their enterprises also tend to be smaller in scale. Shmailan (2016) notes that this may place women at a disadvantage when launching a business, as the lack of initial capital can affect both the survival rates of women-owned firms and their capacity for growth. Furthermore, male entrepreneurs are generally more experienced in seeking external funding and in cultivating trust with banks and financial institutions. In this regard, the author observes that banks are often less willing to provide capital to women because they typically possess less business experience than men and also face family-related obligations.

Consistent with these findings, Vuk (2006) adds that most women start businesses using personal assets and with minimal-if any-external financing. Women also have less access to informal financial networks that could provide funding, although they are more likely to gain access to capital once their businesses become successful.

Conversely, Brush (1997) cites a study indicating that 43% of women who obtained bank financing did not experience discrimination. The author notes that for women entrepreneurs, access to finance is often more important than growth intentions and that obtaining initial start-up capital is generally easier than securing funding for expansion. Even when women deliver strong business performance, they are often perceived as a "greater risk" than men.

In line with this, Brush (1997) argues that to secure additional capital for growth, women must demonstrate excellent planning, a focus on market and technological expansion, and high levels of commitment to their business ventures.

The following section, presented in Table 4, illustrates differences in motivation between male and female entrepreneurs.

Table 4. Differences in Motivation Between Male and Female Entrepreneurs (source: Bin Shmailan, A., 2016)

Entrepreneurs (Men)	**Entrepreneurs (Women)**
Financial aspect	Autonomy
Focus on task completion	Emotions as the main component
Focus on profit	Sense of satisfaction

According to Table 4, men are primarily motivated by profit and revenue generation, whereas women value the independence that entrepreneurship affords. Women also appear to exhibit more positive "business traits" than men, including strong initiative, sound judgment, critical thinking skills, and decision-making capabilities. Shmailan (2016) further notes that women can be highly focused when pursuing their goals and achieving success.

Siri Roland et al. (2012) summarise gender-based differences in entrepreneurship, observing that female entrepreneurs generally offer more stable employment. While their businesses tend to be smaller, they lay off fewer employees and display greater concern for workers' welfare, emphasising interpersonal relations. The authors further note that women entrepreneurs are more likely to support employees' ambitions and to invest in staff training and education.

Zirdum and Cvitanović (2017) argue that female entrepreneurs define success less through profit and more through customer satisfaction. Women entrepreneurs also demonstrate a greater willingness for teamwork, focusing on collective rather than purely individual achievement.

In sum, women entrepreneurs tend to be more conservative-particularly in terms of financial risk-taking-while men display stronger profit- and cost-oriented behaviour. Women, by contrast, prioritise social contribution and maintaining business quality. Male and female entrepreneurs therefore pursue different objectives and are driven by different motivations.

Contemporary business increasingly includes women, yet they continue to face numerous challenges far less prevalent among their male counterparts. Women remain underrepresented in senior positions across corporations, public administration, and other institutions. Moreover, as Buble and Kružić (2006) observe, gender-based disparities in lifetime earnings translate into lower pensions for women-approximately 22% lower than those of men.

The following section outlines four fundamental forms of gender discrimination in the business world (Buble and Kružić, 2006, p. 87):

- Pay discrimination – in many cases, women are paid less than their male colleagues for the same work.
- Hiring discrimination – men are often given preference in recruitment, regardless of the qualifications and expertise of female applicants.
- Occupational segregation – women are frequently channelled into specific occupations, such as teaching, clerical work, or nursing.
    - Discrimination in education and career advancement – women face reduced opportunities to enhance their knowledge and skills through education and professional development

Furthermore, Ivanković et al. (2016) identify four types of barriers to women's entrepreneurship, as presented in Table 5.

Table 5. Four Types of Barriers to Women's Entrepreneurship (source: Ivanković D. et al., 2016)

Types of Barriers	Characteristic of Barriers
Social barriers	• lack of self-confidence • lack of vision • insufficient readiness for action • lack of courage • insufficient willingness to take risks
Entrepreneurial skills	• lack of adequate entrepreneurial competencies
Environment	• complex administrative processes • the state provides unstable financial support for entrepreneurial development • entrepreneurship is presented in the media as a negative concept • extremely weak promotion of good practices and examples • insufficient collaboration between different institutions • very poor business infrastructure
Financial barriers	• insufficient initial capital and other sources of financing • inadequate information on government incentives • inefficient tax system • limited options for venture capital • highly unfavorable attitude of banks towards small entrepreneurs

The previous table presents some of the most prevalent barriers in entrepreneurship faced by women. Environmental and financial barriers exert the greatest impact, and reducing these obstacles would allow women to encounter fewer challenges in entrepreneurship. Social and educational barriers, on the other hand, can be addressed directly by women themselves, who can take steps to mitigate or overcome them.

The key issues related to women and entrepreneurship, as highlighted by the Government of the Republic of Croatia and the Ministry of Entrepreneurship and Crafts (2014) in the Strategy for the Development of Women's Entrepreneurship in the Republic of Croatia, include:

- Significant underrepresentation in entrepreneurial activity,
- Significant underrepresentation in employment,
- Lower wages for similar work,
- Higher share in unemployment,
- Significant underrepresentation in managerial positions,
- Significant underrepresentation in company and craft ownership structures,
- Insufficient gender-disaggregated statistical monitoring,
- Although investments have been made in various activities to strengthen women's entrepreneurship,
- During the 2010–2013 Strategy period, women entrepreneurs accounted for only 19.5% of the total value of approved financial support,
- Activities aimed at strengthening women's entrepreneurship are not interconnected,
- No mechanism exists to evaluate and assess the effects of individual measures for developing women's entrepreneurship, and
- Public policy actors, programmes, and initiatives lack sufficient coordination and cooperation.

The above-mentioned problems illustrate the significant underrepresentation of women in the entrepreneurial sphere and highlight areas requiring improvement in the future. It is of considerable importance that the Government of the Republic of Croatia and the Ministry of Entrepreneurship and Crafts (2014), in the Strategy for the Development of Women's Entrepreneurship in the Republic of Croatia, identified these issues as a basis for developing an action plan to address them and improve the position of women in entrepreneurship.

Indeed, it can be concluded that these barriers are interconnected: addressing some would simultaneously reduce the impact of others. However, eliminating this web of obstacles is highly complex and requires time, political will, financial resources,

and institutional support (Government of the Republic of Croatia and Ministry of Entrepreneurship and Crafts, 2014).

While the state has increasingly invested in removing barriers, significant results are not yet visible. The Strategy for the Development of Women's Entrepreneurship in the Republic of Croatia distinguishes three categories of barriers-structural, economic, and "soft" barriers-as presented in Table 6. Structural barriers are the most complex, arising from cultural perspectives, insufficient political will to implement policy and regulatory frameworks, and inadequate support for family life.

Table 6. Three Types of Barriers to Women's Entrepreneurship (source: Vlada Republike Hrvatske i Ministarstvo poduzetništva i obrta 2014)

Types of Barriers	**Characteristics of Barriers**
Structural barriers	• women have fewer educational opportunities, which limits their ability to start businesses in technological sectors • persistent stereotypes about women in science and technology • traditional views regarding women's roles in society • insufficient support for women managing dual responsibilities (family care and professional work) • underdeveloped political and regulatory frameworks aimed at fostering gender equality
Economic barriers	• financing is not easily accessible • lack of networking in the business world hinders access to funding source
„Soft" barriers	• insufficient access to entrepreneurial mentoring • insufficient access to entrepreneurial channels • lack of education and training programs in technology-intensive engagements

Structural barriers, as previously noted, are the most prevalent and require the most demanding measures for their removal. Their elimination necessitates political consensus, long-term projects within the education system, and regulatory changes that enable diverse forms of employment and participation in business ventures. Furthermore, structural barriers can be reduced by supporting the development of

childcare and eldercare institutions, while the media and education systems play a key role in raising public awareness of gender equality and embedding it into society (Government of the Republic of Croatia and Ministry of Entrepreneurship and Crafts, 2014).

As for economic barriers, despite Croatia's stable banking system and the well-developed offering of financial products, funding for entrepreneurial projects remains insufficient. Solutions include the introduction of targeted incentive measures and partnerships between commercial banks and government programmes to foster women's entrepreneurial initiatives and support potential growth. Alternative financing mechanisms through tax policy and regulatory frameworks could also expand financing opportunities (Government of the Republic of Croatia and Ministry of Entrepreneurship and Crafts, 2014).

The final category of barriers-so-called "soft" barriers-can be mitigated by expanding access to mentoring, advisory services, and training to enable women to launch entrepreneurial projects, particularly in technology-intensive sectors. Collaborations with universities could foster such initiatives, while business associations could facilitate networking and peer learning among female entrepreneurs.

Žapčić (2020) argues that women-owned firms are among the most affected by insufficient financial support and that women are often denied loans due to gender and cultural biases. Moreover, the relatively small number of women-led technology-based ventures reflects broader issues in education and training.

Stilin (2016) adds that stereotypes about women's entrepreneurial capabilities persist. Women's innovative ideas are often undervalued, particularly in technological and scientific sectors, with decision-makers and investors continuing to perceive female entrepreneurs as less professional. As a result, potential customers, suppliers, partners, and investors sometimes view women entrepreneurs with scepticism.

According to Stilin (2020), additional challenges faced by women include underdeveloped business networks and social and cultural constraints that limit women's participation in business activities. In some countries, women may even be required to have a male partner negotiate deals or act as the public face of the enterprise.

