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# TRENDY A VÝZVY RODINNÉHO PODNIKANIA A NÁSTUPNÍCTVA XI.

## Vybrané ekonomické otázky podnikania s dôrazom na hodnotový reťazec

# TRENDS AND CHALLENGES OF FAMILY BUSINESS AND SUCCESSION XI.

## Selected economic issues of business with an emphasis on the value chain

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# Trendy a výzvy rodinného podnikania a nástupníctva XI. (Vybrané ekonomické otázky podnikania s dôrazom na hodnotový reťazec) – Trends and challenges of family business and succession XI. (Selected economic issues of business with an emphasis on the value chain)

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*Zborník vedeckých statí prezentuje názory autorov na vybrané problémy ekonomiky a manažmentu, ktoré sa prejavujú v rodinných podnikoch, dotýkajú sa ich fungovania a v procese podnikového nástupníctva môžu pozitívne/negatívne ovplyvniť ich ďalšiu existenciu.*

*The collection of scientific papers presents the authors' opinions on selected problems of economics and management, which are reflected in family businesses, affect their functioning and can positively/negatively affect their further existence in the process of business succession.*

Rozsah: 9,70 AH.

# OBSAH
# (CONTENT)

# FACTORS INFLUENCING TECHNOLOGY IMPLEMENTATION IN ENTERPRISES: A MULTILEVEL PERSPECTIVE ON INDIVIDUAL, ORGANIZATIONAL, AND MANAGERIAL DETERMINANTS

*Federico Banda*

***Abstract***
The implementation of digital technologies and artificial intelligence is one of the key prerequisites for the competitiveness and long-term sustainability of enterprises. Despite increasing investments, however, many organizations fail to transform technological potential into real operational and economic benefits. This article focuses on a systematic analysis of factors influencing the implementation of technologies in enterprises from a multilevel perspective that integrates individual, organizational and managerial determinants. Based on the synthesis of existing empirical and conceptual studies, key technological characteristics, organizational conditions and managerial mechanisms that shape the success of technological implementation in various sectors are identified. Special attention is paid to the methods of measuring these factors, the methodological approaches used and the theoretical anchoring of research. The article points out the importance of factors such as system and task complexity, trust in technology, privacy and security, innovation culture, resistance to change, availability of qualified experts, education, managerial skills and support from top management. It also identifies significant research gaps, notably the lack of longitudinal studies, the weak link between implementation factors and economic outcomes, and limited knowledge of the Central and Eastern European context. The paper thus creates an integrated analytical framework that can serve as a starting point for further empirical research in the field of digital transformation of enterprises.

***JEL classification:*** *M15, L21, O33*
***Keywords:*** *Digital transformation; Technology implementation; Measurement tools; Organizational factors; Individual factors; Managerial capabilities*

## Introduction

The implementation of digital technologies has become a critical prerequisite for maintaining competitiveness, operational efficiency, and long-term sustainability of enterprises across industries. Despite significant investments in digital solutions, many organizations fail to achieve the expected benefits from technology adoption. Prior research suggests that technological success is not determined solely by the quality of the technology itself, but rather by a complex interaction of individual, organizational, and managerial factors.

This scientific article aims to analyze and critically evaluate multilevel factors influencing technology implementation in enterprises, based on structured measurement tables capturing individual-level, firm-level, and managerial determinants. The article

contributes to the literature by systematizing these factors into coherent analytical dimensions, identifying research gaps and underexplored relationships, and critically assessing the adequacy of measurement tools used to operationalize these constructs.

## 1 Current State of the Solved Problem at Home and Abroad

The international literature on technology implementation and digital transformation emphasizes socio-technical perspectives that highlight the interaction between users and the organizational context. At the individual level, three key models have been widely applied in the literature:

1. **Technology Acceptance Model (TAM):** This model assumes that technology acceptance is mainly determined by two factors: perceived usefulness and perceived ease of use. In the context of resources, it is directly correlated with system complexity, where high mastery negatively affects employees' willingness to use.
2. **Unified Theory of Technology Acceptance and Use (UTAUT):** This more comprehensive model integrates elements from multiple theories and identifies four key determinants: expected performance, expected effort, social influence, and facilitating conditions. In our framework, these conditions are reflected in the need for educational resources and training, and in the importance of collaboration and communication within the team.
3. **Task-Technology Fit (TTF):** Unlike attitude-based models, TTF must meet all requirements to be effective. This concept is directly identified in the sources as task-technology fit and is closely related to task complexity.

Despite their popularity, these models are often criticized for their limited explanatory power in complex organizational environments. Individual adjustment alone is not enough if it is not supported by systemic factors such as managerial skills (managerial skills) and clarity of roles and responsibilities (clarity of roles and responsibilities).

**At the organizational level, research is increasingly focusing on:**

- **Innovation culture (Innovation culture):** The ability of the company to absorb new ideas and support creativity.
- **Resistance to change (Resistance to change):** Psychological barriers of employees that must be overcome through support from top management.
- **Availability of resources:** The presence of qualified experts and the technical support for the implementation of technologies themselves (technology implementation).

Current studies regularly argue in favor of multilevel frameworks (multilevel frameworks). These integrate individual behaviors, such as trust in (Trust in technology) and perceptions of privacy and security (Privacy and security), with organizational structures and processes for effective operations (Effective Operations). Only such a holistic approach allows us to understand how managerial decision-making processes drive technology adoption in practice.

In the context of Central and Eastern Europe (CEE), including Slovakia, empirical research on technology implementation remains fragmented and largely descriptive. Current studies in this region are often limited to monitoring adoption rates, while neglecting deeper analysis of implementation quality, technological maturity, or performance in the post-adoption phase. Integrative measurement frameworks are lacking that would allow not only comparisons between individual studies, but also the necessary longitudinal analysis of the development of digital transformation over time.

To move forward in this area, it is crucial to integrate into research complex factors that directly affect the success of transformation at multiple levels:

- Organizational support and management: Research in the CEE region must begin to accurately measure the impact of top management support and managerial capabilities on the dynamics of innovation processes. Without a clearly defined clarity of roles and responsibilities within the organizational structure, implementation remains only a formal act with no impact on operational effectiveness.
- Individual psychology and trust: Descriptive studies often ignore internal barriers of employees. It is necessary to examine the correlations between trust in technology and perceptions of privacy and security, which in our socio-cultural space play a significant role in shaping attitudes towards innovations.
- Overcoming resistance through education: Instead of simply stating the existence of resistance to change, scientific interest should focus on how targeted educational resources and training and the presence of skilled experts change the perception of the system complexity of technologies.
- Technical-process fit: A critical point that is absent in Slovak research is the measurement of task-technology fit with respect to the specific complexity of tasks in local enterprises. Effective technology implementation occurs only when the tool is in symbiosis with the needs of the worker, not when it is imposed on him from above.

Connecting these factors into a unified analytical model would allow the Slovak scientific community to move from describing “what is happening” to understanding “why and with what result” the digital transformation is being implemented in the region. This would create space for the development of an innovation culture based on data and effective collaboration and communication across all levels of the company.

## 2 Research design and methodology

The research design of this article is based on a systematic synthesis of existing scientific knowledge on factors influencing the implementation of digital technologies and artificial intelligence in the organizational environment. The study has the character of conceptual-analytical research, the aim of which is not primarily to test hypotheses, but to critically analyze, compare and systematize existing empirical findings across different methodological approaches, sectors and geographical contexts.

The basic analytical tool of the research is thematically structured tables that summarize selected studies according to uniform criteria: methodology used, measurement tools, characteristics of the research sample, study objective and theoretical foundations. These tables cover factors at the individual level (e.g. system complexity, trust in technology, privacy and security), at the task and process level (task complexity, task–technology fit, efficient operations), as well as at the organizational and managerial level (clarity of roles and responsibilities, culture of innovation, resistance to change, education and training, availability of experts, managerial skills, top management support and technology implementation itself).

The selection of studies reflects the methodological diversity of current research and includes qualitative, quantitative and mixed research designs. Particular attention is paid to the measurement tools used, such as questionnaire scales, structural equation modeling, Delphi technique, case studies, systematic literature reviews and expert assessments. The analysis is complemented by an assessment of the theoretical anchoring of individual studies, especially in relation to frameworks such as the Technology Acceptance Model, Technology–Organization–Environment framework, Unified Theory of Acceptance and Use of Technology, Diffusion of Innovations and sociotechnical approaches.

The result of this research design is an integrated overview of the determinants of technological implementation, which allows us to identify relationships between individual levels of analysis, point out shortcomings of existing research, and formulate directions for further empirical investigation.

## 3 Research results and discussion

In this chapter, we focus on technological factors influencing the adaptation and use of digital technologies at the individual level (Individual-Level Influencing Technological Factors), as well as on factors acting at the firm and individual level (Firm-level and Individual-level Influencing Factors). The aim of the chapter is to systematically summarize and compare the scientific findings to date in both areas, with an emphasis on how technological characteristics, organizational conditions and individual attributes shape the behavior of actors in the process of digital transformation.

Based on a review of the existing literature, we analyze the approaches of individual authors, the research methods used, the characteristics of the research samples and the main empirical findings. Special attention is paid to identifying common patterns, differences in approaches and contextual specificities of the studies examined. At the same time, we point out existing gaps in research, especially in the area of the connection of individual and organizational factors, insufficiently researched contexts and limitations of methodological approaches, which represent a space for further scientific investigation.

### 3.1 System complexity

Within the Individual-Level Influencing Technological Factors, the studies analyzed in the table number 1 focus significantly on system complexity as a key determinant of the perception and adoption of artificial intelligence and advanced digital technologies by individuals. From a methodological point of view, quantitative research approaches prevail in this area, which dominate especially in empirical studies conducted after 2021. The authors most often use questionnaire surveys based on Likert scales (5- or 7-point), while data collection is often carried out through web surveys. Advanced statistical methods such as Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), including tools such as AMOS, SmartPLS or SPSS, are repeatedly used to analyze the data. These methods allow testing complex relationships between technological characteristics of the system (e.g. complexity, compatibility, perceived difficulty of use) and individual attitudes, intention to use or level of acceptance of the technology.

In terms of research samples, studies work predominantly with managers, IT professionals and employees in organisations, with samples often being context-specific – for example, construction, hospitality, healthcare or the public sector. Sample sizes range from a few dozen respondents in qualitative case studies to hundreds or more than a thousand respondents in international quantitative research. Geographically, the studies are mainly concentrated on developing and rapidly digitising economies (China, Vietnam, India, Middle East), with the European context only marginally represented. Qualitative studies, although less numerous, use semi-structured interviews and case studies, which provide deeper insights into how individuals perceive the complexity of AI systems, in particular in terms of their comprehensibility, transparency and demands for new skills.

In terms of theoretical anchoring, the authors most often draw on the frameworks of TAM, TOE, UTAUT and their combinations, where system complexity is operationalized as the perceived difficulty of the system, technical sophistication or the degree of cognitive load on the user. Nevertheless, it turns out that system complexity is often understood relatively narrowly, mainly as a technical property, without a deeper distinction between objective technological complexity and subjective perception of complexity at the individual level.

In terms of gaps for further research, the table points to several significant areas. First, there is a lack of longitudinal studies that would examine how the perception of system complexity changes over time with increasing user experience. Second, only limited attention is paid to the interaction of system complexity with individual characteristics such as digital skills, cognitive style, age or professional experience. Third, the research is largely based on self-observation data, which opens up space for experimental or mixed-methods approaches combining questionnaires with behavioral observation or analysis of real user data. Finally, a significant gap remains the insufficient examination of the European and especially Central European context, where institutional and cultural factors can fundamentally influence how individuals perceive the complexity of digital systems and how this complexity affects their willingness to accept and use technologies.

**Table 1**
System Complexity

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Golightly *et al.* (2022) | Qualitative | Semi-structured interviews, scenario method | 25 expert participants (rail infrastructure experts, non-infrastructure rail experts, automation experts from outside rail) | Identify human, organizational and societal factors of introducing robotics into railway infrastructure maintenance and recommend procedures for their successful adoption | Socio-technical systems theory; approaches from the field of human factors in automation, frameworks from the field of industrial robotics, technology acceptance theories, cultural factors and norms, TOE framework |
| Grover *et al.* (2022), | Qualitative | Systematic literature review | 181 scientific articles | To examine selected factors influencing the adoption of artificial intelligence in operations management through the lens of literature and practical discussions on social networks | PC utilization model (Thompson et al., 1991) extended to AI in OM; factors such as job-fit, complexity, perceived consequences, affect towards use, social factors, facilitating conditions |
| Na *et al.* (2022) | Quantitative | 5-point Likert scale | 241 respondents employed in construction companies with 6-10 years of experience, maximum bachelor's degree | To examine factors influencing the intention and adoption of AI technologies among users in construction companies, to verify a model of the influence of technological, organizational, environmental factors and personality characteristics on the acceptance of AI | Technology Acceptance Model (TAM) combined with the Technology-Organization-Environment (TOE) framework |
| Pan *et al.* (2022) | Quantitative | Questionnaire survey according to the TOE model, extended by transaction costs | 297 Chinese companies (HR and management respondents); company size, industry, regulatory environment included | To explore factors influencing the adoption of AI in employee recruitment; identify barriers and enabling factors in practice | TOE framework (Technology-Organization-Environment); transaction cost theory |
| Phuoc (2022) | Quantitative | Survey; Structural Equation Modeling (SEM) using AMOS and SmartPLS | 193 senior managers, IT managers, CIOs, CEOs and IT professionals from Vietnamese private and public companies | Investigate critical factors influencing AI application adoption on organizational level in Vietnam | Technology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) |
| Pizam *et al.* (2022) | Quantitative | Web-based survey; 7-point Likert scale; Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM) | 1077 hotel managers in 11 countries (Brazil, Canada, Greece, India, Israel, Japan, Romania, Spain, Turkey, UK, USA) | Identify effects of technological, organizational, and environmental (TOE) factors, and moderating effect of innovativeness on managers' intention to adopt robotic technologies | Technology-Organization-Environment (TOE) framework; includes constructs for technological (relative advantage, compatibility, complexity, perceived cost), organizational (top management support, organizational readiness), environmental (competitive pressure) factors; innovativeness as moderator |
| Nam *et al.* (2021) | Qualitative | In-depth case study interviews (semi-structured, open-ended questions) | 8 senior hotel asset managers (Dubai), totaling more than 40 hotels and 7,000 rooms | To explore factors influencing the adoption of AI and robotics in hotels from a management perspective (in the context of smart hospitality in Dubai) | Technology-Organization-Environment (TOE) framework: factor analysis in the areas of technology (relative advantage, complexity, IT expertise), organization (financial justification, employee resistance), environment (customer, competition, legal issue) |
| Singh *et al.* (2020) | Qualitative methodology (barrier analysis based on expert perspective, literature review and expert discussions) | Overview and discussion analysis (review article, synthesis of problems and proposals, expert knowledge of the AAO Task Force) | Experts on AI in ophthalmology (authors, members of the AAO Task Force, with reference to systemic and real-world issues, not a specific empirical sample) | Identify the main barriers to implementing AI in healthcare — from the perspective of the organization, provider, and patient; propose recommendations for the development and safe introduction of AI into clinical practice | Using prevailing theories and regulatory frameworks: discussing issues of interoperability, "black box" AI models, legislation, security, ethics, education, patient acceptance, financial model and organizational culture |

*Source: custom processing*

## 3.2 Privacy and security

In the area of Privacy and Security as significant individual and organizational factors influencing the adoption of advanced digital technologies and artificial intelligence systems, the analyzed studies present a methodologically and thematically differentiated research stream. As can be seen from the table, qualitative research approaches are dominant, which allow for detailed capture of complex concerns related to personal data protection, cybersecurity, accountability and trust in AI systems. The authors often use case studies, semi-structured interviews and thematic analysis, focusing on the experiences of experts, managers and policymakers operating in the public sector, infrastructure, healthcare or smart cities. This approach reflects the fact that privacy and security issues are closely linked to regulatory frameworks, institutional context and

sector specificities, which can only be captured to a limited extent through standardized questionnaires.

From a methodological perspective, quantitative studies in this area are less common, focusing mainly on the development and validation of measurement tools or on specific clinical or technical applications. The tools used include standardized scales, expert assessments and multi-criteria decision-making methods, such as DEMATEL, which allow the identification of causal relationships between security, organizational and technological risks. In these cases, the samples are either relatively small and expert, or they are specifically defined groups of respondents, which increases the internal validity of the results, but also limits their broader generalizability.

From a theoretical perspective, the studies draw mainly on socio-technical approaches, technological acceptance models and risk management frameworks, with privacy and security issues often conceptualized as barriers to adoption or as critical conditions for trust in AI systems. The economic dimension of these factors is reflected in discussions about transaction costs, compliance costs, reputational risks and potential losses resulting from security breaches or data leaks. At the same time, several studies show that insufficiently addressing privacy and security issues can significantly reduce the return on investment in digital technologies and slow down their wider implementation at the level of organizations and entire industries.