3. Analysis of Woman's Entrepreneurial Activity in the Republic of Croatia

According to Cvitanović and Zirdum (2017), women accounted for 52% of the total European population, while estimates by the Croatian Bureau of Statistics (2019) indicate that women constituted 51.7% of Croatia's population. Despite women comprising a slight majority of the population, they remain underrepresented in both employment and self-employment.

Data from the Croatian Bureau of Statistics (2019) show that in 1961 only 0.8% of women aged 15 and above had completed higher education, compared to 2.8% of men. By 2011, however, this gap had nearly closed: 16.7% of women and 16% of men had completed higher education. According to the Croatian Employment Service (HZZ, 2022), the number of women completing tertiary education has continued to rise over the years, encompassing professional studies, polytechnics, university studies, and art academies. Since 1990, more women than men have graduated from higher education institutions. Data from 2022 reveal that women accounted for 63.4% of university graduates, 59.6% of professional studies graduates, and 53.8% of polytechnic graduates.

Croatia's Gender Equality Act guarantees men and women equal rights in public and private life, equal status, equal opportunities for exercising various rights, and equal benefits from achieved outcomes. Nevertheless, in practice, this law is not always respected in relation to women's labour market participation. Women continue to face barriers in recruitment and advancement, lower wages, and systemic gender discrimination. Globally, women constitute over 30% of the labour force yet earn only 10% of total world income (Burušić Barčan, 2021).

In the European Union, women earn on average 14.1% less per hour than men, though Croatia reports a smaller gender pay gap. In 2019, Croatian women earned 11.5% less than men (Eurostat, 2022).

Average gross wages for men and women also reveal persistent gaps. In 2020, men earned an average of €1,279.71, while women earned €1,149.25. In 2021, average gross wages increased to €1,296.70 for men and €1,213.22 for women. The latest data for 2022 indicate further increases: men earned €1,425.58 on average, while women earned €1,318.07. While wages for both genders rose over this three-year period, men consistently earned more, underscoring the ongoing gender wage gap in Croatia.

Eurostat (2022) also compared hourly wages across nine occupational groups in its publication The Life of Women and Men. In all categories-including elementary occupations, skilled trades, machine operators, service and sales workers, administrative assistants, technicians, professionals, and managers-women in both the EU and Croatia earned less than men.

Data from 2017 show that women's average net wages represented 87.5% of men's. Interestingly, in male-dominated sectors such as construction (108.6%) and mining (101.3%), women's average wages exceeded men's. Conversely, in female-dominated sectors such as finance and insurance (74.6%) and health and social care (74.8%), women's average wages were substantially lower. This pattern suggests that in sectors where women are the majority, average female wages tend to be lower, and vice versa.

Reasons for these pay disparities have been identified by the European Parliament (2020) and will be discussed further in the following section.

- On average, women spend more time on unpaid work (childcare and household responsibilities).
- In 2018, one-third of women (30%) worked part-time compared to only 8% of men.
- Women experience more frequent career interruptions due to family obligations.
- Women are overrepresented in lower-paying sectors.
- Women in managerial positions earn 23% less than men.
- Executive positions are predominantly held by men, with women occupying fewer than 10% of top executive roles.
- Workplace discrimination: women are paid less than male colleagues with the same qualifications performing the same job.
- Career setbacks after maternity leave.

It can be concluded that despite achieving higher levels of education, women remain unable to access positions or jobs that would provide higher wages and consequently reduce the gender pay gap. In addition to earning less, women perform a greater share of unpaid labour, such as childcare and household duties, which limits their capacity to take on higher-paying employment. Unequal pay is not solely a matter of unfairness, discrimination, or women's economic dependence on men. Equal pay would yield benefits not only from legal and social perspectives but also for the economy as a whole.

Reducing gender pay inequality would lower poverty levels, as women face higher risks of poverty in old age due to limited savings and investment opportunities. Higher wages would also stimulate consumption because individuals with higher incomes typically spend more; the same applies to women-greater earnings would increase their spending, positively impacting economic growth (Tica and Rosan, 2014). Furthermore, higher wages would expand the tax base and reduce pressure on the social welfare system. Some estimates suggest that reducing the gender pay gap by one percentage point could raise GDP by 0.1% (European Parliament, 2020).

To highlight the extent of pay inequality, the European Union introduced the Equal Pay Day in 2011. The aim is to raise awareness among employers and society about

gender discrimination in pay across all sectors and occupations. The Equal Pay Day is observed in all EU Member States (Burušić Barčan, 2021).

Moreover, on 21 January 2021, Members of the European Parliament adopted a resolution on the EU Gender Equality Strategy, calling on the European Commission to develop a new action plan to reduce the gender pay gap over the next five years, with implementation responsibilities assigned to Member States (European Parliament, 2020).

Entrepreneurial activity among women and men can also be analysed using the TEA (Total Early-Stage Entrepreneurial Activity) index. The Global Entrepreneurship Monitor (GEM) provides insights into gender differences in entrepreneurial activity through this metric. In 2020, Croatia's TEA index stood at 1.7, close to the EU average of 1.8. Table 7 presents male and female entrepreneurial activity as measured by the TEA index.

Table 7. Entrepreneurial Activity of Women and Men Measured by the TEA Index (source: Singer S. i sur., 2021)

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
TEA female	4,8	5,7	5,6	6,4	7,1	7,96	9,3
TEA male	11,3	9,7	11,2	11,5	12,1	13,01	16,1
TEA male/female	2,4	1,7	2	1,8	1,7	1,6	1,7

In Croatia, a narrowing of the gender gap was observed in 2020 compared to previous years, with the widest gap recorded in 2014, when men were 2.4 times more likely than women to be entrepreneurially active. Furthermore, the TEA index for women has been increasing over the years, suggesting that women are becoming more engaged in entrepreneurial ventures.

According to the TEA index by age group, women in Croatia are most entrepreneurially active in the 18–24 age bracket, whereas the lowest activity levels are recorded among women aged 55–64 (Singer et al., 2021). Table 8 presents the ratio of entrepreneurially active women and men by age and gender structure.

Table 8. Entrepreneurial Activity by Age and Gender Structure Measured by the TEA Index (source: Singer et al., 2021)

Age	2018	2019	2020
18-24	1,7	1,7	1,4
25-34	2,6	1,7	2,3
35-44	2,2	1,5	2,3
45-54	1,5	1,3	1,3
55-64	0,8	1,9	2,4

An analysis of these trends reveals that the most significant gender gap in entrepreneurial activity occurs in the 25–34 age group, primarily due to the roles of motherhood and family care responsibilities, which often lead women to deprioritize their careers. However, in 2018, women aged 55–64 were found to be more entrepreneurially active than men. This finding can be associated with the fact that women in this age group face greater financial vulnerability due to lower pensions, prompting them to pursue entrepreneurship as a means of gaining independence. In contrast, the most gender-balanced entrepreneurial activity was observed in the 45–54 age group.

Nevertheless, despite the existence of such programs and projects, women's entrepreneurial potential remains underutilized in driving economic growth and job creation. Moreover, achieving gender equality ultimately benefits not only economic development but also society as a whole.

The Strategy for the Development of Entrepreneurship in the Republic of Croatia 2013–2020 also represented an important framework for fostering entrepreneurial potential and strengthening the culture of entrepreneurship. It explicitly recognized women's entrepreneurship as a cornerstone for increasing start-up rates and emphasized the need for Croatia to seize this opportunity. Consequently, the strategy defined five strategic objectives aimed at stimulating the creation of new businesses, including measures specifically designed to encourage women to establish their own enterprises.

Investment in innovation and research and development (RandD) constitutes the first strategic objective of the Strategy. RandD is a key determinant of success in adapting to constantly changing economic conditions worldwide. By fostering innovation and RandD, the potential for economic growth, increased productivity, and enhanced competitiveness can be realized.

The second strategic objective focuses on reducing the financial gap by improving access to finance. Although Croatia provides numerous financial support schemes, they remain insufficient to meet the potential demand for financial resources, thereby creating a financing gap. This gap can be reduced by increasing the amount of available funding and by developing new and diversified financing programs for entrepreneurs. In addition to introducing new or expanding existing funding opportunities, entrepreneurs should be granted easier access to financing through improved information dissemination and the creation of a more efficient institutional framework.

The third strategic objective concerns the promotion of entrepreneurship through the provision of support for the establishment of new businesses and assistance to existing enterprises. By promoting entrepreneurship, the state can bring about positive changes such as altering public attitudes towards entrepreneurship, encouraging individuals to engage in entrepreneurial activities, and supporting start-ups in particular. Ensuring sufficient quantity and quality of business support is therefore crucial for both new and established entrepreneurs.

Enhancing entrepreneurial skills represents the fourth strategic objective of the Strategy, aiming to promote lifelong education and training for employees to ensure a highly skilled workforce. By providing adequate educational programs for both entrepreneurs and their employees, new skills and knowledge can be developed, enabling businesses to modernize operations and strengthen competitiveness in the marketplace.

The final strategic objective concerns the improvement of the business environment. As the business environment often poses significant barriers to enterprise development, it greatly affects decisions to engage in entrepreneurial ventures. The goal here is to reduce or eliminate administrative burdens, thereby shortening the time required for documentation, licensing, and approvals, and simplifying overall business operations, especially in the context of international business activities. A potential additional benefit would be the reduction of business operating costs (Strategy for the Development of Entrepreneurship in the Republic of Croatia 2013–2020, 2013).