**Table 2**
Privacy and security

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Campion *et al.* (2022) | Qualitative | Case study, 24 semi-structured interviews, coding and thematic analysis | 24 participants (university, two regional governments; top management, middle management, analysts) | Identify challenges of collaboration in AI adoption between a university and two public boards, analyze organizational routines to overcome them | Categorization of the main barriers to AI implementation in the public administration sector (social, economic, technological, data, organizational, ethical, political); use of the concepts of interorganizational routines, data |
| Golightly *et al.* (2022) | Qualitative (semi-structured interviews) | Interviews, thematic analysis | 25 experts (railways, robotics, infrastructure, automation) | Identify the human and organizational challenges of implementing robotic systems in railway maintenance | Socio-technical approach, technology acceptance theory |
| Grover, et al. (2022) | Qualitative | Literary research, sentiment analysis, text analytics (Python, R, Excel), content analysis, word cloud | 181 peer-reviewed articles + thousands of tweets from experts, managers and organizations in OM | To explore the possibilities of applying AI in various areas of operations management (production, development, services, supply chain) with an emphasis on factors facilitating the adoption of AI | PC utilization model extended to AI factors: job-fit, complexity, long-term consequences, attitude towards use, social factors, facilitating conditions; digital transformation; AI theories |
| Ghandour (2021) | Quantitative | Adam's Scale of Posterior Stroke (ASPOS), NIHSS and other clinimetric scales | 126 patients with posterior cerebral infarction, hospitalized in 2017-2018 | To develop and validate a reliable and repeatable clinimetric tool for assessing symptoms of posterior infarction | Comparison with the National Institutes of Health Stroke Scale (NIHSS), assessment in accordance with the clinical scale, psychometric analyses, reliability and construct/predictive accuracy of the instrument |
| Wang, Zhao, *et al.* (2021) | Quantitative methodology, systematic review + DEMATEL | DEMATEL technique, questionnaire, expert evaluation | 10 experts from universities, the public sector, research institutes and companies | Analyze the main challenges in implementing AI and IoT in smart cities, determine the interrelationships between the challenges | Division of challenges into "cause" (dominant) and "effect" (influenced), importance of AI/IoT for sustainable cities, citations of leading works, systematic literature review (PRISMA) |
| Brooks *et al.* (2020) | Qualitative | Nástroje merania založené na reprezentational theory of measurement, metrologii, psychometrike, axiomatickom a štatistickom prístupe | No sample is applied, this is a conceptual/methodological study | To propose a formal measurement theory for AI systems, enabling comparison of models, tasks, and research groups on a quantitative basis | The output from standardized measurement practices, combines representational theory of measurement, measure theory and metrology, describes the principles of creating robust scales for complex AI phenomena; emphasizes the importance of axiomatic and statistical methods in building comparable measurable constructs |

*Source: custom processing*

In terms of gaps in existing research, it is clear that the area of privacy and security is still studied in a fragmented manner, often isolated from other technological and individual factors. In particular, integrated quantitative models that would systematically link privacy and security concerns with economic indicators such as productivity, process efficiency or willingness to invest in AI solutions are lacking. Another significant gap is the lack of comparative studies across sectors and regions, especially in the European context, where the regulatory environment (e.g. GDPR, AI Act) fundamentally influences the economic decision-making of organizations. This opens up space for future research for economically oriented, empirically robust, and longitudinal studies that could

quantify the costs and benefits of different approaches to privacy and security and better explain their role in the sustainable digital transformation of businesses.

### 3.3 Trust in technology

The Trust in Technology table shows that trust in technological systems is a key individual factor influencing the adoption and effective use of artificial intelligence, and is being studied in a strongly interdisciplinary context. From a methodological perspective, this field is dominated by qualitative and mixed-methods approaches that allow us to capture the complex nature of trust as a socio-psychological and technological construct. Qualitative studies most often use case studies, semi-structured interviews, expert analyses and thematic or cognitive analysis, focusing on identifying barriers and mechanisms for building trust in the context of specific AI applications, such as the public sector, agriculture, education or collaborative robotics. The measurement tools used reflect the effort to operationalize trust as a multidimensional concept. In addition to descriptive and exploratory analytical approaches, psychometric scales measuring trust, safety, perceived risk and acceptance of technology are mainly used, often combined with behavioral analysis of human-technology interaction or with data generated through learning analytics platforms. Mixed-methods designs allow users to connect subjective assessments with their real behavior when working with AI systems, thereby increasing the explanatory power of the results and their relevance for economic decision-making in organizations.

In terms of research samples, the analyzed studies focus mainly on expert and professional groups, such as researchers, educators, technicians, farmers, public administration workers or specialists in the field of robotics. The samples are often relatively small and sector-specific, which points to the authors' effort to examine trust in technology in real application contexts, where it has a fundamental impact on work procedures, decision-making processes and performance. From an economic perspective, however, this specialization is also a limitation, as it limits the possibilities of generalizing the results across industries and types of organizations.

The theoretical foundations of the studies connect technology adoption models, psychological theories of trust and socio-technical approaches, with trust in technology conceptualized as a mediating mechanism between technological characteristics of a system (e.g. transparency, reliability, explainability) and individuals' willingness to use the technology. From an economic perspective, trust appears to be a critical factor in reducing transaction costs, as it influences the degree of control, the need for additional safeguards and the willingness to delegate decision-making to technological systems. Insufficient trust can lead to underutilization of the technological potential of AI, thereby reducing the return on investment and the overall effectiveness of digital solutions.

Regarding gaps in further research, the table points to the need for more systematic quantitative modeling of trust in technology and its economic consequences. In particular, studies linking trust in technology to measurable outcomes such as work productivity, decision-making quality, or organizational performance are lacking. The dynamics of trust over time, especially as users gain experience with AI systems, are also

understudied. This opens up opportunities for longitudinal and comparative studies, as well as for integrating trust into broader economic and organizational models of digital transformation.

**Table 3**
Trust in technology

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Campion *et al.* (2022) | Qualitative | Case study, 24 semi-structured interviews, coding and thematic analysis | 24 participants (university, two regional governments; top management, middle management, analysts) | Identify challenges of collaboration in AI adoption between a university and two public boards, analyze organizational routines to overcome them | Categorization of the main barriers to AI implementation in the public administration sector (social, economic, technological, data, organizational, ethical, political); use of the concepts of interorganizational routines, data governance, GDPR |
| Kalyanaraman *et al.* (2022) | Qualitative | Descriptive analysis of institute activities and expert insights | Výskumníci, farmári, pracovníci v poľnohospodárstve, prípadové oblasti v špecializovanej rastlinnej výrobe | Advance the use of artificial intelligence in decision support and workforce efficiency in specialty agriculture | Connecting informatics and agronomy, emphasis on AI to solve challenges (water, climate, labor), ethical and responsible innovations in AgriTech |
| Nazaretsky *et al.* (2022) | Qualitative + quantitative methodology (mix of methods including data analysis, AI learning and evaluation) | Learning analytics platform, AI models for trustworthiness assessment, data mining and behavioral analysis | User educational platform providers, students and teachers involved in e-learning | Explore the integration of AI and learning analytics to build trusted education systems and more effective learning | Teória dôvery v technológiu, analýza používateľského správania v e-learning prostredí a aplikácia AI na vzdelávanie; interdisciplinárny prístup kombinujúci pedagogiku a informatiku |
| Kopp *et al.* (2021) | Mix of qualitative and quantitative methodology, includes analysis of open-ended questions and psychometric scales | Psychometric scales assessing attitude, trust and safety, questionnaires, behavioral analysis, human-robot interaction analysis | Experts, technicians and agricultural workers evaluating the use of cobots in real-world scenarios (numbers not specified) | To explore the technical, social, safety and ethical aspects of introducing cobots into agricultural practice, assessing trust and acceptance of the technology | Interdisciplinary connection of robotics, AI, occupational safety, psychology and societal impacts; emphasis on safety and trust in HRC – human-robot collaboration |
| Bröhl *et al.* (2019) | Combined methodology: quantitative (psychometrics, behavioral analysis) and qualitative (interviews, case studies) | Psychometric questionnaires for assessing trust, safety and effectiveness, behavioral recordings of interactions, video analysis, analytical software | Robotics specialists and agricultural workers for pilot testing of human-robot collaboration | To explore the impact of psychological and technical factors on the effectiveness and adoption of collaborative robotics in agriculture | An interdisciplinary framework combining robotics, cognitive psychology, and AI, with an emphasis on improving collaboration between humans and robots in practical environments. |

*Source: custom processing*

## 3.4 Task-technology fit

The table focused on task-technology fit shows that the degree of correspondence between technological characteristics and job requirements is one of the decisive mechanisms influencing the adoption and effective use of digital technologies and artificial intelligence. From a methodological point of view, quantitative research approaches clearly prevail in this area, which are often supplemented with elements of mixed methodology in order to capture complex interactions between humans, technology and the work environment. The most commonly used tools are questionnaire surveys based on five- or seven-point Likert scales, psychometric measurements focused on perceived usefulness, safety and trust, as well as advanced analytical techniques, in particular confirmatory factor analysis and structural equation modeling. In some studies, these tools are extended to include behavioral analysis of human-technology interaction, video recordings or expert assessments, which allows for a more accurate assessment of the real correspondence of technology with the tasks performed.

The research samples in the analyzed studies are predominantly oriented towards professional groups operating in sectors with a high degree of technology intensity, especially in construction, logistics, hospitality, healthcare and industrial production. The sample sizes range from a few dozen experts in specialized applications to large international sets including hundreds to thousands of respondents. Geographically, the research is concentrated mainly in Asian countries and in international comparisons, while the European context is represented to a lesser extent. This trend indicates a

growing interest in investigating task-technology fit in environments where digital technologies are rapidly penetrating everyday work processes and fundamentally changing the nature of work.

In terms of study objectives, the research focuses primarily on identifying technological, organizational and environmental factors that influence the degree of fit between technology and work tasks, as well as on examining its consequences for occupational safety, productivity, quality of decision-making and innovative behavior of users. Theoretical foundations are most often based on a combination of technology acceptance models, the technology-organization-environment framework and the concept of task-technology fit, with some studies further extending these approaches to theories of innovation diffusion, digital transformation or sustainability. From an economic perspective, task-technology fit is understood as a factor that directly affects the efficiency of using technology investments, as a mismatch between technology and work tasks leads to higher adaptation costs, lower productivity and increased operational risks.

**Table 4**
Task-technology fit

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Leigh *et al.* (2022) | Combined methodology | Psychometric questionnaires assessing attitude, trust and security; behavioral analysis of interactions; video recordings | Warehouse workers; robotics experts; collaborative robot users | To explore factors influencing effective human-robot collaboration in warehouses, increasing safety and productivity | Interdisciplinary framework integrating robotics, cognitive psychology, ergonomics and occupational safety; emphasis on implementing cobots in real work environments |
| Na *et al.* (2022) | Quantitative | Questionnaire (25 questions, Likert scale 1-5), expert validation | Construction company workers in Korea (241 respondents; 167 men, 74 women; age and experience detailed in the article) | Preskúmať faktory ovplyvňujúce úmysel používateľov a akceptáciu AI technológií v stavebných firmách, analyzovať vplyv rôznych faktorov podľa modelu TAM a TOE | Technology Adoption Model TAM + Technology-Organization-Environment (TOE) Framework |
| Pizam *et al.* (2022) | Quantitative | Web-based survey; 7-point Likert scale; Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM) | 1077 hotel managers in 11 countries (Brazil, Canada, Greece, India, Israel, Japan, Romania, Spain, Turkey, UK, USA) | Identify effects of technological, organizational, and environmental (TOE) factors, and moderating effect of innovativeness on managers' intention to adopt robotic technologies | Technology-Organization-Environment (TOE) framework; includes constructs for technological (relative advantage, compatibility, complexity, perceived cost), organizational (top management support, organizational readiness), environmental (competitive pressure) factors; innovativeness as moderator |
| Regona *et al.* (2022) | Combined methodology | Web survey, 7-point Likert scale, CFA, SEM, SLR | 241 construction workers in Korea | Analysis of factors influencing the acceptance of AI technologies in the construction sector, Assess the opportunities and challenges of AI adoption in construction | Technology Acceptance Model (TAM), Technology—Organization—Environment (TOE) framework, Concepts of innovation and technology adoption in construction |
| Ghandour (2021) | Quantitative | Adam's Scale of Posterior Stroke (ASPOS), NIHSS and other clinimetric scales | 126 patients with posterior cerebral infarction, hospitalized in 2017-2018 | To develop and validate a reliable and repeatable clinimetric tool for assessing symptoms of posterior infarction | Comparison with the National Institutes of Health Stroke Scale (NIHSS), assessment in accordance with the clinical scale, psychometric analyses, reliability and construct/predictive accuracy of the instrument |
| Kopp *et al.* (2021) | Mix of qualitative and quantitative methodology, includes analysis of open-ended questions and psychometric scales | Psychometric scales assessing attitude, trust and safety, questionnaires, behavioral analysis, human-robot interaction analysis | Experts, technicians and agricultural workers evaluating the use of cobots in real world scenarios (numbers not specified) | To explore the technical, social, safety and ethical aspects of introducing cobots into agricultural practice, assessing trust and acceptance of the technology | Interdisciplinary connection of robotics, AI, occupational safety, psychology and societal impacts; emphasis on safety and trust in HRC – human-robot collaboration |
| Yang *et al.* (2021), | Quantitative | Standardized tools (ISO 14040–14044) — life cycle analysis: inventory, impact assessment, interpretation | 18 practitioners from Chinese construction companies and technology firms | The aim is to analyze the sustainability of resource renewal throughout the life cycle of products/services according to ISO standards | ISO 14040–14044 methodological basis, LCA framework |
| Delgado *et al.* (2019) | Quantitative | Closed questionnaire based on theoretical framework, Likert scale; questions on technology use, perception and adoption strategies; Google form, distribution via social networks | Construction workers in Malaysia, random sample, not restricted by profession or experience, sample size >30 according to CLT (exact number not in cited sections) | To determine the readiness of the construction sector for digital transformation, identify the level of adoption and perception of digital technologies | Theoretical framework from the field of digital transformation; use of a deductive approach, supporting the framework with questions about usage, strategy and project performance |
| Pan and Pan (2020) | Quantitative | Questionnaire (closed-ended items, Likert scale, constructed from previous literature, piloted on 10 experts; structured questions on determinants from the TOE framework) | 94 typical construction contractors in Hong Kong (CEOs, directors, senior managers) | To examine the critical determinants of construction robot adoption at the organizational level and empirically validate a model of determinants in construction firms | TOE framework (Technology-Organization-Environment); also inspired by Diffusion of Innovations (DOI) theory |

*Source: custom processing*

From the perspective of further research, the table points to several significant gaps. In particular, longitudinal studies are lacking that would monitor how task-technology fit develops over time along with changes in work processes and increasing user experience. The interaction between individual worker characteristics and technological

properties of systems also remains insufficiently explored, especially in the context of automation and human cooperation with autonomous technologies. Further research should also focus on systematically linking task-technology fit with economic indicators of organizational performance, such as productivity, return on investment, and sustainability of digital transformation, to better understand its strategic importance in the corporate environment.

### 3.5 Clarity of roles and responsibilities

Within the group of firm-level and individual-level influencing factors, the table focused on clarity of roles and responsibilities focuses on one of the key organizational mechanisms that significantly affects the adoption and effective use of digital technologies and artificial intelligence. An overview of the included studies shows that a clear definition of roles, responsibilities and decision-making powers is an important prerequisite not only for the technical implementation of AI systems, but also for their acceptance by employees and managers.

From a methodological point of view, this area is characterized by a significant predominance of combined and qualitative research approaches, which are in some cases supplemented by quantitative experimental or questionnaire designs. The authors often use case studies, semi-structured interviews, thematic analysis and analysis of organizational documents, which allows for a detailed capture of the processes of redefinition of work roles in the environment of digitalization and automation. Quantitative studies rely mainly on structured questionnaires with Likert scales, experimental designs and correlation analyses, while standard statistical tools, including regression, correlation and mediation analysis, are used for data processing.

The measurement tools used mainly focus on assessing the perceived clarity of roles, responsibilities, job expectations and decision-making powers, often in combination with variables such as trust in technology, workload, safety, employee satisfaction or quality of decision-making. In some studies, these tools are extended to include behavioral experiments or simulated tasks with AI agents, which allow analyzing the impact of role clarity on cognitive processes, human-technology collaboration and managerial decision-making in a controlled environment. This approach is particularly relevant from an economic point of view, as it allows identifying the mechanisms through which organizational ambiguity generates additional coordination and transaction costs.

The research samples are predominantly composed of managers, employees and experts working in various sectors, including public administration, construction, energy, telecommunications, libraries and research institutions. The sample sizes range from smaller qualitative sets to larger quantitative samples including tens to hundreds of respondents, with the studies being conducted in different national and cultural contexts. This diversity points to the universal importance of clarity of roles and responsibilities across sectors, but also complicates direct comparison of results between studies.

From a theoretical perspective, the research is based on interdisciplinary frameworks including theories of organizational design, project management, technology acceptance and organizational behavior. In these approaches, role clarity is understood as a key factor in reducing uncertainty, improving coordination and supporting responsible use of technology. From an economic perspective, this factor is mainly reflected in the reduction of costs associated with unclear decision-making, conflicts of competence and duplication of activities, thereby contributing to higher efficiency of AI implementation and better use of human capital.

From the perspective of further research, the table points to the need for more systematic quantification of the economic impacts of clarity of roles and responsibilities in digitally transformed organizations. In particular, longitudinal studies are lacking that would monitor how clarity of roles develops over time in response to the introduction of AI systems and how it affects the performance of teams and organizations. Similarly, the interaction between clarity of roles and responsibilities and other organizational factors, such as organizational culture, leadership or level of automation, is insufficiently examined, which represents a significant area for further empirical research.

**Table 5**
Clarity of roles and responsibilities

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Baumgartner *et al.* (2022) | Combined methodology | Web-based interactive tool based on a questionnaire with rating scales and a set of six acceptance factors (e.g. safety, work structure, company culture) | Small and medium-sized enterprises (SMEs) in Germany – 3 companies, 5 representatives, 4 workshops with employees | Identify and structure key factors in employee acceptance of cobots (collaborative robots) and develop a tool to assess and improve acceptance in companies | Technology acceptance theory with a focus on the specifics of collaborative robots; a comprehensive approach to human factors in HRI; emphasis on safety, cultural and work changes |
| Campion *et al.* (2022) | Qualitative | Case study, 24 semi-structured interviews, coding and thematic analysis | 24 participants (university, two regional governments; top management, middle management, analysts) | Identify challenges of collaboration in AI adoption between a university and two public boards, analyze organizational routines to overcome them | Categorization of the main barriers to AI implementation in the public administration sector (social, economic, technological, data, organizational, ethical, political); use of the concepts of interorganizational routines, data governance, GDPR |
| Golightly *et al.* (2022) | Qualitative (semi-structured interviews) | Interviews, thematic analysis | 25 experts (railways, robotics, infrastructure, automation) | Identify the human and organizational challenges of implementing robotic systems in railway maintenance | Socio-technical approach, technology acceptance theory |
| Paluch *et al.* (2022) | Quantitative methodology | Structured questionnaire with psychological and environmental items for assessing work factors and health status | Construction workers, sample size unknown in detail from the document | To examine the impact of work factors on the psychological health and well-being of workers in the construction professions | Psychological and environmental models of health in the work environment, legislative and organizational frameworks |
| von Richthofen *et al.* (2022) | Qualitative methodology (case studies, 41 semi-structured interviews) | Semi-structured interviews with project leaders, managers, developers and experts, analysis of published materials as well | 8 German organizations of various sizes and sectors (finance, telecommunications, energy, libraries, etc.) | To explore the changes perceived by knowledge workers in the adoption of AI and the factors supporting the successful development of AI systems | Theory of organizational adoption of AI, interdisciplinary approach, identification of new tasks, roles and skills, with emphasis on managerial support and participation |
| Mogaji and Nguyen (2021) | Quantitative methodology with elements of qualitative research | Structured interviews and questionnaire surveys of managers in banking and financial services | Managers from multiple countries, specific size not detailed in online sources | To explore how managers perceive AI and its application in financial services marketing, including challenges and opportunities | Study of AI in financial services marketing, theoretical frameworks on technology adoption and managerial decision-making |
| Sbragia (1984) | Quantitative (correlational field study) | Questionnaire to project managers; Clarity about Responsibilities Index (CRI) + project performance criteria (technical, cost, schedule, client satisfaction) | 58 multidisciplinary R&D projects in a large Brazilian research institution | To assess whether clarity of manager roles (project vs. functional manager) is associated with performance outcomes of R&D projects in matrix structures | Draws on organizational role clarity and project management theory, examining how responsibility definition affects performance in a matrix organisational context |
| Li et al. (2025) | Quantitative experiment (between-subject and within-subject design) | Controlled behavioral experiments; Likert-scale questionnaires; interaction logs with AI agents | 96 human participants collaborating with LLM-based AI agents in simulated tasks (collaboration, planning, persuasion, decision-making) | To examine how collaboration with LLM-based AI agents influences human cognition, bias, trust, task performance and collaboration dynamics, and to identify risks and opportunities | Draws on Organizational Role Theory, Transactional Model of Stress, locus of control frameworks and mediation analysis within organizational behaviour research |
| Selvakumar & Nagasubramaniyan (2025) | Quantitative (cross-sectional survey) | Self-administered structured questionnaires; validated scales (IPNI, RSQ, RCQ, Loco Inventory); correlation & mediation analysis (SPSS) | 120 employees from various organizations in Tamil Nadu, India | To examine the relationships between interpersonal needs, role stress, role clarity and locus of control and assess mediating effects of role clarity and locus of control on the relationship between interpersonal needs and role stress | Draws on Organizational Role Theory, Transactional Model of Stress, locus of control frameworks and mediation analysis within organizational behaviour research |

*Source: custom processing*

## 3.6 Innovation culture

The table focused on innovation culture highlights the importance of an innovation-oriented organizational culture as one of the key firm-level factors influencing the readiness of organizations to adopt digital technologies and artificial intelligence. The analyzed studies approach innovation culture as a set of values, norms, attitudes and management practices that shape the ability of an organization to adopt technological

changes, experiment with new solutions and systematically transform existing processes.

From a methodological point of view, the table highlights a balanced representation of qualitative and quantitative research approaches. Qualitative studies mainly use semi-structured interviews, document analysis and conceptual or methodological approaches that allow for a deeper understanding of innovation culture in specific institutional and sectoral contexts, especially in public administration. Quantitative research relies on large-scale questionnaire surveys conducted through online platforms, uses structured questionnaires with Likert scales and is aimed at measuring the readiness of organizations to adopt AI and digital technologies. These approaches allow identifying statistically significant relationships between elements of innovation culture and the level of technological readiness of organizations.

The measurement tools used focus on assessing dimensions such as openness to change, support for innovation by management, willingness to experiment, tolerance for failure and the ability to learn from previous experiences. In some cases, these are standardized tools, while other studies work with their own conceptual frameworks or adapt existing theoretical models of digital transformation. From an economic perspective, these tools allow analyzing how innovation culture affects resource allocation, technology investment decisions and the ability of organizations to generate public or business value through innovation.

The research samples mainly include employees and managers of public institutions, as well as workers in the construction sector, with sample sizes ranging from smaller expert groups to large international samples including hundreds of respondents from several European Union countries. This approach allows for a comparative assessment of the level of innovation culture in different organizational and national contexts, but also points out the differences between the public and private sectors in terms of motivations, regulatory constraints and innovation incentives.

From a theoretical point of view, the analyzed studies are mainly based on technology-organization-environment frameworks, digital transformation theories and approaches focused on organizational readiness. In these models, innovation culture is understood as a mediating factor between technological opportunities and the organization's real ability to effectively use these opportunities. From an economic point of view, innovation culture plays a key role in reducing innovation uncertainty, supporting the efficient use of resources and increasing the return on investment in digital technologies.

From the perspective of further research, the table points to several open questions. In particular, longitudinal studies tracking the development of innovation culture over time and its impact on long-term organizational performance are lacking. There is also a limited number of studies that systematically link innovation culture to specific economic outcomes, such as productivity, quality of public services, or the effectiveness of AI investments. These gaps indicate the need for further empirical research to better understand the strategic role of innovation culture in the process of digital transformation of organizations.

**Table 6**
Innovation culture

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Neumann *et al.* (2022) | Qualitative methodology | Semi-structured interviews (17 participants including representatives of government agencies, regional governments, research and academic organizations), supplemented by analysis of public materials | 17 experts from various segments and public sector institutions in Kenya | To examine the readiness of public sector organizations for AI adoption and the relevant conditions for public value creation | Technology–Organization–Environment (TOE) framework supplemented by Dynamic Capability Theory, focusing on the public sector context and factors influencing AI adoption |
| Brooks *et al.* (2020) | Qualitative | Nástroje merania založené na reprezentational theory of measurement, metrologii, psychometrike, axiomatickom a štatistickom prístupe | No sample is applied, this is a conceptual/methodological study | To propose a formal measurement theory for AI systems, enabling comparison of models, tasks, and research groups on a quantitative basis | The output from standardized measurement practices, combines representational theory of measurement, measure theory and metrology, describes the principles of creating robust scales for complex AI phenomena; emphasizes the importance of axiomatic and statistical methods in building comparable measurable constructs |
| Whitford *et al.* (2020) | Quantitative methodology | Online survey conducted via Dynata platform, structured questionnaire, Likert scale (1-7) | 576 public sector managers from 7 EU countries (Germany, Spain, France, Netherlands, Austria, Poland, Sweden) | To explore factors influencing AI adoption in public administration and readiness for AI use | TOE framework (Technology-Organization-Environment) focusing on managerial attitudes, organizational readiness and environmental factors |
| Delgado *et al.* (2019) | Quantitative | Closed questionnaire based on theoretical framework, Likert scale; questions on technology use, perception and adoption strategies; Google form, distribution via social networks | Construction workers in Malaysia, random sample, not restricted by profession or experience, sample size >30 according to CLT (exact number not in cited sections) | To determine the readiness of the construction sector for digital transformation, identify the level of adoption and perception of digital technologies | Theoretical framework from the field of digital transformation; use of a deductive approach, supporting the framework with questions about usage, strategy and project performance |

*Source: custom processing*

## 3.7 Resistance to change

The table focused on resistance to change points to resistance to change as a significant firm-level and individual-level factor that influences the adoption rate of digital technologies and artificial intelligence in organizations. The analyzed studies perceive resistance to change as a complex phenomenon resulting from the interaction of individual employee attitudes, organizational routines and managerial approaches to managing transformation processes. This factor appears to be one of the main limiting elements of digital transformation, especially in sectors with traditional work practices and a high level of regulatory restrictions.

From a methodological point of view, this area mainly uses quantitative research approaches, which are in some cases supplemented by combined methodologies. The authors most often use questionnaire surveys conducted via web platforms, based on five- or seven-point Likert scales. Advanced statistical methods are used for data processing, primarily confirmatory factor analysis and structural equation modeling, which allow analyzing the relationships between resistance to change, technological characteristics and organizational factors. The qualitative contributions in the table are mostly conceptual or methodological in nature and are aimed at creating standardized measurement frameworks.

The measurement tools used focus on assessing employees' attitudes towards technological innovations, perceived difficulty of change, fear of job loss, as well as the readiness of organizations to manage transformation processes. These tools are often integrated into broader theoretical frameworks of digital transformation, technological acceptance and organizational readiness. From an economic perspective, they allow identifying how resistance to change contributes to increasing adaptation costs, slowing down technology implementation and reducing the return on investment in AI solutions.

The research samples in the analyzed studies consist mainly of employees in the construction sector and other traditional industries, while the samples are often random and heterogeneous in terms of professional experience. The sample sizes range from a

few dozen respondents to more than two hundred research participants. This sectoral focus highlights the particular relevance of resistance to change in environments where digitalization fundamentally disrupts established work practices and requires significant changes in the organizational structure and competencies of workers.

From a theoretical perspective, studies rely mainly on technology acceptance models, the technology-organization-environment framework, and digital transformation theories. In these approaches, resistance to change is understood as a mediating or moderating factor between technological characteristics and the resulting adoption rate. From an economic perspective, resistance to change represents a significant risk to the successful implementation of digital innovations, as it can lead to inefficient use of technological investments and loss of competitive advantage.

From a research perspective, the table highlights the need for a deeper examination of the mechanisms through which resistance to change arises and persists in organizations. In particular, longitudinal studies that would monitor the development of employee attitudes during individual phases of digital transformation are lacking. There is also limited research that systematically links resistance to change to measurable economic performance indicators such as productivity, process efficiency, or return on investment in digital technologies. These gaps represent significant scope for further empirical research in the field of digital change management.

**Table 7**
Resistance to change

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Regona *et al.* (2022) | Combined methodology | Web survey, 7-point Likert scale, CFA, SEM, SLR | 241 construction workers in Korea | Analysis of factors influencing the acceptance of AI technologies in the construction sector, Assess the opportunities and challenges of AI adoption in construction | Technology Acceptance Model (TAM), Technology—Organization—Environment (TOE) framework, Concepts of innovation and technology adoption in construction |
| Brooks *et al.* (2020) | Qualitative | Measurement tools based on representational theory of measurement, metrology, psychometrics, axiomatic and statistical approaches | No sample is applied, this is a conceptual/methodological study | To propose a formal measurement theory for AI systems, enabling comparison of models, tasks, and research groups on a quantitative basis | The output from standardized measurement practices, combines representational theory of measurement, measure theory and metrology, describes the principles of creating robust scales for complex AI phenomena; emphasizes the importance of axiomatic and statistical methods in building comparable measurable constructs |
| Delgado *et al.* (2019) | Quantitative | Closed questionnaire based on theoretical framework, Likert scale; questions on technology use, perception and adoption strategies; Google form, distribution via social networks | Construction workers in Malaysia, random sample, not restricted by profession or experience, sample size >30 according to CLT (exact number not in cited sections) | To determine the readiness of the construction sector for digital transformation, identify the level of adoption and perception of digital technologies | Theoretical framework from the field of digital transformation; use of a deductive approach, supporting the framework with questions about usage, strategy and project performance |

*Source: custom processing*

## 3.8 Collaboration and communication

The table focused on Collaboration and communication highlights collaboration and communication as key organizational factors influencing the adoption of artificial intelligence and digital technologies across different sectors. The analyzed studies do not perceive them in isolation, but as part of broader organizational processes in which the connection between management, employees, experts and external actors plays a significant role. Collaboration and effective communication appear in the table mainly in the context of sharing knowledge, supporting adoption processes, building understanding of technological changes and coordination between different organizational units or sectors. Their importance is emphasized especially in complex

organizations and in environments where AI adoption requires interdisciplinary interaction and alignment of technical, organizational and strategic perspectives.

From a methodological point of view, the table shows that research on collaboration and communication is most often carried out through qualitative or mixed research designs. Semi-structured interviews dominate, allowing to capture the experiences of managers, experts and representatives of organizations with the processes of cooperation and internal and external communication flow (e.g. Neumann et al.; von Richthofen et al.; Jöhnk et al.). In some cases, these interviews are supplemented with **questionnaire surveys**, creating a combined approach allowing to connect deeper qualitative insight with quantitative assessment of organizational factors. Purely quantitative approaches appear less frequently in the table and are mainly based on standardized questionnaires.

The measurement tools used include questionnaires based on Likert scales, technology acceptance models (TAM, HTAM, UTAUT, UTAUT2) and tools for assessing organizational readiness. In qualitative studies, the main tool is semi-structured interviews, often supplemented with analysis of publicly available or internal documents. These tools allow us to identify how collaboration between actors, support from management and the quality of communication contribute to a better understanding of AI solutions, their adoption and practical implementation in organizations.

In terms of research samples, the table shows considerable heterogeneity. The samples mainly consist of practitioners – managers, developers, experts and professionals in construction, finance, energy, telecommunications, public institutions and academia. The size of the samples varies significantly depending on the methodology: qualitative studies work with smaller sets of respondents (8–25 experts or managers), while quantitative and combined studies involve larger samples, most often around 169 respondents. Geographically, different regions are represented, including Kenya, South Africa, Germany, Finland, Africa and Asia, which indicates the international but still fragmented nature of the knowledge on collaboration and communication in AI adoption.

From a theoretical perspective, the studies are mainly based on the Technology–Organization–Environment (TOE) framework, theories of organizational adoption, organizational readiness and technology acceptance models. In these frameworks, collaboration and communication are implicitly or explicitly understood as supporting mechanisms that enable the connection of technological capabilities with organizational capacities and strategic goals. Their role is mainly manifested in the support of managerial decision-making, in the sharing of knowledge between departments and in the involvement of relevant actors in the adoption processes.

From the perspective of further research, the table indicates several gaps. In particular, there is a lack of studies that would systematically and separately operationalize collaboration and communication as analytical variables, and not only as accompanying factors of broader adoption models. The number of longitudinal studies tracking how the quality of collaboration and communication changes over time during individual phases of AI implementation is also limited. Similarly, a deeper connection of these factors with measurable organizational and performance outcomes is absent. These

shortcomings point to significant scope for future empirical research aimed at a more detailed understanding of the role of collaboration and communication in the successful adoption of artificial intelligence.

**Table 8**
Collaboration and communication

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Neumann *et al.* (2022) | Qualitative methodology | Semi-structured interviews (17 participants including representatives of government agencies, regional governments, research and academic organizations), supplemented by analysis of public materials | 17 experts from various segments and public sector institutions in Kenya | To examine the readiness of public sector organizations for AI adoption and the relevant conditions for public value creation | Technology–Organization–Environment (TOE) framework supplemented by Dynamic Capability Theory, focusing on the public sector context and factors influencing AI adoption |
| Tjebane *et al.* (2022) | Quantitative | Questionnaire survey | 169 construction professionals (Gauteng, SA) | Identify organizational factors influencing AI adoption in construction organizations | Literature on organizational factors of AI adoption, theoretical foundations on digital transformation and innovation in construction |
| von Richthofen *et al.* (2022) | Qualitative methodology (case studies, 41 semi-structured interviews) | Semi-structured interviews with project leaders, managers, developers and experts, analysis of published materials as well | 8 German organizations of various sizes and sectors (finance, telecommunications, energy, libraries, etc.) | To explore the changes perceived by knowledge workers in the adoption of AI and the factors supporting the successful development of AI systems | Theory of organizational adoption of AI, interdisciplinary approach, identification of new tasks, roles and skills, with emphasis on managerial support and participation |
| Jöhnk *et al.* (2021) | Combined | Questionnaire survey, Semi-structured interviews | 169 construction professionals (Gauteng, SA), 25 AI experts (both academic and corporate practice) | Identify organizational factors influencing AI adoption in construction organizations, Identify categories of "AI readiness" factors, create indicators for assessing an organization's readiness for AI adoption | Literature on organizational factors of AI adoption, theoretical foundations on digital transformation and innovation in construction, Organizational Readiness Theory, triangulation of expert interviews and scientific literature |
| Mandapathil and Meyer (2021) | Combined use of quantitative questionnaires (169 construction professionals; 46 healthcare professionals) and qualitative semi-structured interviews (25 AI experts). | Questionnaires based on Likert scales and Health Technology Acceptance Model; semi-structured interviews. | 169 construction professionals from South Africa, 46 healthcare surgeons from Germany, 25 AI experts from academia and industry. | Identify organizational factors influencing AI adoption, assess AI readiness factors, and explore healthcare professionals' acceptance of robotic surgery technology. | Draws on organizational readiness theory, exploratory and confirmatory factor analyses, Health Technology Acceptance Model, and qualitative interview triangulation frameworks. |
| Mogaji and Nguyen (2021) | Quantitative methodology with elements of qualitative research | Structured interviews and questionnaire surveys of managers in banking and financial services | Managers from multiple countries, specific size not detailed in online sources | To explore how managers perceive AI and its application in financial services marketing, including challenges and opportunities | Study of AI in financial services marketing, theoretical frameworks on technology adoption and managerial decision-making |
| Alghamdi (2020) | Quantitative | Structured questionnaires based on Likert scales, Health Technology Acceptance Model (HTAM), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT2), and semi-structured interviews. | 169 construction professionals (South Africa), 46 healthcare surgeons (Germany), 25 AI experts (academia and industry), 601 university students (China, Saudi Arabia). | Identify organizational and individual factors influencing AI adoption and technology use, assess readiness for AI, and understand intentions to use AI and related technologies in different contexts. | Use of organizational readiness theories, exploratory/confirmatory factor analyses, TAM, UTAUT/UTAUT2, HTAM, and qualitative triangulation methods across interdisciplinary domains. |

*Source: custom processing*

## 3.9 Skilled resources experts

The table focused on skilled resources experts points to the availability of qualified experts as one of the key factors influencing the adoption of artificial intelligence and advanced digital technologies in organizations. The analyzed studies emphasize that the lack of professional knowledge, technical skills and practical experience with the implementation of AI represents a significant barrier across multiple sectors, including industry, public administration, healthcare, finance, banking, logistics and services. Qualified human resources are understood in the table not only as technical experts in the field of AI, robotics or data analytics, but also as managers and decision-makers, whose ability to understand the technology and its organizational consequences significantly affects the success of the adoption processes.

From a methodological point of view, the table is dominated by a quantitative research approach, which is supplemented in some cases by combined or qualitative methodologies. The most commonly used research tools are structured questionnaire surveys and psychometric scales, often based on the TOE, TAM, UTAUT frameworks or their extensions. Several studies use advanced analytical techniques, such as structural equation modeling, interpretative structural modeling or analytic network process, which allow identifying and ranking the importance of qualified experts in the context of other organizational and technological factors. Qualitative approaches, in particular semi-structured interviews and case studies, are used primarily to explore in more depth the perception of the lack of expertise and its impact on management decision-making.

The measurement tools used allow focusing on assessing the level of professional skills, the availability of internal experts, the need for external consultants, as well as the perceived readiness of organizations to work with complex AI solutions. In some studies, these tools are supplemented with expert assessment techniques, such as Rough-SWARA or DEMATEL, which serve to identify critical barriers and relationships between the lack of qualified resources and other obstacles to adoption.