Although the implementation period of this Strategy has ended, the Croatian Parliament adopted a new strategic framework aimed at fostering societal and economic development. Within the National Development Strategy of the Republic of Croatia until 2030, a strategic planning document entitled the National Plan for the Development of Entrepreneurship of the Republic of Croatia for the Period 2021–2030 was introduced, focusing on entrepreneurship and economic growth (Croatian Parliament, 2021).

One of the key priorities of the National Plan is to support women's entrepreneurship and enhance female entrepreneurial activity. The adoption of this new Strategy seeks to further stimulate the development of entrepreneurship. Strengthening entrepreneurship is expected to boost the competitiveness and innovativeness of the entire Croatian economy. Moreover, advancing entrepreneurship as a whole is anticipated to promote the growth of women's entrepreneurship as a vital component of overall economic development.

4. Analysis of the Representation and Activities of Woman Entrepreneurs in Selected European Union Countries

Women's entrepreneurial initiatives in the European Union have shown a consistent trend toward the establishment of smaller entrepreneurial ventures and self-employment since the emergence of female entrepreneurs in the 19th century. Currently, women-owned firms with only one employee account for 78% of all female entrepreneurial entities (Kamberidou, 2020).

In recent years, entrepreneurship has faced significant challenges caused by the Covid-19 pandemic and its consequences. Restrictions led to an increase in business closures, with 20% of women-owned firms shutting down as a result. However, when gender differences are considered, only 2.7% of men and 1.7% of women cited Covid-19 as the primary reason for ceasing operations (GEM, 2021). This statistic demonstrates a positive trend for women, positioning Europe as a global leader in this regard.

Unprofitability was identified as the second most common reason for business closures; nevertheless, women entrepreneurs showed greater resilience compared to men, as they were less likely to shut down their businesses despite economic challenges. This trend suggests a higher degree of business sustainability among women-owned enterprises compared to those owned by men.

Globally, the highest levels of women's entrepreneurial activity are observed in the retail sector. Conversely, sectors such as government organizations, healthcare, education, and social services report 1.7 times more female entrepreneurs compared to men, while gender equality has been achieved in transportation and manufacturing (GEM, 2021).

When entrepreneurship is analyzed by sector, particular attention is given to information and communication technology (ICT), which attracts significant capital investments worldwide. In 2020, male entrepreneurial activity in the ICT sector was

twice as high as that of women, representing the largest gender gap in entrepreneurial activity (GEM, 2021).

At the global level, there is a complete absence of female entrepreneurial activity in the ICT sector in three European countries (Italy, Slovenia, Luxembourg), whereas women were more active in ICT in seven countries. In one European country (the Netherlands), relative gender parity in ICT entrepreneurship has been achieved (GEM, 2021).

The European Commission (EC) has identified the underrepresentation of women in ICT as a major concern for Europe's digital future. Only 17% of women are employed in the ICT sector across Europe (EC, 2020). The primary reasons for this situation are linked to women's educational and career choices. At the European level, only 36% of STEM graduates are women, while women are disproportionately represented in traditionally "female sectors."

Moreover, research (EC, 2020) confirms that the low number of women in ICT is influenced by persistent stereotypes, despite the fact that girls often achieve excellent results in STEM assessments. These findings suggest that girls' reluctance toward "male-dominated" professions develops later in life, likely between the ages of 10–12 and again between 20–22.

Furthermore, due to the tendency of girls to achieve higher academic results, there are opportunities to develop programs designed to encourage their interest in STEM education and careers (GEM, 2021). Although no significant gender differences have been observed in the launch of innovative products or services (UN, 2014; GEM, 2021), men display a stronger tendency toward business internationalization. Globally, women are 30% less likely to internationalize their businesses, with men showing a higher propensity for internationalization in 14 out of 15 European countries (GEM, 2021). Within the European Union, however, the situation is comparatively better, as Europe records the highest rate of business internationalization among women (25.7%), as well as a high level of female entrepreneurial activity in ICT sectors. These values are notably higher compared to other global regions. Innovation and internationalization are closely connected through the potential commercialization of innovations in international markets. Nevertheless, women lag behind in this area, as male-owned firms are reported to have up to 90% greater access to funding from investors and venture capital funds (GEM, 2021).

According to the European Investment Bank (EIB) Report (2022), female entrepreneurs in the European Union face numerous barriers and challenges that hinder the growth of their businesses. Key obstacles include a lack of financial resources, limited access to information, insufficient education, and restricted market access. The primary challenge lies in effectively identifying and addressing these issues

through the prioritization of legislation and public policy implementation. It is also essential to develop national strategies focused on solving gender-specific problems, which require changes in societal attitudes toward gender roles and their integration into structures, institutions, and policies related to self-employment and small enterprises.

The report further highlights that, in most EU member states, women's labor market participation remains lower and female unemployment rates higher than those of men. Women are frequently forced to choose between career and family responsibilities, with a significant proportion working part-time, often involuntarily. Moreover, women are frequently overqualified for the positions they hold, while employers often prefer to hire men, perceiving women as a less stable workforce due to family obligations.

A 2022 study emphasized that gender disparities persist in entrepreneurship. Only 29% of EU entrepreneurs are women, and they typically operate in sectors considered traditionally "female." Women are perceived as more cautious decision-makers, with family responsibilities exerting a stronger influence on their motivation and structuring of work (Van Langendonck, 2022). When respondents were asked about perceived differences in how men and women run their businesses, a majority (54%) stated there were none. However, when questioned further, nearly half (46%) suggested that men often adopt a more aggressive management style and make decisions more rapidly. Women were perceived as more cautious, typically spending more time assessing situations before deciding.

In terms of sectoral choices, women are strongly associated with occupations such as caregiving, personal services, childcare, and fashion, whereas construction, real estate, and communication sectors are predominantly linked to men. This clearly illustrates traditionally gendered career choices.

Regarding entrepreneurial challenges, both male (22%) and female (33%) entrepreneurs reported difficulties in securing financial resources. The main challenges identified by both genders included intense competition (29%), negative international market conditions (25%), and cash flow problems (18%).

When asked whether necessity influenced their decision to start a business, the vast majority of male entrepreneurs (73%) stated it did not, compared to only 44% of women. This suggests that necessity plays a more significant role for female entrepreneurs, with many indicating they started their businesses to address financial difficulties. Some women also reported postponing business establishment until their children were older (Van Langendonck, 2022).

According to Picinac (2017), female entrepreneurs generally assume less risk in business compared to their male counterparts. Fear of failure often prevents them from achieving their goals, while investors tend to consider women in business less frequently and are less likely to provide financial support. As a result, female entrepreneurs often face difficulties in obtaining bank loans or funding for their projects.

Another major challenge is the lack of support and networking opportunities. Although the number of businesswomen in Europe is increasing, it can still be challenging to find fellow female entrepreneurs for collaboration. In this regard, peer support, women's mentorship, and access to professional networks are strongly encouraged. Other barriers female entrepreneurs face include stress from competition and routine business operations, balancing business and family life, lack of financial skills, and the pressure to "do it all" (GEM, 2023). While many of these issues affect both genders, they are more prevalent among women. This is due to various factors, such as limited contacts, information gaps, inadequate business sector selection, difficulties balancing professional and family responsibilities, and unfavorable business environments.

Globally, women are less inclined to invest in entrepreneurship compared to men, with Europe being the region with the lowest percentage of female entrepreneurs investing in startups (only 3.8%). Moreover, there is a tendency among women to invest in other women and family members, while investments in unfamiliar businesses are rare (GEM, 2021). On the other hand, European female entrepreneurs achieve the highest investment value compared to other regions (with a median investment value of $4,383, compared to between $628 and $2,055 in other regions).

This situation highlights untapped potential in women's entrepreneurial activities for fostering economic growth and creating new jobs. The European Commission identifies limited access to financial resources, technology, information, education, weak business networks, and the imbalance between professional and family life as key causes of the gender gap in entrepreneurial activity (EC, 2020). Although the share of female entrepreneurs in the active labor force increased slightly from 10% to 10.4% between 2003 and 2012, some countries, such as Slovakia, Serbia, and the Netherlands, have recorded more significant growth. However, in other countries, such as Portugal, Lithuania, Romania, Poland, Bulgaria, Malta, Estonia, and Croatia, this percentage has declined by more than 1% (EC, 2020).

The following Table 9 presents entrepreneurial activity among men and women in the EU based on the TEA index for 2021.

Table 9. Entrepreneurial Venture Initiation Activities of Women and Men in the EU According to the TEA Index (2021.) (source: Global Entrepreneurship Monitor, 2022)

Country	TEA male	TEA female	TEA M/F
Italy	5,5	2,8	0,5
Poland	6	4,5	0,8
Bulgaria	6,5	5,5	0,8
Germany	6,6	3,3	0,5
Spain	6,8	6	0,9
France	7,0	5,3	0,8
Greece	8,8	3,9	0,4
Slovenia	8,8	3,8	0,4
Sweden	9,5	4	0,4
EU average	9,6	5,6	0,8
Ireland	11,8	7,5	0,6
Croatia	12,1	7,1	0,6
Luxembourg	12,7	8,6	0,7
Austria	13,9	7,9	0,6
Slovakia	15,2	9	0,6
Netherlands	16,3	8,3	0,5
Latvia	17,4	10,9	0,6
Turkey	20	8,4	0,4
Estonia	24	14,3	0,6

According to Table 9, based on the TEA Index (the number of entrepreneurs per 100 individuals), Italy records the lowest index for men (5.5), followed by Poland with 6, Bulgaria with 6.5, and Germany with 6.6. On the other hand, Estonia shows the highest TEA Index for men with 24, followed by Turkey with 20, Latvia with 17.4, and the Netherlands with 16.3.