The research samples in the analyzed studies consist mainly of practitioners, including managers, IT specialists, bank managers, public administration workers, healthcare professionals and manufacturing employees. The sample sizes range from small expert sets with approximately 10 to 20 respondents in qualitative and expert studies to large quantitative samples with several hundred participants, for example among company representatives or professionals from several industries. Geographically, the table includes studies conducted in Europe, Asia, Africa, the Middle East and North America, which points to the global nature of the problem of the lack of qualified experts.

**Table 10**
Skilled resources experts

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Golightly *et al.* (2022) | Qualitative (semi-structured interviews) | Interviews, thematic analysis | 25 experts (railways, robotics, infrastructure, automation) | Identify the human and organizational challenges of implementing robotic systems in railway maintenance | Socio-technical approach, technology acceptance theory |
| Kinkel *et al.* (2022) | Quantitative — cross-national survey | Structured survey questionnaire | 655 company representatives from the manufacturing industry (global sample) | To analyse technological, organizational and environmental prerequisites that influence successful AI adoption in manufacturing companies | Technology-Organization-Environment (TOE) framework |
| Leigh *et al.* (2022) | Combined methodology | Psychometric questionnaires assessing attitude, trust and security; behavioral analysis of interactions; video recordings | Warehouse workers; robotics experts; collaborative robot users | To explore factors influencing effective human-robot collaboration in warehouses, increasing safety and productivity | Interdisciplinary framework integrating robotics, cognitive psychology, ergonomics and occupational safety; emphasis on implementing cobots in real work environments |
| Neumann *et al.* (2022) | Qualitative methodology | Semi-structured interviews (17 participants including representatives of government agencies, regional governments, research and academic organizations), supplemented by analysis of public materials | 17 experts from various segments and public sector institutions in Kenya | To examine the readiness of public sector organizations for AI adoption and the relevant conditions for public value creation | Technology–Organization–Environment (TOE) framework supplemented by Dynamic Capability Theory, focusing on the public sector context and factors influencing AI adoption |
| Pan *et al.* (2022) | Quantitative | Questionnaire survey according to the TOE model, extended by transaction costs | 297 Chinese companies (HR and management respondents); company size, industry, regulatory environment included | To explore factors influencing the adoption of AI in employee recruitment; identify barriers and enabling factors in practice | TOE framework (Technology-Organization-Environment); transaction cost theory |
| Phuoc (2022) | Quantitative | Survey; Structural Equation Modeling (SEM) using AMOS and SmartPLS | 193 senior managers, IT managers, CIOs, CEOs and IT professionals from Vietnamese private and public companies | Investigate critical factors influencing AI application adoption on organizational level in Vietnam | Technology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) |
| Dora *et al.* (2021) | Questionnaire survey according to the TOE model, extended by transaction costs | Rough-SWARA (Step-wise Weight Assessment Ratio Analysis) | 15 domain experts from Indian food supply chain (senior managers, supply chain managers, logistics managers, IT managers, financial manager) | To identify, prioritise and rank critical success factors influencing AI adoption in food supply chains in the Indian context | TOEH framework (Technology–Organisation–Environment–Human) |
| Kumar *et al.* (2021) | Mixed-method (MCDM – hybrid quantitative modeling with expert validation) | ISM (Interpretative Structural Modeling) & ANP (Analytic Network Process) | 18 identified barriers derived from literature and validated with domain experts | To identify and map critical barriers preventing AI adoption in public distribution systems (PDS) in India and to analyse their relationships and prioritise them | Barriers and technology adoption contextual framework with focus on socio-technical barriers (e.g., trust, literacy, political issues) |
| Mogaji and Nguyen 2021) | Qualitative (exploratory, inductive) | Semi-structured interviews | 47 bank and financial services managers from the UK, Canada, Nigeria, and Vietnam | To explore managers' awareness, perceptions, and challenges regarding AI adoption in marketing financial services across developed and developing countries | Grounded in qualitative interpretive research drawing on prior conceptual work in AI, marketing, and financial services, focusing on understanding subjective meanings and managerial perspectives |
| Nam *et al.* (2021) | Qualitative | In-depth case study interviews (semi-structured, open-ended questions) | 8 senior hotel asset managers (Dubai), totaling more than 40 hotels and 7,000 rooms | To explore factors influencing the adoption of AI and robotics in hotels from a management perspective (in the context of smart hospitality in Dubai) | Technology-Organization-Environment (TOE) framework: factor analysis in the areas of technology (relative advantage, complexity, IT expertise), organization (financial justification, employee resistance), environment (customer, competition, legal issue) |
| Victor Mugabe (2021) | Quantitative (survey research) | Structured questionnaire-based survey | Employees/participants from public sector departments in New Zealand (survey respondents) | To identify key barriers and facilitators influencing the likelihood that departments will adopt AI technologies in their practice | Adoption of innovation frameworks (exploring socio-technical and organisational factors that influence AI adoption in public sector practice) |
| Wang, Zhao, *et al.* (2021) | Quantitative methodology, systematic review + DEMATEL | DEMATEL technique, questionnaire, expert evaluation | 10 experts from universities, the public sector, research institutes and companies | Analyze the main challenges in implementing AI and IoT in smart cities, determine the interrelationships between the challenges | Division of challenges into "cause" (dominant) and "effect" (influenced), importance of AI/IoT for sustainable cities, citations of leading works, systematic literature review (PRISMA) |
| Gupta and Bhaskar (2020) | Qualitative (exploratory, inductive) | Semi-structured interviews | 47 managers from banks and financial services in the UK, Canada, Nigeria, and Vietnam | To explore managers' understanding, perceptions, awareness and challenges related to AI adoption in the marketing of financial services across developed and developing countries | Based on interpretive qualitative research, building on conceptual work in AI, marketing and services to understand subjective managerial perspectives |
| Brooks *et al.* (2020) | Qualitative | Nástroje merania založené na reprezentational theory of measurement, metrologii, psychometrike, axiomatickom a štatistickom prístupe | No sample is applied, this is a conceptual/methodological study | To propose a formal measurement theory for AI systems, enabling comparison of models, tasks, and research groups on a quantitative basis | The output from standardized measurement practices, combines representational theory of measurement, measure theory and metrology, describes the principles of creating robust scales for complex AI phenomena; emphasizes the importance of axiomatic and statistical methods in building comparable measurable constructs |
| Singh *et al.* (2020) | Qualitative methodology (barrier analysis based on expert perspective, literature review and expert discussions) | Overview and discussion analysis (review article, synthesis of problems and proposals, expert knowledge of the AAO Task Force) | Experts on AI in ophthalmology (authors, members of the AAO Task Force, with reference to systemic and real-world issues, not a specific empirical sample) | Identify the main barriers to implementing AI in healthcare — from the perspective of the organization, provider, and patient; propose recommendations for the development and safe introduction of AI into clinical practice | Using prevailing theories and regulatory frameworks: discussing issues of interoperability, "black box" AI models, legislation, security, ethics, education, patient acceptance, financial model and organizational culture |
| Delgado *et al.* (2019) | Quantitative | Closed questionnaire based on theoretical framework, Likert scale; questions on technology use, perception and adoption strategies; Google form, distribution via social networks | Construction workers in Malaysia, random sample, not restricted by profession or experience, sample size >30 according to CLT (exact number not in cited sections) | To determine the readiness of the construction sector for digital transformation, identify the level of adoption and perception of digital technologies | Theoretical framework from the field of digital transformation; use of a deductive approach, supporting the framework with questions about usage, strategy and project performance |
| BenMessaoud *et al.*, 2011) | Qualitative (belief-elicitation study) | Semi-structured interviews + content analysis | 21 surgeons (10 users of robotic surgery, 11 non-users) practicing in Indiana (multiple surgical specialties) | To identify key facilitators and barriers influencing surgeons' adoption of robotic-assisted surgery and to adapt/extend the UTAUT model to this healthcare context | UTAUT (Unified Theory of Acceptance and Use of Technology) adapted and extended with additional constructs (Attitude toward Using Technology, Leadership) |

*Source: custom processing*

From a theoretical perspective, the analyzed studies are mainly based on the technology–organization–environment framework, technological acceptance theories and the concepts of organizational readiness and sociotechnical systems. In these

approaches, qualified experts are perceived as an enabling factor that mediates the relationship between the technological complexity of AI and its real use in organizational practice. From an economic perspective, the lack of skilled resource experts increases the costs of external consulting, slows down implementation processes and increases the risk of inefficient use of technological investments.

From a research perspective, the table points to the need for a deeper investigation of the mechanisms of development of internal professional capacities, including education, retraining and organizational learning. In particular, longitudinal studies monitoring how the availability of qualified experts changes over time and how it affects the individual phases of AI adoption are lacking. There is also a limited number of studies that systematically link the availability of professional resources with measurable organizational and economic outcomes, which represents significant scope for further empirical research in the field of digital transformation management.

### 3.10 Educational resources and train

The table focused on educational resources and training points to educational resources and training as significant organizational and individual factors supporting the adoption of artificial intelligence, robotics and digital technologies in various sectors. The analyzed studies perceive them as a key prerequisite for developing the competencies necessary for the effective use of new technologies, reducing employee uncertainty and improving cooperation between people and intelligent systems. Education and training are mainly associated in the table with building knowledge about AI, increasing organizational readiness, supporting the acceptance of technologies and developing the ability of employees to work in technologically complex work environments.

From a methodological point of view, the table shows a significant dominance of qualitative research approaches, which are often focused on exploratory exploration of the experiences, perceptions and needs of different groups of actors. The most frequently used are semi-structured or in-depth interviews, thematic analysis and case studies, as well as the Delphi technique based on expert panels. Systematic literature reviews are used to synthesize existing knowledge on education and training in the context of AI adoption. Quantitative and mixed methodologies appear to a lesser extent in the table, and are mainly based on psychometric questionnaires and structured surveys supplemented with behavioral analyses and experimental elements.

The measurement tools used include systematic literature reviews conducted according to the PRISMA protocol, semi-structured and open-ended interviews, the Delphi technique with iterative rounds of expert assessment, as well as psychometric questionnaires focused on attitudes, trust, safety and perceived effectiveness of collaboration between humans and robots. In combined studies, these tools are supplemented with behavioral analysis of interactions, video recordings and analytical software, which allows for a more detailed capture of the impact of training and educational interventions on work behavior and performance.

**Table 11**
Educational resources and train

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Baumgartner *et al.* (2022) | Qualitative (systematic literature review) | Systematic literature review protocol (PRISMA-based selection and screening) | 91 peer-reviewed journal articles on AI adoption in SMEs (selected from Scopus & Web of Science) | To synthesise existing research on AI adoption in SMEs, identify main drivers, barriers, application areas and research gaps | Draws on technology adoption and innovation literature (e.g. TOE, TAM, RBV) but does not empirically test a single theory |
| Golightly *et al.* (2022) | Qualitative (semi-structured interviews) | Interviews, thematic analysis | 25 experts (railways, robotics, infrastructure, automation) | Identify the human and organizational challenges of implementing robotic systems in railway maintenance | Socio-technical approach, technology acceptance theory |
| Grover *et al.* (2022), | Qualitative | systematic literature review | 181 scientific articles | To examine selected factors influencing the adoption of artificial intelligence in operations management through the lens of literature and practical discussions on social networks | PC utilization model (Thompson et al., 1991) extended to AI in OM; factors such as job-fit, complexity, perceived consequences, affect towards use, social factors, facilitating conditions |
| Leigh *et al.* (2022) | Combined methodology | Psychometric questionnaires assessing attitude, trust and security; behavioral analysis of interactions; video recordings | Warehouse workers; robotics experts; collaborative robot users | To explore factors influencing effective human-robot collaboration in warehouses, increasing safety and productivity | Interdisciplinary framework integrating robotics, cognitive psychology, ergonomics and occupational safety; emphasis on implementing cobots in real work environments |
| Parvez *et al.* (2022) | Quantitative (survey + structural equation modelling) | Structured survey questionnaire + PLS-SEM (SmartPLS) | 500 respondents from the travel, tourism and hospitality (TTH) industry (329 valid responses) from the USA collected via Amazon Mechanical Turk | To examine the antecedents (perceived usefulness, ease of use, robot awareness, motivation, advantages/disadvantages) that influence employees' behavioural intention to use robots and how these factors affect human–robot collaboration (HRC), including the moderating role of strategic HRM involvement | Technology Acceptance Model (TAM) extended with additional determinants such as robot awareness, motivation, advantages/disadvantages of robots and strategic HRM involvement |
| von Richthofen *et al.* (2022) | Qualitative methodology (case studies, 41 semi-structured interviews) | Semi-structured interviews with project leaders, managers, developers and experts, analysis of published materials as well | 8 German organizations of various sizes and sectors (finance, telecommunications, energy, libraries, etc.) | To explore the changes perceived by knowledge workers in the adoption of AI and the factors supporting the successful development of AI systems | Theory of organizational adoption of AI, interdisciplinary approach, identification of new tasks, roles and skills, with emphasis on managerial support and participation |
| Jöhnk *et al.* (2021) | Qualitative (exploratory interview study) | In-depth semi-structured interviews + open & axial coding analysis | 25 AI experts selected purposively from various organizational contexts | To identify and conceptualize organizational AI readiness factors that help determine whether an organization is prepared to adopt and successfully leverage AI | Based on innovation/technology adoption literature, organizational readiness for change theory and grounded coding of interview data to derive readiness factors |
| Kalisz *et al.* (2021) | Qualitative (Delphi expert panel study) | Delphi technique with iterative expert feedback + thematic analysis | Healthcare professionals with extensive experience in social robots and e-health | To explore how healthcare professionals perceive adoption and diffusion of social robots in e-health, especially given their *categorical ambiguity* (hybrid nature between object/service/human-like agent) | Based on innovation adoption & diffusion theory, categorization theory, and socio-technical perspectives relevant to hybrid AI products |
| Mogaji and Nguyen 2021) | Qualitative (exploratory, inductive) | Semi-structured interviews | 47 bank and financial services managers from the UK, Canada, Nigeria, and Vietnam | To explore managers' awareness, perceptions, and challenges regarding AI adoption in marketing financial services across developed and developing countries | Grounded in qualitative interpretive research drawing on prior conceptual work in AI, marketing, and financial services, focusing on understanding subjective meanings and managerial perspectives |
| Victor Mugabe (2021) | Quantitative (survey research) | Structured questionnaire-based survey | Employees/participants from public sector departments in New Zealand (survey respondents) | To identify key barriers and facilitators influencing the likelihood that departments will adopt AI technologies in their practice | Adoption of innovation frameworks (exploring socio-technical and organisational factors that influence AI adoption in public sector practice) |
| Gupta and Bhaskar (2020) | Qualitative (exploratory, inductive) | Semi-structured interviews | 47 managers from banks and financial services in the UK, Canada, Nigeria, and Vietnam | To explore managers' understanding, perceptions, awareness and challenges related to AI adoption in the marketing of financial services across developed and developing countries | Based on interpretive qualitative research, building on conceptual work in AI, marketing and services to understand subjective managerial perspectives |
| Simões et al. (2020) | Qualitative (Delphi expert panel study) | Delphi technique with iterative rounds and thematic/consensus analysis | Healthcare professionals and experts with extensive experience in social robots and e-health practices | To explore healthcare professionals' perceptions of the adoption and diffusion of social robots in e-health, particularly given their *categorical ambiguity* as hybrid AI technologies combining product, service and interactive features | Draws on innovation adoption and diffusion theory, categorization theory, and socio-technical perspectives on hybrid technology adoption |
| Tang *et al.* (2020) | Qualitative (exploratory narrative analysis) | Semi-structured open-ended interviews (pre- and post-semester) + narrative analysis | 7 purposively selected university teachers in management education with teaching experience and interest in educational robotics | To investigate university teachers' perceived opportunities and challenges for using educational robotics (ER) in management education across curriculum, pedagogy and technological domains | Not tied to a single formal theory; draws on technology adoption discourse and Vygotskian social constructivism as conceptual grounding for understanding teacher perceptions and educational technology adoption |
| Bröhl *et al.* (2019) | Combined methodology: quantitative (psychometrics, behavioral analysis) and qualitative (interviews, case studies) | Psychometric questionnaires for assessing trust, safety and effectiveness, behavioral recordings of interactions, video analysis, analytical software | Robotics specialists and agricultural workers for pilot testing of human-robot collaboration | To explore the impact of psychological and technical factors on the effectiveness and adoption of collaborative robotics in agriculture | An interdisciplinary framework combining robotics, cognitive psychology, and AI, with an emphasis on improving collaboration between humans and robots in practical environments. |

*Source: custom processing*

The research samples in the analyzed studies are highly heterogeneous and include experts in robotics, infrastructure, automation and public institutions, warehouse and manufacturing workers, healthcare professionals with experience with social robots, managers in banking and financial services, as well as teachers and academics in the field

of management education. The sample sizes range from small expert sets with approximately 7 to 25 respondents in qualitative studies to large quantitative samples with several hundred participants, for example 500 respondents in questionnaire research conducted through online platforms. This range indicates an effort to capture educational and training needs at different levels of organizations and in different professional contexts.

From a theoretical perspective, the studies in the table draw on technological and organizational frameworks, in particular the Technology Acceptance Model, the TOE framework, theories of innovation adoption and diffusion, as well as interdisciplinary sociotechnical approaches. Education and training are understood in these approaches as mechanisms that mediate the relationship between the technological characteristics of AI and its real-world use, while also helping to reduce barriers associated with lack of knowledge, employee concerns, and organizational unpreparedness.

From the perspective of further research, the table points to the need for a more systematic evaluation of the effectiveness of education and training programs in the long term. In particular, longitudinal studies are lacking that track how education affects changes in attitudes, development of competencies, and actual behavior of employees during individual phases of AI adoption. There is also a limited number of studies that link investments in educational resources with measurable organizational and performance outcomes, which represents a significant area for further empirical research in the field of digital transformation management.

### 3.11 Task complexity

The table focused on task complexity points to the complexity of work tasks as a significant technological and organizational factor influencing the adoption of artificial intelligence and advanced digital technologies. The analyzed studies perceive task complexity primarily in relation to the complexity of work processes, the degree of variability of activities, the need for expert judgment and the requirements for coordination between people and technologies. Task complexity appears in the table as a factor that can either support or hinder the adoption of AI, depending on the extent to which technologies are able to handle complex, unstructured and context-sensitive tasks in a specific organizational environment.

From a methodological point of view, the table mainly presents quantitative research approaches, supplemented by mixed methodology. The research is carried out through large-scale questionnaire surveys and secondary data analysis, often at the national or sectoral level. Quantitative studies use structured questionnaires or census data and apply statistical analytical techniques such as regression models to identify the impact of technological, organizational, and environmental factors, including task complexity. Mixed research designs are represented by studies that combine questionnaire data with analytical methods such as confirmatory factor analysis and structural equation modeling, allowing for a more detailed examination of the relationship between task complexity and technology acceptance.

The measurement tools used include primarily structured Likert-scale-based questionnaires, web-based surveys, and analysis of administrative or census data. These tools allow for capturing how respondents perceive task difficulty, technological complexity, and their relationship to decisions about adopting AI and robotic solutions. In some studies, the measurement is embedded in broader analytical frameworks that track technology adoption at the organizational or sector level.

In terms of research samples, the table includes large and diversified sets of respondents. The samples consist of representatives of manufacturing companies in a global context, construction workers, as well as publicly funded institutions, such as forensic laboratories in the United States. The sample sizes range from a few hundred respondents in questionnaire surveys to census data covering hundreds of organizations, allowing for more robust statistical conclusions about the impact of task complexity on technology adoption.

From a theoretical perspective, the analyzed studies rely mainly on the Technology–Organization–Environment framework, the Technology Acceptance Model, and the extended concepts of innovation adoption and technological transformation. In these approaches, task complexity is understood as a technological characteristic that influences the perceived usefulness, suitability, and feasibility of deploying AI in specific work processes. It is also linked to organizational and environmental factors, such as regulatory conditions, available resources, and the nature of the industry.

From a research perspective, the table highlights the need for a deeper distinction between different types of task complexity, such as routine and unstructured activities, and their differential impact on AI adoption. In particular, qualitative and longitudinal studies that capture in more detail how perceptions of task complexity change over time and how they influence technology implementation decisions during individual phases of digital transformation are lacking. There is also a limited amount of research linking task complexity to specific organizational and performance indicators, which represents significant scope for further empirical research.

**Table 12**
Task Complexity

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Kinkel *et al.* (2022) | Quantitative — cross-national survey | Structured survey questionnaire | 655 company representatives from the manufacturing industry (global sample) | To analyse technological, organizational and environmental prerequisites that influence successful AI adoption in manufacturing companies | Technology-Organization-Environment (TOE) framework |
| Regona *et al.* (2022) | Combined methodology | Web survey, 7-point Likert scale, CFA, SEM, SLR | 241 construction workers in Korea | Analysis of factors influencing the acceptance of AI technologies in the construction sector, Assess the opportunities and challenges of AI adoption in construction | Technology Acceptance Model (TAM), Technology—Organization—Environment (TOE) framework, Concepts of innovation and technology adoption in construction |
| Whitford *et al.* (2020) | Quantitative (empirical statistical analysis) | Survey/census data analysis (probing adoption via probit regression models) | Census of publicly funded forensic crime laboratories in the U.S. (hundreds of labs) | To investigate which organizational and environmental factors influence the likelihood that government crime labs adopt robotics technologies | Innovation adoption and public administration technology adoption literature (push-pull-capability perspective on organizational technology adoption) |

*Source: custom processing*

### 3.12 Effective operations

The table focused on effective operations points to the effectiveness of operational processes as one of the key organizational factors influencing the successful adoption of artificial intelligence in various types of organizations. The analyzed studies approach effective operations as the result of the alignment of technological capacities, organizational structures, decision-making processes and the ability of actors to cooperate within existing workflows. Effective operations are understood in the table mainly in the context of the ability of organizations to integrate AI into everyday processes without disrupting the continuity of activities, while emphasizing the importance of process readiness, clearly defined routines and managerial coordination.

From a methodological point of view, the table shows a significant dominance of qualitative research approaches, which are complemented by quantitative and mixed designs. Frequently used methods are case studies, semi-structured and in-depth interviews, the Delphi technique and systematic literature reviews. These approaches allow for a detailed analysis of how AI affects operational processes and what barriers or facilitators appear during its implementation. Quantitative studies use structured questionnaires and analytical techniques such as partial least squares structural equation modeling to test the relationships between technological, organizational, and environmental factors and operational efficiency.

The measurement tools used include semi-structured interviews, scenario methods, systematic literature reviews conducted according to predefined protocols, and structured questionnaires based on Likert scales. In some studies, these tools are complemented by analysis of public or internal documents and data coding, which allows the identification of recurring patterns related to operational efficiency and organizational routines in the context of AI adoption.

The research samples in the analyzed studies are heterogeneous and include participants from public administration, manufacturing, healthcare, construction, infrastructure, and academia. Sample sizes range from smaller expert sets with approximately 17 to 25 respondents in qualitative studies to large quantitative samples with more than 600 respondents in international surveys. This diversity points to the broad relevance of effective operations as a factor in AI adoption across sectors and organizational contexts.

From a theoretical perspective, the studies in the table draw mainly on the Technology–Organization–Environment framework, theories of technological acceptance, concepts of innovation adoption and diffusion, as well as sociotechnical approaches. Effective operations are understood in these frameworks as the result of the interaction between the technological characteristics of AI, organizational capabilities, and the broader institutional and regulatory environment. Some studies also emphasize the role of organizational routines, change management, and dynamic capabilities in ensuring long-term operational effectiveness.

From a research perspective, the table points to the need for a deeper investigation of the mechanisms through which AI contributes to increasing operational effectiveness at

different stages of implementation. In particular, longitudinal studies tracking the development of operational processes over time and research that systematically links operational effectiveness to measurable performance and economic indicators are lacking. There is also room for a more detailed comparison of the public and private sectors, as well as for analyzing differences between sectors with different levels of process complexity and regulation.

**Table 13**
Effective operations

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Campion *et al.* (2022) | Qualitative | Case study, 24 semi-structured interviews, coding and thematic analysis | 24 participants (university, two regional governments; top management, middle management, analysts) | Identify challenges of collaboration in AI adoption between a university and two public boards, analyze organizational routines to overcome them | Categorization of the main barriers to AI implementation in the public administration sector (social, economic, technological, data, organizational, ethical, political); use of the concepts of interorganizational routines, data governance, GDPR |
| Golightly *et al.* (2022) | Qualitative | Semi-structured interviews, scenario method | 25 expert participants (rail infrastructure experts, non-infrastructure rail experts, automation experts from outside rail) | Identify human, organizational and societal factors of introducing robotics into railway infrastructure maintenance and recommend procedures for their successful adoption | Socio-technical systems theory; approaches from the field of human factors in automation, frameworks from the field of industrial robotics, technology acceptance theories, cultural factors and norms, TOE framework |
| Kinkel *et al.* (2022) | Quantitative — cross-national survey | Structured survey questionnaire | 655 company representatives from the manufacturing industry (global sample) | To analyse technological, organizational and environmental prerequisites that influence successful AI adoption in manufacturing companies | Technology-Organization-Environment (TOE) framework |
| Neumann *et al.* (2022) | Qualitative methodology | Semi-structured interviews (17 participants including representatives of government agencies, regional governments, research and academic organizations), supplemented by analysis of public materials | 17 experts from various segments and public sector institutions in Kenya | To examine the readiness of public sector organizations for AI adoption and the relevant conditions for public value creation | Technology–Organization–Environment (TOE) framework supplemented by Dynamic Capability Theory, focusing on the public sector context and factors influencing AI adoption |
| Tjebane *et al.* (2022) | Quantitative | Questionnaire survey | 169 construction professionals (Gauteng, SA) | Identify organizational factors influencing AI adoption in construction organizations | Literature on organizational factors of AI adoption, theoretical foundations on digital transformation and innovation in construction |
| von Richthofen *et al.* (2022) | Qualitative methodology (case studies, 41 semi-structured interviews) | Semi-structured interviews with project leaders, managers, developers and experts, analysis of published materials as well | 8 German organizations of various sizes and sectors (finance, telecommunications, energy, libraries, etc.) | To explore the changes perceived by knowledge workers in the adoption of AI and the factors supporting the successful development of AI systems | Theory of organizational adoption of AI, interdisciplinary approach, identification of new tasks, roles and skills, with emphasis on managerial support and participation |
| Chatterjee, Rana, *et al.* (2021) | Quantitative (survey-based empirical study) | Structured questionnaire (36 items, 5-point Likert scale); PLS-SEM analysis | 340 valid responses from employees of small, medium and large manufacturing and production firms in India | To identify technological, organizational and environmental antecedents influencing the intention to adopt AI in manufacturing and production firms and to examine the moderating role of leadership support | Integrated TAM–TOE framework (Technology Acceptance Model – Davis, 1989; Technology–Organization–Environment framework – Tornatzky & Fleischer, 1990) |
| Jöhnk *et al.* (2021) | Qualitative (exploratory interview study) | In-depth semi-structured interviews + open & axial coding analysis | 25 AI experts selected purposively from various organizational contexts | To identify and conceptualize organizational AI readiness factors that help determine whether an organization is prepared to adopt and successfully leverage AI | Based on innovation/technology adoption literature, organizational readiness for change theory and grounded coding of interview data to derive readiness factors |
| Kalisz *et al.* (2021) | Qualitative (Delphi expert panel study) | Delphi technique with iterative expert feedback + thematic analysis | Healthcare professionals with extensive experience in social robots and e-health | To explore how healthcare professionals perceive adoption and diffusion of social robots in e-health, especially given their *categorical ambiguity* (hybrid nature between object/service/human-like agent) | Based on innovation adoption & diffusion theory, categorization theory, and socio-technical perspectives relevant to hybrid AI products |
| Siderska (2021) | Qualitative (systematic literature review) | Systematic literature review protocol (database search, inclusion/exclusion criteria, content analysis) | 97 peer-reviewed academic articles on AI adoption in organizations | To systematically review existing research on AI adoption in organizations, identify key determinants, theoretical perspectives, methodologies, and propose a future research agenda | Draws on technology adoption theories (TAM, TOE, UTAUT, Diffusion of Innovations), organizational and strategic management literature |

*Source: custom processing*

## 3.13 Managerial capabilities

The table focused on managerial capabilities points to managerial capabilities as a significant organizational factor influencing the adoption of artificial intelligence at the organizational level. The analyzed studies emphasize the role of management in strategic decision-making, coordination of technological initiatives and translation of technical possibilities of AI into specific organizational processes and goals. Managerial capabilities are perceived in the table mainly in connection with the ability of leaders to understand technological innovations, manage change, set appropriate organizational conditions and support the acceptance of AI among employees.

From a methodological point of view, the table includes two different research approaches. The first is represented by quantitative research based on a questionnaire survey and the application of structural equation modeling, which allows to identify critical factors of managerial decision-making influencing the adoption of AI at the organizational level. The second approach is represented by a qualitative Delphi expert panel study, which uses iterative rounds of expert assessment to examine the perceptions of managerial and professional actors in the field of healthcare. This methodological diversity points to the effort to capture managerial capabilities as both a measurable and interpretable construct.

The measurement tools used include structured questionnaires analyzed using SEM techniques in AMOS and SmartPLS environments, as well as the Delphi technique with thematic and consensus analysis. These tools allow for the examination of managerial capabilities from different perspectives, from statistical testing of relationships between managerial factors and AI adoption to qualitative assessment of expert experiences and professional opinions.

The research samples in the analyzed studies primarily include senior managers, IT managers, CIOs, CEOs and IT professionals from private and public organizations, as well as healthcare professionals with experience with social robots and e-health solutions. The sample sizes range from approximately 193 respondents in the quantitative study to smaller, but highly specialized expert groups in the Delphi research. This selection of respondents emphasizes the importance of the managerial perspective in decisions about AI adoption.

Theoretically, the studies draw on a combination of technological and organizational adoption frameworks, including the Technology–Organization–Environment framework, the theory of innovation adoption and diffusion, the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, and the Theory of Planned Behavior. In these approaches, managerial capabilities are understood as a mediating factor between the technological characteristics of AI and its practical use in organizations, influencing strategic decision-making, resource allocation, and change management.

From a research perspective, the table highlights the need for deeper exploration of specific dimensions of managerial capabilities, such as digital competencies, strategic thinking, and the ability to manage interdisciplinary teams. In particular, longitudinal studies tracking the development of managerial capabilities over time and their impact on individual phases of AI adoption are lacking. There is also a limited amount of research linking managerial capabilities to measurable organizational and performance outcomes, which represents significant scope for further empirical research.

**Table 14**
Managerial capabilities

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Phuoc (2022) | Quantitative | Survey; Structural Equation Modeling (SEM) using AMOS and SmartPLS | 193 senior managers, IT managers, CIOs, CEOs and IT professionals from Vietnamese private and public companies | Investigate critical factors influencing AI application adoption on organizational level in Vietnam | Technology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) |
| Simões et al. (2020) | Qualitative (Delphi expert panel study) | Delphi technique with iterative rounds and thematic/consensus analysis | Healthcare professionals and experts with extensive experience in social robots and e-health practices | To explore healthcare professionals' perceptions of the adoption and diffusion of social robots in e-health, particularly given their *categorical ambiguity* as hybrid AI technologies combining product, service and interactive features | Draws on innovation adoption and diffusion theory, categorization theory, and socio-technical perspectives on hybrid technology adoption |

*Source: custom processing*

## 3.14 Top management support

The table focusing on top management support points to top management support as one of the most frequently identified organizational factors influencing the adoption of artificial intelligence and digital technologies. The analyzed studies perceive top management support as a key mechanism through which technological initiatives are translated into organizational strategy, resource allocation and daily practice. Top management support appears in the table in connection with creating favorable conditions for AI adoption, reducing organizational uncertainty, legitimizing technological changes and strengthening employee trust in new systems.

From a methodological point of view, the table shows a significant predominance of quantitative research approaches, which are in some cases supplemented by qualitative or combined methodologies. Quantitative studies mainly use structured questionnaire surveys based on Likert scales and advanced analytical techniques such as structural equation modeling, confirmatory factor analysis or regression models. These approaches allow empirical testing of the relationships between top management support, technological and organizational factors and the rate of AI adoption. Qualitative and mixed-method studies, especially case studies, in-depth interviews and the Delphi technique, provide deeper insights into the ways in which management support influences decision-making, organisational processes and implementation strategies.

The measurement tools used include structured questionnaires, web surveys, analysis of secondary data and administrative sources, as well as semi-structured interviews with managers, experts and employees. In some studies, the tools are extended with sentiment analysis of text data, systematic literature reviews and hybrid decision-making methods, which allows capturing top management support as a complex and multidimensional construct.

The research samples in the analysed studies are large and heterogeneous. They include managers, IT professionals, CIOs, CEOs, employees of manufacturing and construction companies, public sector workers, healthcare professionals as well as experts from academia and research. Sample sizes range from small expert groups with approximately

17 to 25 respondents in qualitative studies to large quantitative datasets with more than 300 or 500 respondents, with some studies working with thousands of text records from online environments. This range points to the universal relevance of top management support across sectors and organizational contexts.

From a theoretical perspective, the studies in the table draw primarily on the Technology–Organization–Environment framework, the Technology Acceptance Model and its extensions, theories of innovation adoption and diffusion, as well as sociotechnical and organizational approaches. Top management support is understood in these frameworks as a key organizational antecedent that mediates the relationship between the technological characteristics of AI and its real-world use in organizations, while also influencing other factors such as organizational readiness, resource availability, and willingness to take risks.