Regarding the TEA Index for women, the lowest values are observed in Italy (2.8), Germany (3.3), and Sweden (4). However, when examining the ratio of men's to women's TEA Index, it ranges between 0.4 and 0.9. The lowest ratio (0.4) was recorded in Greece, Slovenia, Sweden, and Turkey, indicating that entrepreneurial activity among men in 2021 was 1.4 times higher compared to women. Conversely, the highest ratio was recorded in Spain (0.9), followed by Poland, Bulgaria, and France (0.8).

Furthermore, Graph 4 presents the relationship between necessity-driven and opportunity-driven entrepreneurship among women in the EU.

Ultimately, it can be concluded that the entrepreneurial potential of women for fostering economic growth and creating employment opportunities remains underutilized, despite the presence of various institutions designed to support them.

5. Empirical Research on the Barriers and Potentials of Woman's Entrepreneurship in the Republic of Croatia

For the purpose of data collection, an empirical study was conducted using an online survey. The questionnaire was made available through a Google Form and distributed to female entrepreneurs via email. The "snowball sampling" method was applied to further disseminate the survey among respondents across the Republic of Croatia, resulting in a total sample of 150 female entrepreneurs.

The main objective of the research was to identify the barriers faced by female entrepreneurs when starting a business and in conducting business operations in Croatia. The survey was carried out from August 5, 2023, to October 19, 2023, at which point the target sample of 150 participants was achieved.

The questionnaire was structured into three sections. The first part gathered demographic data about the participants, while the second and third sections focused on their entrepreneurial motivations (eight dimensions) and the barriers they encounter (seven dimensions). The demographic breakdown by age group was used as an independent variable, whereas various aspects of motivation and barriers functioned as dependent variables. In this context, participants answered a series of questions using a five-point Likert scale to indicate their level of agreement. For statistical analysis, the SPSS software package was employed.

Accordingly, Table 10 presents the demographic data of the respondents.

Table 10. Demographic Data of Respondents (source: authors)

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
	<25	12	8,0	8,0	8,0
	25-35	40	26,7	26,7	34,7
	36-45	67	44,7	44,7	79,3
	46-55	31	20,7	20,7	100,0

	Total	150	100,0	100,0	
Enterprise size					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Micro and small	125	83,3	83,3	83,3
	Medium	21	14,0	14,0	97,3
	Large	4	2,7	2,7	100,0
	Total	150	100,0	100,0	
Marital status					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Single	53	35,3	35,3	35,3
	Married	65	43,3	43,3	78,7
	Widow	3	2,0	2,0	80,7
	In a relationship	26	17,3	17,3	98,0
	Divorced	3	2,0	2,0	100,0
	Total	150	100,0	100,0	
Sectors					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Trade and Retail	5	3,3	3,3	3,3
	Manufacturing	10	6,7	6,7	10,0
	Service Activities	34	22,7	22,7	32,7
	Construction and Engineering	10	6,7	6,7	39,3
	Information Technology	7	4,7	4,7	44,0
	Healthcare and Medical Services	14	9,3	9,3	53,3
	Finance and Banking	11	7,3	7,3	60,7
	Education and Training	11	7,3	7,3	68,0
	Arts and Entertainment	9	6,0	6,0	74,0
	Tourism and Hospitality	9	6,0	6,0	80,0
	Agricultural Activities	7	4,7	4,7	84,7
	Real Estate Business	12	8,0	8,0	92,7
	Consulting and Business Advisory	5	3,3	3,3	96,0
	Other	6	4,0	4,0	100,0
	Total	150	100,0	100,0	

The largest proportion of respondents (44.7%) belongs to the age group between 36 and 45 years, while the second largest group (26.7%) falls between 25 and 35 years. A smaller share of respondents is younger than 25 years (8.0%), whereas 20.7% of respondents are aged between 46 and 55 years.

Furthermore, the majority of respondents (83.3%) work in micro and small enterprises. A smaller proportion of respondents are employed in medium-sized (14.0%) and large enterprises (2.7%).

Regarding marital status, most respondents (43.3%) are married, while 35.3% are single. A smaller proportion of respondents are in a relationship (17.3%), while other categories (widows and divorced) account for a lower percentage. This indicates a diversity of marital status among female entrepreneurs in the study.

In terms of sectors, the highest share of respondents (22.7%) work in service industries, while other significant categories include healthcare and medical services (9.3%), finance and banking (7.3%), and education (7.3%). Various other sectors, such as construction, tourism, and others, are also represented but in smaller percentages.

The next table presents the group descriptive results.

Table 11. Descriptive results (source: authors)

	N	Minimum	Maximum	Mean	Std. Deviation
Barriers					
Lack of financial resources	150	3,00	5,00	4,5267	,45901
Lack of support and networks	150	3,00	5,00	4,1044	,51399
Stereotypes and prejudices	150	1,00	3,33	2,1111	,52052
Problems with work–life balance	150	3,00	5,00	3,9889	,51003
Limited access to education and training	150	2,00	5,00	3,4178	,62054
Legal and regulatory challenges	150	2,00	4,67	3,4800	,58502
Lack of self-confidence	150	1,00	4,00	2,5133	,60649
Motivations					
Career development	150	3,00	5,00	4,1667	,47886
Creativity and passion	150	3,00	5,00	4,2089	,47227
Work flexibility	150	1,00	5,00	3,6756	,94356
Economic independence	150	2,33	5,00	4,1511	,70217
Business opportunity	150	2,00	5,00	3,5133	,61504
Social purpose	150	1,00	5,00	3,0244	,86708

According to the presented table, the results indicate a high perception of lack of financial resources as a significant barrier, with an average score of 4.53. This suggests that many female entrepreneurs view the lack of financial means as a major obstacle to starting their own business. Similarly, the perception of lack of support and business networks is also high, with an average score of 4.10, pointing to challenges in accessing support and connecting with other entrepreneurs. Conversely, stereotypes and prejudices were rated lower, with an average score of 2.11, indicating that participants rarely encounter this type of barrier.

The work–life balance factor received an average score of 3.99, reflecting the challenges of balancing family obligations and business responsibilities. Limited access to education and training was rated at 3.42, suggesting that participants feel constrained in accessing education and developing their skills. Legal and regulatory challenges received an average score of 3.48, indicating a perception of the complexity of laws and regulations governing business activities. Finally, lack of self-confidence scored 2.51 on average, showing that participants consider this a less significant limiting factor.

In terms of motivation, participants expressed a strong interest in career development, with an average score of 4.17. This highlights personal growth and success as key motivational factors for entrepreneurship. Creativity and passion also scored highly, at 4.21 on average, demonstrating participants' desire to express creativity and passion through their business ventures. Work flexibility was rated 3.68, reflecting its importance, though with some variation in participants' perceptions. Economic independence ranked high at 4.15, suggesting that many women entrepreneurs aspire to financial independence and a stable future. Business opportunities were rated at 3.51, indicating recognition of potential business prospects but not always as a primary motivational factor. Social purpose scored 3.02, reflecting a lower perceived importance of this motive among participants.

When responses were analyzed by age, several conclusions emerged. Specifically, results comparing participants' age with their perception of barriers in entrepreneurship point to notable insights. Regarding financial resources, younger participants (under 25) expressed the highest concern, giving an average score of 4.83. By contrast, participants aged 36–45 rated this barrier slightly lower, at 4.43 on average. This suggests that younger women perceive lack of financial resources as a more significant obstacle. For lack of support and networks, participants aged 36–45 gave the lowest ratings, while younger participants rated this barrier higher. The overall average for this barrier across all participants was 4.10.

For stereotypes and prejudices, younger participants assigned the lowest ratings, while those aged 25–35 gave the highest scores. The overall average for this barrier

was 2.11. Other barriers-such as work–life balance, access to education and training, legal and regulatory challenges, and lack of self-confidence-did not show significant differences across age groups. Through ANOVA and Bonferroni tests, it was revealed that perceptions of financial resource barriers and lack of support and networks differed significantly across age groups, suggesting that age may influence how women perceive these entrepreneurial challenges.

Regarding motivational factors, it can be concluded that different elements correlate with different age groups. Specifically, the factor "Career Development" tends to be rated more highly among participants aged 36–45 compared to those under 25 and those aged 46–55. This indicates that women in midlife may focus more on career growth aspects. Similarly, "Creativity and Passion" was also rated higher among participants aged 36–45, while other age groups did not differ significantly in their perceptions of this factor. This suggests that midlife may be a key period for exploring and developing creativity and passion in business.

The most notable differences in perception appeared in the factor "Work Flexibility," where participants aged 36–45 assigned significantly higher ratings compared to other age groups. This implies that work flexibility, likely related to balancing family and professional responsibilities, may be a priority for women in midlife. Conversely, factors such as "Economic Independence," "Business Opportunities," and "Social Purpose" did not show significant age-related differences, indicating a more universal perception of these factors across age groups.

5.1. Discussion

The conducted research, along with the obtained results, provides several important insights into the perception of barriers and motivations among women entrepreneurs. By analyzing the data and comparing it across age groups, it is possible to gain a deeper understanding of how different life stages influence the perception and prioritization of barriers and motivations.