**Table 15**
Top management support

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Grover, et al. (2022) | Qualitative | Literary research, sentiment analysis, text analytics (Python, R, Excel), content analysis, word cloud | 181 peer-reviewed articles + thousands of tweets from experts, managers and organizations in OM | To explore the possibilities of applying AI in various areas of operations management (production, development, services, supply chain) with an emphasis on factors facilitating the adoption of AI | PC utilization model extended to AI factors: job-fit, complexity, long-term consequences, attitude towards use, social factors, facilitating conditions; digital transformation; AI theories |
| Na *et al.* (2022) | Quantitative | five-point Likert scale | 241 respondents employed in construction companies with 6-10 years of experience, maximum bachelor's degree | To examine factors influencing the intention and adoption of AI technologies among users in construction companies, to verify a model of the influence of technological, organizational, environmental factors and personality characteristics on the acceptance of AI | Technology Acceptance Model (TAM) combined with the Technology-Organization-Environment (TOE) framework |
| Neumann *et al.* (2022) | Qualitative methodology | Semi-structured interviews (17 participants including representatives of government agencies, regional governments, research and academic organizations), supplemented by analysis of public materials | 17 experts from various segments and public sector institutions in Kenya | To examine the readiness of public sector organizations for AI adoption and the relevant conditions for public value creation | Technology–Organization–Environment (TOE) framework supplemented by Dynamic Capability Theory, focusing on the public sector context and factors influencing AI adoption |
| Pizam *et al.* (2022) | Quantitative | Web-based survey; 7-point Likert scale; Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM) | 1077 hotel managers in 11 countries (Brazil, Canada, Greece, India, Israel, Japan, Romania, Spain, Turkey, UK, USA) | Identify effects of technological, organizational, and environmental (TOE) factors, and moderating effect of innovativeness on managers' intention to adopt robotic technologies | Technology-Organization-Environment (TOE) framework; includes constructs for technological (relative advantage, compatibility, complexity, perceived cost), organizational (top management support, organizational readiness), environmental (competitive pressure) factors; innovativeness as moderator |
| Phuoc (2022) | Quantitative | Survey; Structural Equation Modeling (SEM) using AMOS and SmartPLS | 193 senior managers, IT managers, CIOs, CEOs and IT professionals from Vietnamese private and public companies | Investigate critical factors influencing AI application adoption on organizational level in Vietnam | echnology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) |
| von Richthofen *et al.* (2022) | Qualitative methodology (case studies, 41 semi-structured interviews) | Semi-structured interviews with project leaders, managers, developers and experts, analysis of published materials as well | 8 German organizations of various sizes and sectors (finance, telecommunications, energy, libraries, etc.) | To explore the changes perceived by knowledge workers in the adoption of AI and the factors supporting the successful development of AI systems | Theory of organizational adoption of AI, interdisciplinary approach, identification of new tasks, roles and skills, with emphasis on managerial support and participation |
| Chatterjee, Rana, *et al.* (2021) | Quantitative (survey-based empirical study) | Structured questionnaire (36 items, 5-point Likert scale); PLS-SEM analysis | 340 valid responses from employees of small, medium and large manufacturing and production firms in India | To identify technological, organizational and environmental antecedents influencing the intention to adopt AI in manufacturing and production firms and to examine the moderating role of leadership support | Integrated TAM–TOE framework (Technology Acceptance Model – Davis, 1989; Technology–Organization–Environment framework – Tornatzky & Fleischer, 1990) |
| Jöhnk *et al.* (2021) | Qualitative (exploratory interview study) | In-depth semi-structured interviews + open & axial coding analysis | 25 AI experts selected purposively from various organizational contexts | To identify and conceptualize organizational AI readiness factors that help determine whether an organization is prepared to adopt and successfully leverage AI | Based on innovation/technology adoption literature, organizational readiness for change theory and grounded coding of interview data to derive readiness factors |
| Kumar *et al.* (2021) | Mixed-method (MCDM – hybrid quantitative modeling with expert validation) | ISM (Interpretative Structural Modeling) & ANP (Analytic Network Process) | 18 identified barriers derived from literature and validated with domain experts | To identify and map critical barriers preventing AI adoption in public distribution systems (PDS) in India and to analyse their relationships and prioritise them | Barriers and technology adoption contextual framework with focus on socio-technical barriers (e.g., trust, literacy, political issues) |
| Mogaji and Nguyen (2021) | Quantitative methodology with elements of qualitative research | Structured interviews and questionnaire surveys of managers in banking and financial services | Managers from multiple countries, specific size not detailed in online sources | To explore how managers perceive AI and its application in financial services marketing, including challenges and opportunities | Study of AI in financial services marketing, theoretical frameworks on technology adoption and managerial decision-making |
| Mandapathil and Meyer (2021) | Combined use of quantitative questionnaires (169 construction professionals; 46 healthcare professionals) and qualitative semi-structured interviews (25 AI experts). | Questionnaires based on Likert scales and Health Technology Acceptance Model; semi-structured interviews. | 169 construction professionals from South Africa, 46 healthcare surgeons from Germany, 25 AI experts from academia and industry. | Identify organizational factors influencing AI adoption, assess AI readiness factors, and explore healthcare professionals' acceptance of robotic surgery technology. | Draws on organizational readiness theory, exploratory and confirmatory factor analyses, Health Technology Acceptance Model, and qualitative interview triangulation frameworks. |
| Pan and Pan (2020) | Quantitative | Questionnaire (closed-ended items, Likert scale, constructed from previous literature, piloted on 10 experts; structured questions on determinants from the TOE framework) | 94 typical construction contractors in Hong Kong (CEOs, directors, senior managers) | To examine the critical determinants of construction robot adoption at the organizational level and empirically validate a model of determinants in construction firms | TOE framework (Technology-Organization-Environment); also inspired by Diffusion of Innovations (DOI) theory |
| Simões et al. (2020) | Qualitative (Delphi expert panel study) | Delphi technique with iterative rounds and thematic/consensus analysis | Healthcare professionals and experts with extensive experience in social robots and e-health practices | To explore healthcare professionals' perceptions of the adoption and diffusion of social robots in e-health, particularly given their *categorical ambiguity* as hybrid AI technologies combining product, service and interactive features | Draws on innovation adoption and diffusion theory, categorization theory, and socio-technical perspectives on hybrid technology adoption |

*Source: custom processing*

From a research perspective, the table highlights the need for a more detailed distinction between the individual dimensions of top management support, such as strategic vision, active involvement in implementation, and support for organizational learning. In particular, longitudinal studies tracking how the level and form of management support changes during different phases of AI adoption are lacking. There is also a limited amount of research that systematically links top management support to specific economic and performance indicators, which represents significant scope for further empirical research.

### 3.15 Technology implementation

The table focused on technology implementation points to technology implementation as a complex process that goes beyond the adoption decision itself and includes the practical integration of artificial intelligence and robotic solutions into everyday organizational processes. The analyzed studies focus on how technological, organizational and environmental conditions affect the success of AI implementation in various sectors, especially in manufacturing, construction, distribution systems and in the environment of small and medium-sized enterprises. Technology implementation is understood in the table as the phase in which the technical characteristics of the solutions meet with organizational culture, work procedures and employee readiness.

From a methodological point of view, the table shows the predominance of quantitative research approaches, which are complemented by combined and qualitative methodologies. Quantitative studies mainly use structured questionnaire surveys conducted at the national or international level, often with large samples of respondents. Mixed approaches combine questionnaires with interactive tools, workshops and employee assessments, while qualitative studies use in-depth semi-structured interviews and thematic analysis to capture managers' and experts' perceptions of implementation challenges.

The measurement tools used include web-based and paper-based questionnaires based on Likert scales, interactive assessment tools focusing on factors such as safety, work structure and organizational culture, as well as analytical methods such as PLS-SEM, ISM and ANP. These tools allow identifying critical determinants of successful technology implementation, mapping the relationships between barriers and facilitators and determining their relative priority in organizations' decision-making processes.

The research samples in the analyzed studies are significantly heterogeneous. They include employees and managers of small and medium-sized enterprises in Germany, representatives of manufacturing companies from a global environment, construction professionals from South Africa and Hong Kong, as well as experts involved in public distribution systems in India. Sample sizes range from small expert groups with approximately 17 respondents to large quantitative samples with over 600 participants, allowing for the analysis of technology implementation at different levels of organizations and in different institutional contexts.

From a theoretical perspective, the studies in the table rely primarily on the Technology–Organization–Environment framework, often combined with the Technology Acceptance Model, Diffusion of Innovations theory, and technology readiness frameworks. In these approaches, technology implementation is understood as the result of the interaction between technological suitability of solutions, organizational capabilities, and external conditions such as the regulatory environment, market pressures, and sociotechnical barriers.

From a research perspective, the table points to the need for a deeper examination of the implementation phase itself as a separate analytical object, distinct from the intention to adopt the technology. In particular, longitudinal studies tracking implementation over time and research that more closely analyzes the role of employees, organizational culture, and learning during AI adoption are lacking. There is also room for more systematic linking of implementation factors to measurable operational and performance outcomes of organizations.

**Table 16**
Technology implementation

| Study | Qualitative or Quantitative methodology | Measurement tool | Sample | Aim of the study | Theoretical background |
|---|---|---|---|---|---|
| Baumgartner *et al.* (2022) | Combined methodology | Web-based interactive tool based on a questionnaire with rating scales and a set of six acceptance factors (e.g. safety, work structure, company culture) | Small and medium-sized enterprises (SMEs) in Germany – 3 companies, 5 representatives, 4 workshops with employees | Identify and structure key factors in employee acceptance of cobots (collaborative robots) and develop a tool to assess and improve acceptance in companies | Technology acceptance theory with a focus on the specifics of collaborative robots; a comprehensive approach to human factors in HRI; emphasis on safety, cultural and work changes |
| Kinkel *et al.* (2022) | Quantitative — cross-national survey | Structured survey questionnaire | 655 company representatives from the manufacturing industry (global sample) | To analyse technological, organizational and environmental prerequisites that influence successful AI adoption in manufacturing companies | Technology-Organization-Environment (TOE) framework |
| Hradecky *et al.* (2022) | Qualitative (exploratory interview study) | In-depth semi-structured interviews + reflexive thematic analysis | 17 senior managerial representatives from exhibition organisations across 9 Western European countries | To explore perceptions of AI and organizational readiness to adopt AI in the exhibition sector, and to develop a model of readiness factors | Synthesizes Technology-Organization-Environment (TOE) framework and Technology Readiness Index (TRI) to conceptualise organisational AI readiness factors |
| Tjebane *et al.* (2022) | Quantitative | Questionnaire survey | 169 construction professionals (Gauteng, SA) | Identify organizational factors influencing AI adoption in construction organizations | Literature on organizational factors of AI adoption, theoretical foundations on digital transformation and innovation in construction |
| Chatterjee, Rana, *et al.* (2021) | Quantitative (survey-based empirical study) | Structured questionnaire (36 items, 5-point Likert scale); PLS-SEM analysis | 340 valid responses from employees of small, medium and large manufacturing and production firms in India | To identify technological, organizational and environmental antecedents influencing the intention to adopt AI in manufacturing and production firms and to examine the moderating role of leadership support | Integrated TAM–TOE framework (Technology Acceptance Model – Davis, 1989; Technology–Organization–Environment framework – Tornatzky & Fleischer, 1990) |
| Kumar *et al.* (2021) | Mixed-method (MCDM – hybrid quantitative modeling with expert validation) | ISM (Interpretative Structural Modeling) & ANP (Analytic Network Process) | 18 identified barriers derived from literature and validated with domain experts | To identify and map critical barriers preventing AI adoption in public distribution systems (PDS) in India and to analyse their relationships and prioritise them | Barriers and technology adoption contextual framework with focus on socio-technical barriers (e.g., trust, literacy, political issues) |
| Pan and Pan (2020) | Quantitative | Questionnaire (closed-ended items, Likert scale, constructed from previous literature, piloted on 10 experts; structured questions on determinants from the TOE framework) | 94 typical construction contractors in Hong Kong (CEOs, directors, senior managers) | To examine the critical determinants of construction robot adoption at the organizational level and empirically validate a model of determinants in construction firms | TOE framework (Technology-Organization-Environment); also inspired by Diffusion of Innovations (DOI) theory |

*Source: custom processing*

## Conclusion

The aim of this article was to analyze the factors influencing the implementation of digital technologies and artificial intelligence in enterprises from a multilevel perspective that integrates individual, organizational and managerial determinants. Based on a systematic synthesis of existing studies, it is clear that the successful implementation of technologies is not the result of an isolated technological decision, but a complex process in which technological characteristics, organizational conditions, human behavior and managerial skills intersect. The analysis showed that at the individual level, factors such as perceived system complexity, trust in technology and concerns about privacy and security play a key role, which significantly affect the willingness of employees to accept and use technology. At the work process level, the match between technology and tasks is shown to be decisive, as well as the ability of organizations to ensure efficient operations without disrupting existing work processes. The organizational level is characterized by the importance of a culture of innovation, clearly defined roles and responsibilities, the availability of qualified professionals, training and the ability to manage resistance to change. At the managerial level, the fundamental role of managerial skills and active support from top management as a prerequisite for successfully linking technology initiatives with the strategic goals of the organization is repeatedly confirmed.

At the same time, it has been shown that current research is methodologically fragmented and often limited to one-off, cross-sectional studies that only to a limited extent capture the dynamics of implementation processes over time. A significant shortcoming is also the weak connection of the analyzed factors with measurable economic and performance indicators, such as productivity, process efficiency or return on investment in technologies. A particular research gap is represented by the context of Central and Eastern Europe, where technology implementation research is still predominantly descriptive and poorly integrated.

The contribution of this article lies in the systematization of existing knowledge into a unified analytical framework that allows for a better understanding of the mechanisms of technology implementation in enterprises. The study's conclusions create both a theoretical and methodological basis for future empirical research, which should focus on longitudinal analyses, multilevel models, and a deeper connection between technological, organizational, and managerial factors and the economic outcomes of digital transformation.

## References

Golightly, D., Chan-Pensley, J., Dadashi, N., Jundi, S., Ryan, B. and Hall, A. (2022), “Human, Organisational and Societal Factors in Robotic Rail Infrastructure Maintenance”, Sustainability, Vol. 14 No. 4, p. 2123, doi: 10.3390/su14042123.

Grover, P., Kar, A.K. and Dwivedi, Y.K. (2022), “Understanding artificial intelligence adoption in operations management: insights from the review of academic literature and

social media discussions", Annals of Operations Research, Vol. 308 No. 1–2, pp. 177–213, doi: 10.1007/s10479-020-03683-9.

Na, S., Heo, S., Han, S., Shin, Y. and Roh, Y. (2022), "Acceptance Model of Artificial Intelligence (AI)-Based Technologies in Construction Firms: Applying the TechnologyAcceptance Model (TAM) in Combination with the Technology–Organisation Environment (TOE) Framework", Buildings, Vol. 12 No. 2, p. 90, doi: 10.3390/buildings12020090.

Pan, Y., Froese, F., Liu, N., Hu, Y. and Ye, M. (2022), "The adoption of artificial intelligence in employee recruitment: The influence of contextual factors", The International Journal of Human Resource Management, Vol. 33 No. 6, pp. 1125–1147, doi: 10.1080/09585192.2021.1879206.

Phuoc, N. Van. (2022), "The Critical Factors Impacting Artificial Intelligence Applications Adoption in Vietnam: A Structural Equation Modeling Analysis", Economies, Vol. 10 No. 6, p. 129, doi: 10.3390/economies10060129.

Pizam, A., Ozturk, A.B., Balderas-Cejudo, A., Buhalis, D., Fuchs, G., Hara, T., Meira, J., et al. (2022), "Factors affecting hotel managers' intentions to adopt robotic technologies: A global study", International Journal of Hospitality Management, Vol. 102, p. 103139, doi: 10.1016/j.ijhm.2022.103139.

Nam, K., Dutt, C.S., Chathoth, P., Daghfous, A. and Khan, M.S. (2021), "The adoption of artificial intelligence and robotics in the hotel industry: prospects and challenges", Electronic Markets, Vol. 31 No. 3, pp. 553–574, doi: 10.1007/s12525-020-00442-3.

Singh, R.P., Hom, G.L., Abramoff, M.D., Campbell, J.P. and Chiang, M.F. (2020), "Current Challenges and Barriers to Real-World Artificial Intelligence Adoption for the Healthcare System, Provider, and the Patient", Translational Vision Science &Technology, Vol. 9 No. 2, p. 45, doi: 10.1167/tvst.9.2.45.

Campion, A., Gasco-Hernandez, M., Jankin Mikhaylov, S. and Esteve, M. (2022), "Overcoming the Challenges of Collaboratively Adopting Artificial Intelligence in the Public Sector", Social Science Computer Review, Vol. 40 No. 2, pp. 462–477, doi: 10.1177/0894439320979953.

Ghandour, A. (2021), "Opportunities and Challenges of Artificial Intelligence in Banking: Systematic Literature Review", TEM Journal, pp. 1581–1587, doi: 10.18421/TEM104-12.

Brooks, C., Gherhes, C. and Vorley, T. (2020), "Artificial intelligence in the legal sector: pressures and challenges of transformation", Cambridge Journal of Regions, Economy and Society, Vol. 13 No. 1, pp. 135–152, doi: 10.1093/cjres/rsz026.

Wang, K., Zhao, Y., Gangadhari, R.K. and Li, Z. (2021), "Analyzing the Adoption Challenges of the Internet of Things (IoT) and Artificial Intelligence (AI) for Smart Cities in China", Sustainability, Vol. 13 No. 19, p. 10983, doi: 10.3390/su131910983.

Kalyanaraman, A., Burnett, M., Fern, A., Khot, L. and Viers, J. (2022), "Special report: The AgAID AI institute for transforming workforce and decision support in agriculture",

Computers and Electronics in Agriculture, Vol. 197, p. 106944, doi: 10.1016/j.compag.2022.106944.

Kopp, T., Baumgartner, M. and Kinkel, S. (2021), "Success factors for introducing industrial human-robot interaction in practice: an empirically driven framework", The International Journal of Advanced Manufacturing Technology, Vol. 112 No. 3–4, pp. 685–704, doi: 10.1007/s00170-020-06398-0.

Nazaretsky, T., Ariely, M., Cukurova, M. and Alexandron, G. (2022), "Teachers' Trust In AI-Powered Educational Technology and a Professional Development Program To Improve IT", British Journal of Educational Technology, Vol. 53 No. 4, pp. 914–931, doi: 10.1111/bjet.13232.

Bröhl, C., Nelles, J., Brandl, C., Mertens, A. and Nitsch, V. (2019), "Human–Robot Collaboration Acceptance Model: Development and Comparison for Germany, Japan, China and the USA", International Journal of Social Robotics, Vol. 11 No. 5, pp. 709–726, doi: 10.1007/s12369-019-00593-0.

Leigh, N.G., Lee, H. and Kraft, B. (2022), "Disparities in robot adoption among U.S. manufacturers: a critical economic development challenge", Industry and Innovation, pp. 1–20, doi: 10.1080/13662716.2021.2007757.

Regona, M., Yigitcanlar, T., Xia, B. and Li, R.Y.M. (2022), "Opportunities and Adoption Challenges of AI in the Construction Industry: A PRISMA Review", Journal of Open Innovation: Technology, Market, and Complexity, Vol. 8 No. 1, p. 45, doi: 10.3390/joitmc8010045.

Delgado, J.M.D., Oyedele, L., Ajayi, A., Akanbi, L., Akinade, O., Bilal, M. and Owolabi, H. (2019), "Robotics and automated systems in construction: Understanding industry-specific challenges for adoption", Journal of Building Engineering, Vol. 26, p. 100868, doi: 10.1016/j.jobe.2019.100868.

Pan, M. and Pan, W. (2020), "Understanding the Determinants of Construction Robot Adoption: Perspective of Building Contractors", Journal of Construction Engineeringand Management, Vol. 146 No. 5, doi: 10.1061/(ASCE)CO.1943-7862.0001821.

Yang, Y., Chan, A.P.C., Shan, M., Gao, R., Bao, F., Lyu, S., Zhang, Q., et al. (2021), "Opportunities and Challenges for Construction Health and Safety Technologies under the COVID-19 Pandemic in Chinese Construction Projects", International Journal of Environmental Research and Public Health, Vol. 18 No. 24, p. 13038, doi: 10.3390/ijerph182413038.

Baumgartner, M., Kopp, T. and Kinkel, S. (2022), "Analysing Factory Workers' Acceptance of Collaborative Robots: A Web-Based Tool for Company Representatives", Electronics, Vol. 11 No. 1, p. 145, doi: 10.3390/electronics11010145.

Paluch, S., Tuzovic, S., Holz, H.F., Kies, A. and Jörling, M. (2022), "'My colleague is a robot' – exploring frontline employees' willingness to work with collaborative service robots", Journal of Service Management, Vol. 33 No. 2, pp. 363–388, doi: 10.1108/JOSM-11-2020-0406.

Richthofen, G. von, Ogolla, S. and Send, H. (2022), "Adopting AI in the Context of Knowledge Work: Empirical Insights from German Organizations", Information, Vol. 13 No. 4, p. 199, doi: 10.3390/info13040199.

Mogaji, E. and Nguyen, N.P. (2022), "Managers' understanding of artificial intelligence in relation to marketing financial services: insights from a cross-country study", International Journal of Bank Marketing, Vol. 40 No. 6, pp. 1272–1298, doi: 10.1108/IJBM-09-2021-0440.

Sbragia, R. (1984). Avaliação do desempenho de projetos em instituições de pesquisa. Um estudo empírico dentro do setor de tecnologia industrial. Revista de Administração, 19(1), 83-93.

Neumann, O., Guirguis, K. and Steiner, R. (2022), "Exploring artificial intelligence adoption in public organizations: a comparative case study", Public Management Review, pp. 1–27, doi: 10.1080/14719037.2022.2048685.

Whitford, A.B., Yates, J., Burchfield, A., Anastasopoulos, J.L. and Anderson, D.M. (2020), "The Adoption of Robotics by Government Agencies: Evidence from Crime Labs", Public Administration Review, Vol. 80 No. 6, pp. 976–988, doi: 10.1111/puar.13301.

Tjebane, M.M., Musonda, I. and Okoro, C. (2022), "Organisational Factors of Artificial Intelligence Adoption in the South African Construction Industry", Frontiers in Built Environment, Vol. 8, doi: 10.3389/fbuil.2022.823998.

Jöhnk, J., Weißert, M. and Wyrtki, K. (2021), "Ready or Not, AI Comes— An Interview Study of Organizational AI Readiness Factors", Business & Information Systems Engineering, Vol. 63 No. 1, pp. 5–20, doi: 10.1007/s12599-020-00676-7.

Mandapathil, M. and Meyer, J.E. (2021), "Acceptance and adoption of transoral robotic surgery in Germany", European Archives of Oto-Rhino-Laryngology, Vol. 278 No. 10, pp. 4021–4026, doi: 10.1007/s00405-021-06623-w.

Alghamdi, M.I. (2020), "Assessing factors affecting intention to adopt AI and ML: The case of the Jordanian retail industry", Periodicals of Engineering and Natural Sciences (PEN), Vol. 8 No. 4, pp. 2516–2524.

Kinkel, S., Baumgartner, M. and Cherubini, E. (2022), "Prerequisites for the adoption of AI technologies in manufacturing – Evidence from a worldwide sample of manufacturing companies", Technovation, Vol. 110, p. 102375, doi: 10.1016/j.technovation.2021.102375.

Kumar, S., Raut, R.D., Queiroz, M.M. and Narkhede, B.E. (2021), "Mapping the barriers of AI implementations in the public distribution system: The Indian experience",Technology in Society, Vol. 67, p. 101737, doi: 10.1016/j.techsoc.2021.101737.

Dora, M., Kumar, A., Mangla, S.K., Pant, A. and Kamal, M.M. (2021), "Critical success factors influencing artificial intelligence adoption in food supply chains", International Journal of Production Research, pp. 1–20, doi: 10.1080/00207543.2021.1959665.

Victor Mugabe, K. (2021), "Barriers and facilitators to the adoption of artificial intelligence in radiation oncology: A New Zealand study", Technical Innovations & Patient Support in Radiation Oncology, Vol. 18, pp. 16–21, doi: 10.1016/j.tipsro.2021.03.004.

Gupta, K.P. and Bhaskar, P. (2020), "Inhibiting and Motivating Factors Influencing Teachers' Adoption of AI-Based Teaching and Learning Solutions: Prioritization Using Analytic Hierarchy Process", Journal of Information Technology Education: Research, Vol. 19, pp. 693–723, doi: 10.28945/4640.

BenMessaoud, C., Kharrazi, H. and MacDorman, K.F. (2011), "Facilitators and Barriers to Adopting Robotic-Assisted Surgery: Contextualizing the Unified Theory of Acceptance and Use of Technology", edited by McCulloch, P.PLoS ONE, Vol. 6 No. 1, p. e16395, doi: 10.1371/journal.pone.0016395.

Parvez, M.O., Arasli, H., Ozturen, A., Lodhi, R.N. and Ongsakul, V. (2022), "Antecedents of human-robot collaboration: theoretical extension of the technology acceptance model", Journal of Hospitality and Tourism Technology, Vol. 13 No. 2, pp. 240–263, doi: 10.1108/JHTT-09-2021-0267.

Kalisz, D.E., Khelladi, I., Castellano, S. and Sorio, R. (2021), "The adoption, diffusion& categorical ambiguity trifecta of social robots in e-health – Insights from healthcare professionals", Futures, Vol. 129, p. 102743, doi: 10.1016/j.futures.2021.102743.

Simões, A.C., Lucas Soares, A. and Barros, A.C. (2020), "Factors influencing the intention of managers to adopt collaborative robots (cobots) in manufacturing organizations", Journal of Engineering and Technology Management, Vol. 57, p. 101574, doi: 10.1016/j.jengtecman.2020.101574.

Tang, A.L.L., Tung, V.W.S. and Cheng, T.O. (2020), "Teachers' perceptions of the potential use of educational robotics in management education", Interactive Learning Environments, pp. 1–12, doi: 10.1080/10494820.2020.1780269.

Chatterjee, S., Rana, N.P., Dwivedi, Y.K. and Baabdullah, A.M. (2021), "Understanding AI adoption in manufacturing and production firms using an integrated TAM-TOE model", Technological Forecasting and Social Change, Vol. 170, p. 120880, doi: 10.1016/j.techfore.2021.120880.

Siderska, J. (2021), "The Adoption of Robotic Process Automation Technology to Ensure Business Processes during the COVID-19 Pandemic", Sustainability, Vol. 13 No. 14, p. 8020, doi: 10.3390/su13148020.

Pan, M. and Pan, W. (2020), "Understanding the Determinants of Construction Robot Adoption: Perspective of Building Contractors", Journal of Construction Engineering and Management, Vol. 146 No. 5, doi: 10.1061/(ASCE)CO.1943-7862.0001821.

Hradecky, D., Kennell, J., Cai, W. and Davidson, R. (2022), "Organizational readiness to adopt artificial intelligence in the exhibition sector in Western Europe", International Journal of Information Management, Vol. 65, p. 102497, doi: 10.1016/j.ijinfomgt.2022.102497.

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# CONSUMER TRUST IN ARTIFICIAL INTELLIGENCE RECOMMENDATIONS

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***Abstract***
Consumer trust in artificial intelligence recommendations is becoming a critical factor in the digital economy yet remains understudied in the Central European context. This study examines the determinants of trust among Slovak consumers in AI recommendations for online shopping and service selection through a quantitative analysis of 204 respondents. The research tests seven hypotheses focused on the role of demographic factors (age, gender, education), AI experience, information asymmetry, and perceived principal-agent conflicts. The most significant age differences emerged in the perception of AI recommendation usefulness ($\chi^2 = 94.9$, $p < 0.001$, $\varepsilon^2 = 0.468$) with younger respondents demonstrating significantly higher trust across all dimensions. AI experience did not uniformly affect all aspects of algorithm aversion: it reduced rational concerns about manipulation ($\rho = -0.358$, $p < 0.001$) but had no impact on emotional beliefs about algorithms being "cold". Perceived information asymmetry and algorithm transparency emerged as the strongest predictors of trust ($\rho$ up to 0.855, $p < 0.001$). The perception of conflicting interests between platforms and consumers had a complex effect with the strongest correlation demonstrated for perception of advertiser influence on recommendations ($\rho = 0.693$). The findings confirm that cognitive understanding of algorithmic mechanisms is a fundamental factor in building trust and reducing information asymmetry in the digital economy. This study provides empirical evidence for regulatory and practical measures aimed at increasing AI system transparency.

***JEL classification:*** *D82, M31, O33*
***Keywords****: consumer trust, artificial intelligence, information asymmetry*

## Introduction

Artificial intelligence and its applications in recommendation systems have become an integral part of the digital shopping environment. Among the various forms of consumer-technology interaction, recommendation systems rank among the most controversial particularly concerning questions of trust, privacy, and transparency. While technical developers emphasize the increasing accuracy and personalization of AI systems, consumers themselves face growing concerns about algorithmic manipulation, hidden tracking, and conflicts of interest between their needs and platform profits.

Within the European Union, the issue of AI regulation and trust in AI systems has been significantly accelerated by the adoption of the Artificial Intelligence Act in 2024 which emphasizes transparency, explainability and accountability. Nevertheless, understanding consumer trust in AI in Central European countries remains substantially insufficient. Slovakia, as a country with relatively lower penetration of AI tools compared to Western

economies, offers a unique opportunity to examine factors of trust in AI at an early stage of technology adoption when consumer attitudes are still less formalized and therefore more sensitive to changes and information.

The theoretical foundations of this study draw from two economic concepts: information asymmetry theory and the principal-agent problem which are intensively studied in the context of corporate governance. Information asymmetry in the context of AI arises when platforms and their developers have substantially more information about how algorithms function, how data are processed, and what commercial objectives they pursue than consumers do.This asymmetry creates an ideal environment for principal-agent conflicts where algorithms in practice often serve non-consumer interests: platform profit, advertiser placements, and data retention. Current research on AI trust at the global level has revealed several consistent findings. A systematic review by Afroogh et al. (2024) analysing 182 studies indicates that age is a significant predictor of trust in AI with younger users demonstrating higher trust. Men generally express higher trust than women often attributed to different patterns of risk appetite and security sensitivity. Education has a complex relationship with trust: higher levels of education can paradoxically increase both trust and scepticism as better-educated individuals better understand both AI's potential and its risks. Experience with AI and frequency of its use are positive predictors of trust though the effect is not uniform across all aspects of trust.

The phenomenon of "algorithm aversion"—the tendency of people to prefer human decisions over algorithmic ones even when algorithms are more accurate—represents a separate research issue examined in detail by Dietvorst et al. (2015). However, according to more recent research the phenomenon is context-dependent: people are willing to accept algorithms in objective data-driven tasks but reject them in tasks requiring subjective or emotional judgment.

The contribution of this study lies both in extending AI trust research into the Central European context and in applying classical economic theories (information asymmetry, principal-agent problem) to a new phenomenon of algorithmic mediation. Although global studies provide valuable insights, local particularities in legislation, culture and technological literacy levels mean that Western findings cannot be mechanically transposed to the Slovak population. Most available studies focus on general "trust in AI" without deeper distinction between individual aspects (cognitive, emotional, behavioural) and without deeper examination of the role of information asymmetry and conflicts of interest. The main objective of this study is to identify and quantify factors determining trust among Slovak consumers in AI recommendations with particular focus on the role of information asymmetry and principal-agent conflicts. Simultaneously, we wish to test the hypothesis that algorithm transparency and explanation quality are the key mechanisms for reducing information asymmetry and building trust. The objective is also to distinguish between different types of concerns about algorithms—rational concerns about manipulation which diminish with experience, and emotional beliefs about machines' inability to understand human needs.

## 1 Current state of the solved problem at home and abroad

Trust in artificial intelligence systems (AI) is a multidimensional construct that encompasses cognitive, emotional, and behavioural dimensions (Gu et al., 2024; Afroogh et al., 2024). The Trust Building Model (TBM) identified key components of trust in online environments: structural assurance, perceived reputation, perceived quality, perceived web risk, trust beliefs, and behavioural intentions (Saxborn et al., 2024). In the context of AI recommendation systems this model extends to algorithm-specific factors: perceived authenticity of recommendations, service quality, mechanism transparency and willingness to share interaction data (Saxborn et al., 2024; Lee, 2025).

The Technology Acceptance Model (TAM) provides a framework for understanding the acceptance of new technologies where perceived usefulness and perceived ease of use are primary determinants of technology adoption (Rejali et al., 2023; Yang et al., 2025). In the context of AI recommendations, research demonstrates that up to 63 % of differences in purchase behaviour can be explained through factors such as AI system quality, consumer trust, and user experience (Syifa & Vanany, 2023).

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) extend the original TAM model with additional factors: hedonic motivation, price, habit, expected performance and social influence (Xue et al., 2024; Ibrahim et al., 2025). Application of the UTAUT2 model in the context of AI adoption has shown that expected performance, social influence and hedonic motivation are significant predictors of behavioral intention to use AI tools (Rejali et al., 2023).

### 1.1 Information asymmetry and Principal-Agent problem in AI systems

Information asymmetry in the context of AI arises when one party to a transaction has more or better information than the other leading to market forecast imbalances and potential erosion of trust (Board Foundation, 2025; Koroye & Alaekwe, 2025). AI systems negatively affect traditional forms of information asymmetry in several ways: (1) opacity of algorithmic decision processes, (2) asymmetric access to data and performance metrics, (3) complexity of machine learning models that exceeds average consumer understanding (IMF, 2023; NTIA, 2024). The Board Foundation (2025) argues that AI has the potential to transform corporate governance from a paradigm of information asymmetry to information symmetry. However, current reality shows that AI more often deepens information imbalances creating new forms of opacity and monitoring challenges (Koroye & Alaekwe, 2025; IMF, 2023).

The principal-agent problem occurs when an employee (agent) has different interests from an employer (principal) and acts in pursuit of their own interests. In the context of AI, the principal-agent problem represents a modern manifestation of traditional economic theory. The combination of algorithm opacity and their functioning create significant barriers for human principals (owners, stakeholders) in identifying cases of misuse or unethical algorithm behaviour (Kim, 2020). In the context of consumer AI applications, there is also the problem of "shadow principals"—situations where AI

agents that appear to act in users' interests prioritize the interests of developers, platforms, or advertisers (NTIA, 2024).

### 1.2 Algorithm aversion and transparency

Algorithm aversion—the tendency of people to prefer human recommendations over algorithmic ones, even when algorithms achieve better results—represents a significant barrier to AI system adoption (Dietvorst et al., 2015; Reich & Savary, 2020). The work of Dietvorst et al. (2015) demonstrated that people are particularly averse to algorithmic predictors after seeing them outperform human predictors. Reich and Savary (2020) extended this research by identifying that consumers avoid algorithmic advice based on often-mistaken assumptions that algorithms, unlike humans, cannot learn from mistakes.

Logg et al. (2019) identified the "algorithm appreciation effect" where consumers may prefer algorithmic recommendations in specific contexts particularly in objective data-driven tasks. More recent research has shown that algorithm aversion depends on task characteristics with consumers rejecting artificial intelligence in tasks requiring subjective or emotional judgment (Buder & Badali, 2024; Castelo et al., 2019).

Transparency and explainability emerge as the key factors for calibrating trust in AI systems (Bauer et al., 2023; Arrieta et al., 2020). Bauer et al. (2023) explained in their study that providing function-based explanations enables artificial intelligence systems to transform how users perceive and utilize information. They also found asymmetric effects—explanations can reinforce existing misconceptions and create spillover effects into other decision domains (Bauer et al., 2023).

### 1.3 Demographic factors and AI trust

Sociodemographic factors play a significant role in determining the level of trust in AI systems (Kozak et al., 2024; Afroogh et al., 2024). Research by Kozak et al. (2024) on a sample of 2,098 students in Poland and the United Kingdom identified nationality, gender, length of study, place of study, religious practices, and religious development as significant predictors of trust in AI. Regression analysis revealed that these predictors explain 16.5 % of total variance in trust (Kozak et al., 2024). The systematic review by Afroogh et al. (2024) analysing 182 studies confirmed that age is a significant factor with younger users demonstrating higher trust in AI than older users. Men express higher trust than women which researchers attribute to women being generally more cautious and inclined to risk avoidance expressing greater concerns about safety and privacy related to new technology adoption (Kozak et al., 2024; Ryan et al., 2025).

Education and AI knowledge have a complex relationship with trust. Students in higher academic years demonstrate higher trust in AI than students in early years suggesting that length of study may influence perception and trust in AI (Kozak et al., 2024). Consumers who consider themselves knowledgeable about AI are simultaneously more trusting and more skeptical—they are more aware of AI's potential but also recognize its risks (Ryan et al., 2025).

### 1.4 AI in Central European and Slovak context

Research on AI adoption in Central European economies reveals heterogeneity across countries. According to the CEDMO Trends survey (2025), 43 % of Slovaks had at least occasional practical experience using generative AI tools with 11 % using them daily and 17 % weekly. For comparison, in the Czech Republic, 38 % of the population used AI tools with 7 % being daily users (CEDMO Hub, 2025).

Slovak users are cautious about trusting AI. More than three-fifths (60 %) of Slovak users report a tendency to trust outputs but verify them from other information sources. Only 6 % of Slovak users fully trust generative AI without further verification. The most common tool for verifying data provided by generative AI models is the internet search engine used by 73 % of Slovak users (CEDMO Hub, 2025).

Ethical aspects of AI tools are a priority for Slovak consumers. The vast majority (76 %) report that AI tools should respect user privacy. A high proportion of respondents are also interested in thorough testing of these new technologies (72 %) to ensure they work as expected. According to 75 % of Slovaks, users should be informed about the system's purpose, including how it functions and what limitations can be expected (CEDMO Hub, 2025).

## 2 The aim of the paper, research methodology and methods

This section focuses on describing the research design, objectives established, and methodological approaches applied during the empirical research. Its objective is to provide a transparent picture of how the research was designed, what specific questions the research team posed, and what methods were used to examine these questions.

### 2.1 Research objectives

The primary objective of this research is to identify and quantify factors that influence trust among Slovak consumers in AI recommendations for online shopping and service selection with particular emphasis on the role of information asymmetry and the principal-agent problem. To achieve the primary objective, four sub-objectives were established.

The first sub-objective is to create a comprehensive overview of relevant domestic and foreign literature focused on trust in AI systems including theoretical models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT2). The second objective is to analyse the relationship between demographic characteristics (age, gender, education) and the level of trust in AI recommendations including identification of possible statistically significant differences between different population groups. The third objective is to examine how previous experience with artificial intelligence affects current consumer trust including analysis of the algorithm aversion phenomenon. The fourth objective is to measure the impact of perceived information asymmetry and principal-agent problems on trust in AI recommendations while simultaneously testing whether the algorithm transparency and

clear explanations reduce perceived asymmetry and increase trust. These four sub-objectives are interconnected and contribute to a holistic understanding of factors determining trust in AI in the Slovak context.

### 2.2 Research hypotheses

To fulfil the primary objective of this research, we established several assumptions and hypotheses described in more detail in Chapter 4:

Hypothesis 1: Younger consumers demonstrate higher levels of trust in AI recommendations than older consumers.

- $H_0$: There is no statistically significant difference in the level of trust in AI recommendations among different age groups of consumers.
- $H_1$: Younger consumers demonstrate higher levels of trust in AI recommendations than older consumers.