One of the most significant findings of the study is the high perception of lack of financial resources and support as major barriers for women entrepreneurs. The lack of financial resources received a high average score (4.53), suggesting that many women consider financial obstacles to be critical. This highlights the need for more accessible funding sources and support programs for women starting a business. Furthermore, the high average score for lack of support and networks (4.10) points to challenges in connecting with other entrepreneurs and creating valuable business links. This aspect could also be improved by developing networks and mentoring tailored to the needs of women entrepreneurs. On the other hand, stereotypes and prejudices were rated lower (average score 2.11), suggesting that participants rarely encounter this type of barrier in their entrepreneurial journey. This represents a

positive sign, indicating a shift toward greater inclusivity and diversity in entrepreneurship.

When discussing the perception of barriers specific to age groups, younger women entrepreneurs expressed greater concern about lack of financial resources. This is important as it points to the need for targeted programs and resources to facilitate access to funding for this group. In contrast, participants in midlife often place more value on career development and work flexibility. This suggests potential priorities in professional growth and work–life balance, and understanding these priorities can help design policies and programs that better meet their needs. Moreover, the results indicate that different factors are associated with different age groups. For example, the factor "Work Flexibility" tends to be rated more highly among participants aged 36–45, pointing to the need for greater flexibility to better align professional and family responsibilities. This is particularly important in today's society, where many women strive to achieve a successful career while also being dedicated to family life.

When comparing the research findings with studies on women entrepreneurs in the EU, some significant similarities and differences emerge. Firstly, both this study and previous EU-level research emphasize that women entrepreneurs face certain challenges when starting and running businesses. These include lack of financial resources, social discrimination, and limited access to business networks. EU studies also confirm that women entrepreneurs are often forced to start businesses with less capital compared to men, which was also evident in this study.

Another similarity lies in the fact that women entrepreneurs in both contexts often experience challenges in finding support and networking opportunities in entrepreneurial environments. This points to the need for mentoring programs and better business networks tailored to women to foster their entrepreneurial activity. Moreover, like this study, various other studies highlight the need for greater work flexibility to facilitate the alignment of professional and family obligations, which is important from the perspective of women entrepreneurs.

As for differences, this study found that stereotypes and prejudices were considered less significant barriers, whereas EU-level studies identify them as highly important challenges. This may suggest that the perception of such barriers varies depending on region and culture. EU studies also provide data showing that the unemployment rate among women is often higher than that of men, further emphasizing the challenges women face in professional advancement. Furthermore, the results of this study indicate that lack of self-confidence is perceived as a less significant factor, while EU-level research highlights that women entrepreneurs often avoid taking greater risks and have a stronger fear of failure. In the European context, there is also a strong emphasis on the need for access to financial resources, education, and technology to foster entrepreneurial activity among women.

Overall, both studies highlight the importance of recognizing the specific challenges and needs of women entrepreneurs and developing targeted support measures and programs to enable their successful participation in entrepreneurship.

Sharing experiences and best practices across regions and countries can contribute to improving the situation for women entrepreneurs throughout Europe.

5.2. Research Limitations

Primarily, it is important to emphasize that this study is based on research conducted within a specific geographical area and population, which may limit the generalizability of the findings to a broader global context. The perceptions and challenges faced by female entrepreneurs may vary depending on cultural, economic, and social factors, meaning that research conducted in different settings could yield different results.

A second limitation arises from the data collection method. In this study, a survey was used as the primary tool for gathering information. While surveys are an efficient way to obtain quantitative data from a large number of respondents, they limit in-depth analysis and contextual understanding. Qualitative research methods, such as interviews or focus groups, could provide deeper insights into the personal stories and experiences of female entrepreneurs that are not captured by this study.

Furthermore, the research relies on participants' self-assessments and perceptions. This may involve subjective judgments and potential response biases. The actual circumstances of female entrepreneurs may differ from those expressed in the survey, indicating the need for objective indicators to obtain a more comprehensive understanding of their challenges.

Finally, it should be noted that the research was conducted within a specific timeframe, and the circumstances and challenges faced by female entrepreneurs may change over time. Consequently, this study does not account for potential developments that may have occurred after data collection was completed.

6. Conclusion

Female entrepreneurs face a range of challenges and barriers in the entrepreneurial world. One of the main obstacles they frequently encounter is the lack of financial resources and access to capital. The financial sector and investors are often less inclined to support female entrepreneurs, which can hinder both the start-up phase and the further growth of their businesses. Limited access to capital can significantly affect women's ability to achieve their entrepreneurial goals.

The aim of this study was to deepen the understanding of the barriers faced by female entrepreneurs in the Republic of Croatia, to identify the key challenges

affecting their entrepreneurial activity, and to analyze the underlying causes of these barriers. Furthermore, the research sought to provide insights into ways of overcoming or mitigating these obstacles in order to encourage greater participation of women in entrepreneurship. Through this analysis, the study aimed to highlight the specific needs and types of support essential for female entrepreneurs in Croatia to enhance their role in the business environment. Therefore, the primary focus of this work was on identifying the barriers women encounter when starting and managing businesses in the Republic of Croatia.

The research conducted provided profound insights into the perception of barriers and motivations among female entrepreneurs and highlighted several key findings. The lack of financial resources and support emerged as significant challenges, underscoring the need for more accessible funding sources and support programs for women starting businesses. It is also noteworthy that stereotypes and prejudices were rated relatively low, suggesting a positive societal shift toward greater inclusivity in entrepreneurship.

Moreover, the study offered valuable insights into how perceptions of barriers and motivations differ across age groups of female entrepreneurs. Younger women expressed greater concern about the lack of financial resources, while those in middle age often placed higher value on career development and work flexibility. Understanding these age-specific priorities can help shape targeted support programs and policies.

Finally, comparing the findings with studies on the situation of female entrepreneurs in the EU highlights both similarities and differences in perceptions and challenges. Both streams of research emphasize the importance of recognizing the specific needs of female entrepreneurs and developing targeted support measures to enhance their role in entrepreneurship. The exchange of experiences and best practices among different regions and countries can contribute to improving the overall position of women entrepreneurs across Europe.

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Professional Managers in Family Businesses: Navigating Challenges and Unlocking Growth Potential

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Abstract

Family businesses represent a crucial segment of the global and Croatian economy, yet their sustainability is often jeopardized by succession challenges and a reluctance to professionalize management. This paper explores the complex interplay between family ownership and professional management, focusing on the readiness of family business owners in Croatia to integrate external professional managers into their operations. Through a dual approach combining a theoretical framework and qualitative empirical research, the study identifies the key functions and potential benefits of engaging professional managers—such as enhanced strategic planning, improved efficiency, and facilitated generational transitions. In-depth interviews with owners of selected Croatian family businesses reveal a prevailing hesitation to relinquish control, often rooted in emotional and cultural factors, despite recognizing the managerial value professionals can bring. Findings suggest that while there is conceptual openness to managerial professionalization, practical implementation remains limited. A critical factor for success is the willingness of family businesses to embrace shared leadership and adopt structures that align business growth with long-term family values. This research highlights the importance of strategic mindset shifts and structured succession planning, positioning professional managers not as threats but as catalysts for sustainable development. The implications are particularly relevant for economies like Croatia's, where family businesses dominate but face demographic and talent-related uncertainties.

Keywords: Family business; Professional manager; Management professionalization; Succession; Governance; Socioemotional wealth; Croatia

JEL Classification: L26, L29, M10, M12, M14

1. Intoduction

Family businesses constitute the backbone of many national economies, accounting for the majority of enterprises worldwide and employing a substantial share of the workforce (Astrachan and Shanker, 2003). In Croatia, as in many European countries, family-owned enterprises represent a dominant organizational form, particularly among micro, small, and medium-sized firms (Alpeza and Peura, 2012). Their significance lies not only in their economic contribution but also in their long-term orientation, community engagement, and intergenerational continuity (European Family Business, 2019).

Despite these advantages, family businesses face unique challenges that distinguish them from non-family enterprises. The interdependence of ownership, management, and family dynamics creates complex decision-making environments in which emotional considerations and rational business logic must coexist (Gersick et al., 1997). Among the most critical challenges are succession planning and the integration of professional management practices. Research indicates that only about 30% of family firms successfully transition to the second generation, with survival rates declining further in subsequent successions (Alpeza et al., 2015).

Professionalization of management is often presented as a key mechanism to strengthen family businesses, improve their resilience, and ensure continuity across generations (Chrisman et al., 2005). However, the decision to introduce external professional managers frequently triggers dilemmas related to trust, identity, and control (Dyer, 1989). Owners may perceive professional managers as threats to family values and autonomy, even though they recognize their potential to enhance organizational effectiveness.

The purpose of this paper is to examine the readiness of Croatian family business owners to engage professional (non-family) managers, identify the conditions under which they would do so, and assess the perceived benefits, desired qualifications, and barriers to professionalization—thereby clarifying how professional management can support long-term competitiveness, succession, and governance in family firms. By integrating theoretical insights with qualitative empirical evidence, the study aims to shed light on how Croatian family businesses approach the question of engaging professional managers, and what conditions may facilitate or hinder this process.

This paper explores the evolving role of professional managers in family businesses. The central research question is: To what extent are Croatian family business owners willing to delegate managerial authority to professional, non-family managers and under which circumstances?

The paper is structured as follows. Section 2 reviews the specificities of family businesses, including their definitions, life cycle, and main advantages and disadvantages. Section 3 focuses on management functions in the context of family enterprises, highlighting the influence of family dynamics. Section 4 addresses the professionalization of management, outlining both opportunities and challenges. Section 5 explains the research methodology, followed by the presentation of results in Section 6. Section 7 discusses the findings in light of existing literature, and Section 8 concludes with limitations, implications for practice and future research.

2. Specificities of Family Businesses

In Croatia, they dominate among micro and small enterprises and often remain under the ownership and control of the founding generation (Alpeza and Peura, 2012). However, unlike in many EU countries, the Croatian legal framework does not recognize family businesses as a distinct category, which complicates efforts to systematically monitor their role and performance in the economy (Braut Filipović, 2017).

Defining a family business is not straightforward, as different scholars and institutions apply varying criteria. The European Commission (n.d.) defines family businesses as enterprises in which the majority of ownership rights are held by one family, decision-making power is exercised directly or indirectly by family members, and at least one family member is involved in management. Astrachan and Shanker (2003) distinguish between broad, medium, and narrow definitions of family businesses, depending on the extent of family involvement and the intention of maintaining ownership across generations. This layered approach highlights the heterogeneity of family enterprises and their strategic orientations.

The life cycle of family businesses mirrors both organizational and family dynamics. Typically, businesses progress from foundation and survival, through phases of growth and maturity, and finally to decline or renewal (Kružić and Bulog, 2012). Succession constitutes a critical point in this cycle, as research shows that only a minority of firms successfully survive generational transfers (Alpeza et al., 2015). According to Gersick et al. (1997), family businesses are shaped by the overlapping systems of family, ownership, and business, which evolve simultaneously over time and create unique pressures during transitions.

The advantages of family businesses are often linked to their strong long-term orientation, commitment to preserving family legacy, and the trust-based relationships among family members (Bakotić et al., 2016, Alpeza, 2012). Such features

contribute to organizational resilience, loyalty of employees, and the cultivation of a distinctive reputation in the community (Dollinger, 2007). Moreover, family businesses may benefit from the flexibility of decision-making, rapid responses to environmental changes, and financial patience—owners are often willing to reinvest profits and accept lower short-term returns to secure long-term survival (Ward, 2016).

Disadvantages, however, often arise from the overlap of family and business roles. Conflicts of interest, nepotism, and lack of professional expertise may hinder organizational growth and innovation (Bakotić et al., 2016; Alpeza, 2012). Moreover, risk aversion, resistance to change, and difficulties in delegating authority can limit competitiveness (Gómez-Mejía et al., 2010). Balancing "family first" and "business first" logics is particularly challenging: prioritizing business goals may strain family relationships, while overemphasizing family cohesion may compromise business efficiency (Kružić, 2004).

In summary, family businesses are characterized by the interplay of unique strengths and vulnerabilities. Their distinctiveness lies in the interwoven nature of ownership, management, and family ties, which simultaneously provides resilience and exposes them to specific risks. Understanding these specificities is essential for analyzing management functions and evaluating the potential contribution of professional managers.

3. Management Functions in Family Business

The classical framework of management functions includes planning, organizing, human resource management, leadership, and control (Drucker, 1975; Sikavica et al., 2008). In family businesses, these functions are influenced by the interaction of family values and ownership structures, which may strengthen or hinder managerial effectiveness. Strategic decisions are often centralized in the hands of family members, particularly founders, which provides agility but may also constrain professionalized processes and limit participation of non-family employees in decision-making.

Planning in family businesses tends to emphasize continuity and preservation of family wealth rather than aggressive expansion (Kružić and Bulog, 2012). Long-term orientation can be a source of stability, but the absence of formalized planning processes often results in reactive rather than proactive strategies. When external professional managers are introduced, they may contribute to more systematic strategic planning, aligning family vision with market realities and competitive demands (Ward, 2016).

Organizing within family firms is usually less formalized than in non-family companies, with structures evolving organically as the business grows. The founder

often serves as the central coordinator, and roles among family members may be assigned on the basis of trust or kinship rather than expertise. While this approach fosters cohesion, it can create inefficiencies and role ambiguities. Professional managers, when engaged, tend to push for clearer structures, role definitions, and performance systems (Stewart and Hitt, 2012; Carney, 2005).

Human resource management is one of the most sensitive functions in family businesses. Recruitment and promotion decisions often reflect family priorities rather than market-based criteria (Bakotić et al, 2016). This may ensure loyalty but also risks perpetuating nepotism and excluding more qualified candidates. External managers can introduce merit-based practices, professional development programs, and performance evaluations that improve organizational effectiveness, though their implementation often meets resistance from family members (Dyer, 1989).

Leadership in family businesses combines emotional authority with formal managerial roles. Founders often embody the company's identity and values, and their personal leadership style shapes organizational culture (Kružić, 2004). While this can foster strong commitment, it may also discourage dissent and innovation. Professional managers bring new perspectives and leadership practices that can balance tradition with modern management techniques (Chrisman, Chua and Sharma, 2005).

Finally, control in family firms is frequently informal, relying on trust and direct supervision rather than formal systems of accountability (Alpeza et al., 2015). While trust reduces monitoring costs, it also increases vulnerability to inefficiencies and errors. Professional managers typically emphasize structured reporting, performance indicators, and audits, which can enhance transparency and investor confidence (Anderson and Reeb, 2003).

Management functions in family businesses are deeply embedded in family dynamics, providing both strengths and weaknesses. The professionalization of these functions requires balancing the preservation of family values with the adoption of systematic managerial practices that support growth and sustainability.

4. Professionalization of Management in Family Business

Professionalization in family businesses refers to the introduction of formal structures, processes, and non-family managers who apply modern management practices (Stewart and Hitt, 2012). While the concept is widely recognized as a key factor in improving performance and longevity, its implementation often encounters resistance from family owners. The reluctance stems from fears of losing control, diluting family values, or undermining the legacy established by previous generations.

Theoretical approaches emphasize that professionalization is not a single event but a gradual process. It often begins with the implementation of formal accounting and

control mechanisms, followed by the establishment of boards of directors or advisory councils, and finally the recruitment of professional managers with specialized knowledge (Dyer, 1989). Through these steps, the family firm gradually reduces its dependence on informal decision-making and personal trust, replacing them with formalized systems that support efficiency and accountability.

The process of professionalization usually begins with formalizing governance structures, such as establishing supervisory boards or advisory councils that include external experts (Kružić and Bulog, 2012). This helps balance family interests with business objectives and provides a platform for accountability. Moreover, adopting transparent reporting and financial management systems is often the first step toward building trust between family owners and external managers (Anderson and Reeb, 2003).

One of the main arguments in favor of professionalization is the improvement of strategic decision-making. Family firms frequently rely on short-term, intuitive decision-making rooted in the founder's experience. While this approach can be flexible, it often lacks analytical rigor and may hinder long-term competitiveness. Professional managers contribute by introducing structured strategic planning, risk assessment, and market analysis, thereby aligning family firms with best practices in modern management (Chrisman, Chua and Sharma, 2005).

Another dimension is the impact on human resource management. In family firms, recruitment and promotion often prioritize kinship and loyalty over competence. This practice can undermine organizational performance, particularly in larger or more complex enterprises. Professionalization introduces merit-based systems, training programs, and transparent evaluation criteria, thereby enhancing organizational effectiveness and ensuring that positions are filled by the most competent individuals (Bakotić et al., 2016).

At the same time, professionalization poses certain risks. Excessive reliance on external managers can dilute family values and weaken the emotional capital that differentiates family firms from their competitors. Some scholars warn that the introduction of non-family managers may erode socioemotional wealth, especially if professionals prioritize financial returns over family legacy (Gómez-Mejía, Makri and Kintana, 2010). In addition, the cultural clash that can arise when professional managers' values differ from family traditions, creating tensions that must be carefully managed (Sonfield and Lussier, 2009). Therefore, successful professionalization requires finding a balance between preserving family culture and implementing professional standards.

Resistance to professionalization is particularly evident in smaller family firms, where founders often perceive professional managers as outsiders lacking emotional attachment to the business (Stewart and Hitt, 2012). Yet, studies suggest that those firms which successfully integrate professionals achieve higher levels of innovation, competitiveness, and survival across generations (Sirmon and Hitt, 2003). Thus, the

issue is not whether to professionalize, but how to reconcile family identity with managerial professionalism.

Ultimately, professionalization should not be perceived as a threat but as an adaptive strategy that allows family businesses to preserve their values while equipping them with the managerial tools necessary for growth. The success of this process depends on mutual trust, clearly defined roles, and the willingness of family owners to accept shared leadership.

5. Methodology

The empirical part of the research was designed to investigate how Croatian family business owners perceive the role of professional managers in their enterprises. A qualitative approach was adopted in order to capture the subjective attitudes and experiences of respondents.

Semi-structured interviews were used as the primary method of data collection. This technique was chosen because it ensures that all respondents are asked about key topics while leaving room for additional probing and elaboration. The interviews were guided by a set of questions covering four main areas: the characteristics of the business and ownership structure, current management practices, succession planning, and attitudes toward the engagement of professional managers. For the purposes of this study, selected questions were adapted from the research of Silva et al. (2021), ensuring comparability with prior studies on managerial professionalization in family firms.

The study included five family businesses in Croatia operating in different industries, such as construction, automotive services, and agriculture. The sample was purposive, with companies selected to ensure variation in size and generational stage of development.

The family businesses were chosen according to the following criteria:

- the company is owned by a single family,
- at least two family members are employed in the business,
- the company has been operating for more than two years,
- management positions are held by family members,
- in addition to family members, the business employs non-family workers.

In all selected firms, ownership and control remained within the founding family. Respondents were either founders or successors with managerial responsibilities, as they were best positioned to provide insights into decision-making and professionalization processes.

Interviews were conducted during the research period specified in the thesis. Each lasted between 45 and 60 minutes and was carried out either in person or via online communication tools, depending on the availability of participants. With the consent of respondents, interviews were recorded and later transcribed to allow for systematic analysis.

The analysis was performed by identifying recurring themes and patterns in the answers of respondents. Particular attention was given to differences in attitudes between smaller and medium-sized businesses, the perceived benefits of hiring professional managers, and the barriers that hinder their engagement. The analysis provided the basis for deriving the main findings, which are presented in the following section.

6. Results

The empirical research involved five Croatian family businesses operating in different industries. All firms were majority family-owned, employed multiple family members, and combined family with non-family employees. The respondents were founders or current owners with significant decision-making authority.

Table 1. Characteristics of Family Businesses Included in the Study on Owners' Readiness to Engage Professional Managers (source: authors)

Enterprise	Industry	Total employees/family members employed	Number of children in the family	Years in business
A	Construction	39 (2 family members)	2	29
B	Construction	16 (5 family members)	4	28
C	Parking and transport services	11 (5 family members)	2	3
D	Car cosmetics - maintenance and repair of motor vehicles	10 (3 family members)	1	6
E	Family farm (OPG)	20 (3 family members)	2	20

Table 1 presents the basic characteristics of the five family businesses included in the study. These descriptive data provide context for understanding the owners' perspectives, which are further elaborated in the following subsections (6.1–6.5).

6.1 Attitudes toward Professional Managers

The research findings indicate that owners of Croatian family businesses generally hold a positive view of professional managers. Respondents acknowledged that external managers often possess greater expertise, knowledge, and managerial skills than family members, particularly in specific operational and strategic areas. This recognition reflects an understanding that professional managers could contribute to business growth, improve efficiency, and in some cases even outperform family managers in certain functions.

At the same time, the interviews revealed a consistent ambivalence rooted in the emotional dimension of family businesses. Owners unanimously emphasized that while professional managers may provide technical competence, they typically lack the emotional attachment and sense of belonging that family members bring to the enterprise. This emotional bond—often described as "human connection" or "passion for the business"—was regarded as indispensable for sustaining the long-term vitality of the firm.

Several respondents articulated this tension explicitly:

- Enterprise C: "…the challenge would be that I don't know how other family members would function with a professional manager."
- Enterprise D: "I believe it's not all about finances. Sometimes it's important to give more so that family or employees feel better and stay longer, and I think most professional managers don't have that emotional connection with people."
- Enterprise E: "…although the emotional connection we have with the business is difficult to replace."

These insights confirm that family business owners perceive professional managers as valuable resources for knowledge and skills, yet remain cautious about their integration due to perceived deficits in emotional commitment. This duality illustrates the central paradox of professionalization: openness to external expertise coexists with a reluctance to compromise the socioemotional wealth that characterizes family firms.

6.2 Conditions for Hiring Professionals

The decision to engage professional managers in family businesses is not perceived as a standard practice, but rather as a conditional and context-dependent option. Owners across cases expressed a willingness to consider professionalization only in specific situations that exceed the family's managerial capacities or threaten business continuity.

The most frequently mentioned circumstances include business growth, generational transition, and unexpected events such as illness or death of a key family member. In addition, some respondents highlighted international expansion and

modernization as contexts in which external expertise could become indispensable. For example, the owner of Enterprise D stated: *"In case of illness or death of a family member, or expansion abroad, I would consider a professional manager."*

These conditions reveal that professional managers are not viewed as complementary partners in the daily running of the firm, but rather as a solution to extraordinary challenges or as substitutes when family resources are insufficient. As one respondent from Enterprise B explained, professionalization would be relevant *"during growth or generational change, if family members are unable or unwilling to take over."*

At the same time, the interviews also illustrated variation in how owners conceptualize professionalization. While most see it as conditional support, others equate it with a full transfer of the business. The owner of Enterprise C emphasized this view clearly: *"…if professionals were to be involved, it would only be by handing over the entire business, not for partial cooperation."*

In sum, the findings suggest that the readiness to hire professional managers is highly contingent on critical events or business transitions. This conditional approach demonstrates both recognition of the potential benefits of professionalization and a persistent preference for family control under normal circumstances.

6.3 Desired Qualifications of Professional Managers

When discussing the desirable characteristics of professional managers, respondents emphasized a combination of professional competence and personal integrity. Technical expertise and prior managerial experience were recognized as important assets, but owners placed particular weight on values and interpersonal qualities that align with the family business context.

Across cases, responsibility, reliability, and respect for family culture emerged as recurrent themes. For example, the owner of Enterprise A highlighted that a professional manager should be "*responsible, reliable, experienced, and respectful of family values*." Similarly, the respondent from Enterprise B emphasized competence and adaptability, while underlining the importance of fitting into the family environment.

Some owners articulated their expectations in explicitly personal terms. The owner of Enterprise D explained: *"A normal personality, financial reliability ('good payer'), and responsibility in work and documentation"* as essential qualifications. Such statements indicate that beyond technical skills, family business owners assess potential managers on perceived character and trustworthiness.

At the same time, the absence of detailed requirements in some cases reflects limited experience with professional managers. For instance, Enterprise C did not

specify particular qualifications, as the owner envisions professionalization only through a complete transfer of the business, rather than through shared management.

Overall, the findings suggest that while competence and expertise are valued, the decisive factors for acceptance of professional managers in family businesses remain personal qualities, cultural alignment, and the ability to demonstrate loyalty and responsibility akin to that of family members.

6.4 Barriers to Professionalization

Despite recognizing the potential advantages of professional managers, owners consistently expressed concerns and identified barriers that hinder their integration into family businesses. These challenges are primarily rooted in issues of trust, cultural fit, and the preservation of emotional attachment.

One of the most frequently cited barriers is the perceived lack of emotional connection among professionals compared to family members. The owner of Enterprise D highlighted this point: *"I believe it's not all about finances. Sometimes it's important to give more so that family or employees feel better and stay longer, and I think most professional managers don't have that emotional connection with people."* Similarly, the respondent from Enterprise E noted: *"…although the emotional connection we have with the business is difficult to replace."*

Concerns about potential conflicts were also raised. The owner of Enterprise A emphasized the possibility of misunderstandings: *"The challenge would be potential conflicts between family and professional managers and the need to integrate outsiders into the family culture of the business."* Echoing this concern, the owner of Enterprise C stated: *"…the challenge would be that I don't know how other family members would function with a professional manager."*

In addition, some owners stressed their limited experience with professionals and reliance on family trust. The owner of Enterprise B admitted that professionalization had not yet been introduced, remarking that „*trust remains with family members*".

Taken together, these findings illustrate that while the functional benefits of professional managers are acknowledged, the primary barriers relate to socioemotional wealth: owners fear losing the loyalty, commitment, and emotional cohesion that they see as essential to the identity of the family firm. In addition, many owners still view professional management as a "luxury" that smaller firms cannot afford until they reach a certain stage of maturity. This reflects the contingency perspective, where the need for professionalization increases as firms grow in complexity and scale (Chrisman, Chua and Sharma, 2005).

6.5 General Trends

The findings reveal a clear divergence in attitudes toward professionalization depending on the maturity of the family business. Younger family firms, with shorter operational histories, are generally not prepared to professionalize their management structures nor to hand over full control to external managers. Instead, they emphasize the importance of maintaining family control, while simultaneously acknowledging that some form of external support may become necessary as the business grows and the scope of operations expands. As the owner of Enterprise B remarked: *"Small companies do not really require much advice from experts, but during significant growth there would be a need for it."*

In practice, the involvement of external professionals in these firms has so far been limited to specific areas such as marketing, finance, and human resource management, as well as material modernization through the acquisition of tools, machinery, and contemporary technologies. This perspective is well illustrated by Enterprise D, where the owner explained: *"Modernization of the company goes through the acquisition of tools and machines, because my plan is that my son will inherit the company, so management modernization is not needed in a small company like ours. I would only hire a professional manager for some parts, such as marketing and legal and tax issues. I already have an external accountant and lawyer."*

At the same time, some respondents stressed the commitment of their family members to continue leading the business, thereby postponing consideration of professional managers. For instance, the owner of Enterprises C stated: *"At the moment, my family members are very interested in the business and will work as long as they can, and what will happen in a few years we will see."* Similarly, the owner of Enterprise E acknowledged: *"It is possible that the growth of the company would require the engagement of external experts, but for now we manage everything within the family."*

By contrast, family firms with longer operational histories appear more open to the idea of professionalization and change in management structures. As emphasized by the owner of Enterprise B: *"When the company grows and the scope of work increases, it is rational to say that the family alone cannot continue to lead the company, and they are forced to gradually introduce external help. When the firm has grown to a large level, management should be introduced. As soon as one generation changes, there is already a need for change in management. We are relatively open to better changes and to introducing changes in general."*

This openness was echoed in Enterprise A, where the owner expressed strong support for cooperation with external experts: *"We are currently quite open to the idea of working with external managers, recognizing that their knowledge and skills can be crucial for further growth and development. We believe that for the company's further growth it can be useful to hire experts outside the family. External managers can bring*

new knowledge, experience, and perspectives that will help in professionalization and modernization of operations." Similarly, Enterprise E admitted: *"Yes, I am aware that hiring external experts could be useful in certain aspects, especially if family members are not interested in taking over."*

Overall, family business owners expressed confidence in their ability to handle current challenges independently, without the need for full professionalization. Succession is still predominantly envisioned within the family, most often to sons or younger generations. However, respondents are also aware that successors may not always be interested in continuing the business despite early mentoring. In such cases, some owners foresee the possibility of leasing the business or engaging a professional manager as a contingency strategy.

In general, the study found that Croatian family business owners are open to cooperating with professional managers in principle, but actual implementation remains limited. Owners prefer to rely on family successors and see professional managers as temporary or complementary solutions rather than permanent leaders. At the same time, there was recognition that business growth and generational transitions may require more openness to professionalization in the future.

Table 2. Interview Summary: Family Business Owners' Views on Professional Managers (source: authors)

	Attitudes toward Professional Managers	**Conditions for Hiring Professionals**	**Desired Qualifications**	**Barriers**	**General Trends**
A	Generally open, already engaged external experts, aware of future need during growth and succession	Business expansion, succession, when specific expertise is required	Integrity, reliability, managerial experience, ability to respect family values	Conflicts with family managers and integrating outsiders into the family culture	Conceptually supportive and partially implemented, but careful in practice
B	Acknowledges future need but has not professionalized yet; emphasizes trust and caution toward hierarchy.	During growth or generational change, if family members cannot take over	Competence, trustworthiness, adaptability, proven track record	Lack of experience with professionals and reliance on family trust	Professionalization expected in the future but not prioritized now
C	Owner considers fully handing over the business to an external manager/company rather than shared management	Possible if transferring the entire business; not partial cooperation	Full responsibility for business operations, independence, financial reliability	Owner unwilling to share control, prefers complete transfer instead	Distinct case: owner sees professionalization as replacement, not complement
D	Skeptical, believes family can manage; external experts acceptable only in specialized areas (law, tax, marketing)	In case of illness or death of a family member, or expansion abroad	Normal personality, financial reliability, and responsibility in work and documentation	Deep distrust of outsiders for leadership roles, cost concerns	Strong resistance to professionalization in leadership; acceptance only in advisory roles
E	Open to collaboration with professionals, highlights usefulness during growth or lack of successors; some processes already professionalized	Growth, absence of family successors, need for modernization	Professional knowledge, openness, respect for family culture and processes	Lack of family connection and passion for the business	Relatively open and already on the path of partial professionalization

Table 2 provides a concise overview of the main attitudes, conditions, expectations, barriers, and general trends identified across the five family businesses. It illustrates both the similarities and differences in owners' views and serves as the basis for the discussion in the following section.

7. Discussion

In the Croatian context, the issue of professionalization is particularly pronounced due to the fact that most family businesses are still in the hands of the first generation of founders. Many of them are approaching succession, yet a large proportion of owners either do not have successors within the family or the potential successors are not interested in taking over the business. This situation increases the importance of professional managers as potential continuity carriers, but at the same time reinforces resistance, since entrusting the company to outsiders is perceived as a loss of family identity.

The findings of this study highlight the complex interplay between family logic and managerial professionalism in Croatian family businesses. While owners recognize the value of professional managers in terms of knowledge, skills, and external perspectives, their integration into family firms remains limited and highly conditional. This ambivalence is consistent with prior studies that emphasize the importance of socioemotional wealth in shaping decision-making in family enterprises (Gómez-Mejía et al., 2007; Zellweger et al., 2012).

The study also revealed that desired qualifications of professional managers are defined less in terms of technical skills and more in terms of personal attributes such as responsibility, reliability, and alignment with family values. This preference reflects the embedded role of trust and interpersonal relationships in family business governance. Similar findings were reported by Stewart and Hitt (2012), who argued that cultural compatibility is often a more decisive factor than managerial expertise in determining whether a professional manager will be accepted by the family.

A central theme emerging from the research is that professionalization is not perceived as a continuous or strategic process, but rather as a situational response to critical events. Owners most often consider hiring professional managers in cases of business growth, generational transition, or unexpected disruptions such as illness or death of a family member. This finding mirrors the observations of Dyer (1989) and Chrisman, Chua and Sharma (2005), who noted that family firms frequently postpone structural changes until external pressures make them unavoidable.

Findings from previous research in Croatia confirm that family businesses usually involve professional managers only when no family members are available or willing to take on leadership roles. In such cases, professionals are perceived less as partners in growth and more as "substitutes" for missing family successors. This reactive approach significantly limits the potential of professionalization, as it reduces the process to crisis management rather than strategic planning (Alpeza, 2012).

The barriers identified in this study—such as fear of losing emotional attachment, distrust of outsiders, and reliance on family loyalty—underscore the resilience of family-centered governance structures. At the same time, they also highlight the risks of underprofessionalization, including missed opportunities for modernization and

competitiveness. Previous literature points out that while socioemotional wealth offers unique advantages, it may also constrain rational decision-making and inhibit adaptation to market dynamics (Berrone et al., 2012; Miller and Le Breton-Miller, 2006).

An important trend observed is the generational divide: firms with longer operational histories demonstrated greater openness to external expertise and management change, while younger firms remained more resistant, relying heavily on family cohesion. This corresponds with Gersick et al.'s (1997) family business development model, which suggests that openness to professionalization tends to increase as businesses evolve across generational stages. In addition, Sonfield and Lussier (2009) emphasised in their research that firm size and resources are key determinants of openness to professional management.

The results indicate that professionalization in Croatian family businesses to date has primarily occurred in limited domains such as marketing, accounting, legal services, and technology acquisition. This partial professionalization supports the notion of "selective adoption" (De Massis et al., 2018), where family firms modernize certain functions without fully altering governance or leadership structures. Such an approach helps balance continuity of family control with the benefits of external expertise, but it may delay systemic adaptation and succession planning.

In summary, the discussion highlights that Croatian family businesses are positioned at an early stage of professionalization. While owners conceptually accept the potential benefits of external managers, their readiness to integrate them into leadership remains limited by cultural, emotional, and generational factors. These findings reinforce the importance of developing governance mechanisms, succession strategies, and trust-building practices to enable smoother integration of professional managers while preserving the socioemotional wealth that defines family firms.

8. Conclusion

This study examined the readiness of Croatian family business owners to engage professional managers and explored the specific conditions, desired qualifications, expectations, and barriers surrounding the process of professionalization. The research combined theoretical insights with qualitative evidence from five family firms of varying sizes and stages of development.

The results confirm that family business owners generally acknowledge the potential benefits of professional managers, including the introduction of new knowledge, skills, and perspectives that can support growth, modernization, and succession. However, readiness to adopt professional management is highly conditional and largely limited to extraordinary circumstances such as international expansion, illness or death of a family member, or the absence of a willing successor.

A key contribution of this study is the identification of the central paradox in the professionalization of Croatian family businesses. While owners conceptually value managerial expertise, they remain cautious in practice due to the perceived lack of emotional attachment among outsiders and the strong reliance on family trust and loyalty. Desired qualifications for professional managers were thus framed less in terms of technical skills and more in terms of personal integrity, responsibility, and respect for family culture.

The findings also indicate generational differences in openness to professionalization. Firms with longer operational histories were more willing to consider external managers and adopt governance changes, whereas younger firms remained resistant and focused on maintaining family control. In practice, professionalization has so far been implemented selectively, most often in specific domains such as accounting, marketing, or legal services, and through material modernization rather than comprehensive managerial change. From a theoretical perspective, the study supports models of family business development (Gersick et al., 1997) that suggest gradual movement toward professionalization as firms evolve across generations.

The limitations of the study are as follows: the small sample size, which included only five family businesses, restricts the generalizability of the findings to the broader Croatian context. In addition, the research is context-specific, focusing solely on Croatian enterprises, and cultural particularities may limit the transferability of results to other countries. Methodologically, reliance on semi-structured interviews means that the data reflect the self-reported attitudes of respondents, which may have been influenced by social desirability bias. Finally, the research captures perceptions at a single point in time, without considering how attitudes toward professionalization might evolve across generations or in response to external economic changes.

Future studies should broaden the sample to include a larger number of family businesses across industries and regions. Comparative research between Croatia and other European countries would provide insights into the role of cultural and institutional factors in shaping attitudes toward professionalization. Longitudinal studies could also track how perceptions evolve across generational transitions and how the integration of professional managers impacts firm performance over time.

The results carry several implications for both practice and policy. For family business owners, the study highlights the need to view professional managers as partners rather than threats, capable of complementing family values with technical expertise and leadership skills. Early consideration of professionalization can ease succession challenges and reduce the risks associated with generational transitions. For professional managers, the findings emphasize the importance of demonstrating cultural sensitivity, respect for family traditions, and building trust with owners in order to be accepted. Finally, for policymakers and support institutions, the research suggests that targeted programs—such as training, advisory services, and financial

incentives—could encourage family firms to adopt professional practices while preserving their unique identity.

To conclude, Croatian family businesses remain at an early stage of professionalization. Although conceptual openness exists, practical implementation is limited, and family logic continues to dominate business logic - managerial decision-making. Overcoming this gap will require both cultural shifts within families and the design of institutional frameworks that support professional governance while respecting the unique socioemotional dimensions of family enterprises. The professionalization of family businesses in Croatia represents both a challenge and an opportunity. By embracing external expertise while safeguarding family values, these enterprises can strengthen their competitiveness and ensure continuity across generations.

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