Hypothesis 2: Men demonstrate higher levels of trust in AI recommendations than women.

- $H_0$: There is no statistically significant difference in the level of trust in AI recommendations between different genders.
- $H_2$: Men demonstrate higher levels of trust in AI recommendations than women.

Hypothesis 3: Consumers with higher levels of education demonstrate higher levels of trust in AI recommendations than consumers with lower levels of education.

- $H_0$: There is no statistically significant difference in the level of trust in AI recommendations among consumers with different levels of education.
- $H_3$: Consumers with higher levels of education demonstrate higher levels of trust in AI recommendations than consumers with lower levels of education.

Hypothesis 4: Previous experience with AI positively influences trust in AI recommendations.

- $H_0$: Previous experience with AI has no statistically significant impact on trust in AI recommendations and algorithm aversion.
- $H_4$: Previous experience with AI positively influences trust in AI recommendations and algorithm aversion.

Hypothesis 5: Increased perceived information asymmetry reduces trust in AI recommendations.

- $H_0$: Perceived information asymmetry has no statistically significant impact on trust in AI recommendations.
- $H_5$: Increased perceived information asymmetry reduces trust in AI recommendations.

Hypothesis 6: There is a statistically significant negative relationship between perception of conflicts of interest and trust in AI recommendations (higher perception of conflict relates to lower trust).

- $H_0$: There is no statistically significant relationship between perception of conflicts of interest and the level of trust in AI recommendations.
- $H_6$: There is a statistically significant negative relationship between perception of conflicts of interest and trust in AI recommendations (higher perception of conflict relates to lower trust).

Hypothesis 7: There is a statistically significant positive relationship between perceived algorithm transparency and trust in AI recommendations (higher transparency relates to higher trust).

- $H_0$: There is no statistically significant relationship between perceived algorithm transparency and the level of trust in AI recommendations.
- $H_7$: There is a statistically significant positive relationship between perceived algorithm transparency and trust in AI recommendations (higher transparency relates to higher trust).

### 2.3 Research methodology and methods

The research employs a quantitative approach based on cross-sectional empirical research which collects data from respondents at a single point in time and enables analysis of relationships among variables. The sample consists of 204 respondents. Data were collected through an online questionnaire distributed to the Slovak population over 18 years of age with practical experience using the internet and online shopping. The sample was stratified by age groups, gender and education level. The questionnaire was available in Slovak and contained five main sections: (1) demographic characteristics (age, gender, education), (2) previous experience with AI including number and type of interactions with AI systems, (3) perceived information asymmetry and principal-agent problem, (4) algorithm transparency and (5) trust in AI recommendations.

Data analysis was performed using Jamovi software, a freely available statistical tool compatible with standard analysis procedures. To test the first hypothesis concerning age differences in AI trust, the Kruskal-Wallis's test was used, a non-parametric alternative to classical ANOVA. This method was chosen because it compares five age groups simultaneously and does not require the normality assumption. The K-W test results were supplemented with epsilon-squared ($\varepsilon^2$) effect size calculations which quantify the practical significance of observed differences. For the second hypothesis on gender differences, involving a comparison of only two groups, the Mann–Whitney U test was applied and the effect size r was calculated. For the third hypothesis concerning education effects, the Kruskal–Wallis test was used again with calculation of $\varepsilon^2$. To test the fourth hypothesis concerning AI experience, the fifth hypothesis concerning information asymmetry, the sixth hypothesis concerning principal-agent problems, and the seventh hypothesis concerning transparency, Spearman correlation analyses were applied. Spearman's correlation coefficient ($\rho$) is a non-parametric measure of association suitable for ordinal and continuous variables and does not require assumption of linear relationships. For each correlation, a p-value was calculated to assess statistical significance. All statistical tests were performed at an alpha level equal to 0.05 meaning that results with p-values less than 0.05 are considered statistically

significant. Additionally, effect sizes were calculated to interpret the practical significance of findings.

The methodological framework described in this section provides the foundation for empirical testing of established hypotheses and achievement of defined research objectives. The combination of literature analysis, quantitative cross-sectional research and application of non-parametric statistical methods enabled us to achieve the primary objective and identify and quantify factors determining trust among Slovak consumers in AI recommendations.

## 3 Research result

This chapter presents empirical findings of the research examining factors influencing Slovak consumer trust in artificial intelligence recommendations. The research was conducted on a sample of 204 respondents using an online questionnaire with 40 items measuring multiple dimensions of trust, AI experience, information asymmetry and other relevant variables. Analysis was performed using Jamovi software employing non-parametric statistical methods suitable for empirically determined violation of the normality assumption. In total, seven research hypotheses were tested aimed at identifying key determinants of trust in AI in a Slovak consumer sample with particular emphasis on the role of information asymmetry and principal-agent problems as theoretically outlined in the introduction.

The research sample consisted of 204 Slovak respondents over 18 years of age with practical experience using the internet and online shopping. Sample structure was stratified by key demographic characteristics relevant to hypothesis testing: age groups (18-25 years, 26-35 years, 36-50 years, 51-65 years, 65+ years), gender (women, men), and highest level of education achieved (primary, secondary, university first degree, university second and third degrees).

Regarding experience with AI tools, respondents demonstrated heterogeneous profiles. The variable measuring frequency of AI tool use (1-5 scale) captured the intensity of interaction with AI systems in daily life while the variable measuring level of AI experience (1-5 scale) reflected subjective perception of own expertise in this field. Assessment of previous AI experience (1-5 scale) measured whether respondents perceived their previous interactions with AI positively or negatively which, according to literature, has significant impact on formation of future trust.

For testing the first hypothesis, the Kruskal-Wallis's test was applied to all seven items measuring trust in AI recommendations (1-10 scale). Results provided strong empirical support for $H_1$ across all trust dimensions. The most pronounced age differences appeared in the item "AI recommendations are useful and help me make decisions" ($\chi^2$ (4) = 94.9, $p < 0.001$, $\varepsilon^2 = 0.468$) representing a large effect according to conventional criteria. Nearly half of the variance (46.8 %) in this trust dimension can be attributed to age differences. Other items showed similar results. Notably, the smallest, though still highly statistically significant difference, appeared in the item "I believe the AI system takes my interests into account" ($\chi^2$ (4) = 35.6, $p < 0.001$, $\varepsilon^2 = 0.175$). This pattern suggests

that while younger respondents generally trust more in technical aspects of AI (reliability, quality, usefulness), generational differences are somewhat smaller in the dimension of personal relevance and consideration of individual interests. This finding can be interpreted in the context of the principal-agent problem discussed in the theoretical section—concerns about conflicts of interest between platforms and users appear to be distributed less asymmetrically across generations than general trust in the technical competence of AI systems.

Younger consumers demonstrate higher trust across all these dimensions—from cognitive confidence in reliability and quality through emotional sense of safety to behavioural intention to follow AI recommendations in the future. We accept hypothesis $H_1$ in assumption 1 and reject $H_o$.

The second research hypothesis predicted that men demonstrate higher levels of trust in AI recommendations than women. This assumption is based on research findings that women are generally more cautious and inclined toward risk avoidance expressing greater concerns about security and privacy related to adoption of new technologies (Kozak et al., 2024; Ryan et al., 2025).

The Mann-Whitney U test applied to seven trust items provided partial support for $H_2$. Statistically significant differences between men and women appeared in four of five items. The most pronounced difference was identified in the item "AI recommendations have high quality and reliability" ($U = 4133$, $p = 0.008$, $r = -0.194$). Effect sizes ranged from small to medium representing milder but consistent gender differences compared to more pronounced age differences identified in $H_1$. From the perspective of information asymmetry theory and risk aversion, we can interpret these results as suggesting that women may be more sensitive to ambiguities and opacity in algorithmic processes manifesting lower trust in technical aspects of AI. Paradoxically, transparency itself showed no gender differences ($p = 0.259$) suggesting that both genders perceive current AI systems as similarly non-transparent, but their reactions to this transparency differ—women translate it into lower confidence in reliability and safety. Hypothesis $H_2$ is therefore partially supported.

The third research hypothesis predicted that consumers with higher levels of education demonstrate higher levels of trust in AI recommendations. The theoretical foundations of this hypothesis are based on findings by Kozak et al. (2024) that students in higher academic years demonstrate higher trust in AI suggesting that length and intensity of education may influence perception and trust in AI systems.

The Kruskal-Wallis's test applied to three education levels (primary/secondary; university first degree; university second and third degrees) revealed partial results. Statistically significant differences appeared in three of five items: "AI recommendations have high quality and reliability," "I believe the AI system takes my interests into account," and "AI recommendations are reliable and accurate." The item "I will follow AI recommendations in the future" showed weaker though still statistically significant effect. Items "I feel safe following AI recommendations," "I believe AI recommendations are transparent and justifiable," and "AI recommendations are useful and help me make decisions" did not

reach statistical significance though the first two were close to the critical value of p = 0.05.

Effect sizes were generally smaller than in the education hypothesis indicating that education has milder impact on AI trust than age. This pattern can be interpreted through the information asymmetry concept— more educated respondents may have a better understanding of basic AI and algorithmic principles which reduces perceived information asymmetry and supports cognitive trust in AI quality and reliability. Education by itself, however, may not necessarily influence trust, sense of safety, or perception of transparency of specific AI implementations in commercial platforms.

Education has differentiated impact on trust in AI depending on context. People with different education levels clearly recognize AI usefulness ($\varepsilon^2 = 0.014$) but differ significantly in how they assess its quality and reliability ($\varepsilon^2 = 0.101$). According to Ryan et al. (2025), this explains the paradox whereby more educated users are simultaneously more trusting and more sceptical: they better understand AI's potential but also recognize its risks. Differences between groups are therefore small. Hypothesis $H_3$ was confirmed; however, education influences trust more weakly than age and only in certain aspects.

The fourth research hypothesis predicted that previous experience with AI positively influences trust in AI recommendations and negatively influences algorithm aversion. This hypothesis reflects findings by Reich and Savary (2020) that people tend to reject algorithms based on incorrect assumptions that they cannot learn from mistakes and research by Logg et al. (2019) on the "algorithm appreciation effect" in specific contexts.

Spearman correlation analyses provided strong and consistent support for $H_4$. All three AI experience variables—frequency of use, level of experience, and assessment of previous experience—showed statistically highly significant positive correlations with all AI trust items ($p < 0.001$ in all cases). Frequency of AI tool use showed the strongest correlations with trust. Level of experience (subjective assessment of own expertise) correlated most strongly with items "AI recommendations are useful" and "I will follow AI in the future." Three of five aversion items showed statistically significant negative correlations with experience supporting $H_4$. The strongest relationship appeared in the item "I feel algorithms are trying to manipulate and pressure my decisions" which correlated negatively with frequency of AI use ($\rho = -0.358$, $p < 0.001$), level of experience ($\rho = -0.299$, $p < 0.001$), and experience assessment ($\rho = -0.222$, $p = 0.001$). This indicates that the more respondents use AI and the more positively they assess their experience, the less they perceive manipulative potential of algorithms.

Two aversion items showed no significant correlations with experience: "I would prefer to rely on my own experience and instincts rather than algorithms" and "Algorithms are too cold and don't consider human needs." This finding is theoretically significant suggesting that while AI experience does mitigate concerns about manipulation, it does not change fundamental beliefs that machines cannot understand human needs and that human intuition has irreplaceable value.

This finding is confirmed by Castelo et al. (2019) who showed that people reject AI in tasks requiring emotional or subjective judgment. Concerns about "coldness" of algorithms and preference for own instincts are emotional beliefs that do not change with technical experience. Concerns about manipulation, by contrast, are more rational, and positive experiences with AI mitigate them because they demonstrate that algorithms serve users. Experience with AI thus has differentiated effects on different types of concerns. Hypothesis $H_4$ is supported, but with the note that experience only changes certain aspects of algorithm aversion.

The fifth research hypothesis predicted that increased perceived information asymmetry reduces trust in AI recommendations. This hypothesis is theoretically grounded in conceptualization of information asymmetry in AI context by Board Foundation (2025) and Koroye and Alaekwe (2025) who argue that the opacity of algorithmic decision-making processes, asymmetric access to data, and the complexity of machine-learning models create significant information imbalances between platforms and consumers.

An important methodological note is that questionnaire items measuring information asymmetry are formulated positively (e.g., "I understand how the AI system makes recommendations," "I know how my data is used") meaning higher scores indicate lower information asymmetry (better understanding, more information). Therefore, we expect positive correlations between these items and trust which empirically confirm the hypothesis that higher information asymmetry (lower scores) reduces trust.

Correlation analyses provided strong and consistent support for $H_5$. All six items measuring perceived information asymmetry showed statistically highly significant positive correlations with all seven trust items ($p < 0.001$ in all cases). The strongest relationships appeared between transparency items and cognitive dimensions of trust. "I understand how the AI system makes recommendations" correlated strongly with "AI recommendations are useful" ($\rho = 0.710$, $p < 0.001$), "AI is reliable" ($\rho = 0.587$, $p < 0.001$), and "I will follow AI" ($\rho = 0.644$, $p < 0.001$). The correlation pattern for the item "I feel in control of my data" is particularly interesting. This item showed the weakest correlations with trust among all six information asymmetry items (e.g., with AI quality $\rho = 0.311$, with usefulness $\rho = 0.267$, with future use $\rho = 0.244$) though all remained statistically highly significant ($p < 0.001$). This suggests that while cognitive understanding of AI mechanisms (how it works, what parameters it uses) has strong relationship with trust, mere feeling of control over own data has weaker effect. From principal-agent theory perspective, we can interpret this finding as suggesting that consumers may be relatively resigned to real lack of control over their data in the digital economy, and therefore this dimension carries less weight in forming trust than transparency of algorithmic processes themselves.

Hypothesis $H_5$ is fully supported by correlations across all information asymmetry and trust dimensions.

The sixth research hypothesis predicted that increased perception of conflicts of interest reduces trust in AI recommendations. Spearman correlation analyses applied to all six principal-agent problem items and all seven AI trust items provided strong support for

$H_6$. All correlations were statistically highly significant ($p < 0.001$) showing consistently positive relationships with effect sizes from moderate to very strong.

The strongest correlations were shown by the item "Advertisers have greater influence than consumers" with usefulness ($\rho = 0.693$), future use ($\rho = 0.639$), and quality ($\rho = 0.602$). The item "I believe platforms act in my interest" correlated strongly with sense of safety ($\rho = 0.662$), transparency ($\rho = 0.630$), and perception of concern for my needs ($\rho = 0.581$). The item "I believe platforms care about data security" correlated with safety ($\rho = 0.586$), transparency and quality (both $\rho = 0.549$). Notably, the item "AI tries to convince me to buy regardless of usefulness" showed the weakest correlations ($\rho = 0.289$ to 0.370) suggesting that perception of manipulative character of AI has less relationship with trust than other principal-agent problem dimensions.

These results confirm that perception of platform intentions and interest alignment is a fundamental predictor of trust across all dimensions. Hypothesis $H_6$ is supported by correlation relationships empirically confirming the principal-agent problem concept in AI context as defined by Board Foundation (2025) and NTIA (2024). Algorithm transparency and clear explanations of AI mechanisms are confirmed as fundamental factors in building consumer trust in AI recommendation systems in the Slovak context.

The seventh research hypothesis predicted that algorithm transparency and clear explanations of AI mechanisms increase consumer trust. This hypothesis stems from theoretical framework by Arrieta et al. (2020) and empirical findings by Bauer et al. (2023) who demonstrated that providing function-based explanations enables artificial intelligence systems to transform how users perceive and use information. Transparency and explainability are key factors for calibrating trust in AI systems helping reduce perceived information asymmetry between platforms and consumers. Spearman correlation analyses applied to six transparency items and seven trust items provided support for $H_7$. All 42 correlations were statistically highly significant ($p < 0.001$), showing positive relationships ($\rho = 0.244$ to 0.855). Positive correlations confirm the hypothesis: the better respondents understand AI mechanisms, the higher trust they demonstrate.

The item "I understand how the AI system makes recommendations" showed the strongest correlations with usefulness ($\rho = 0.710$), quality and future use ($\rho = 0.644$) demonstrating that understanding basic AI mechanisms is a strong predictor of trust. The item “I know how my data is used” showed moderate to strong correlations with transparency and usefulness. The item "Platforms adequately inform me about algorithms" showed relatively weaker correlations suggesting subjective understanding has stronger relationship with trust than perception of platforms' communication efforts. The item "I feel in control of my data" showed the weakest correlations.

These results confirm that respondents who perceive AI systems as transparent and understandable demonstrate consistently higher trust. The difference between "I understand" items (strong correlations) and "I have control" items (weak correlations) reflects the reality of the digital economy where consumers acknowledge limitations of their actual control but nevertheless demand transparency. Hypothesis $H_7$ is fully supported by correlation relationships confirming that algorithm transparency is an important factor in building trust in AI recommendations.

From seven tested hypotheses, six were fully supported by empirical data ($H_1$, $H_4$, $H_5$, $H_6$, $H_7$) and one was partially supported ($H_2$). The strongest effects appeared in age differences ($H_1$, $\varepsilon^2$ up to 0.468), AI experience, and information asymmetry ($H_4$, $H_5$, $\rho$ up to 0.710). Education had weaker effects ($H_3$, $\varepsilon^2$ = 0.039-0.101), gender differences were subtle ($H_2$) while perception of conflicts of interest and transparency had greater effects on trust ($H_6$, $H_7$, $\rho$ = 0.289-0.855).

## 4 Discussion

The empirical findings of this study provide a perspective on consumer trust in AI recommendations and broaden understanding of theoretical models of information asymmetry and the principal-agent problem. The strongest effects appeared in age differences where younger respondents demonstrated significantly higher trust across all dimensions ($\varepsilon^2$ = 0.175 to 0.468). A noteworthy finding is that the smallest age differences appeared in the item measuring perception of whether AI considers individual interests suggesting that principal-agent problem concerns are distributed less asymmetrically across generations. Gender differences were less pronounced with women showing lower trust in technical aspects of AI, yet paradoxically, perceived algorithm transparency showed no gender differences. The difference lies in how both genders react to perceived opacity: women translate it into lower confidence in reliability and safety. Education showed the weakest effects reflecting a paradox where educated respondents are simultaneously more trusting and more sceptical supporting more rational calibrated trust.

The hypothesis concerning AI experience was fully supported except for two aversion items. This finding distinguishes between rational and emotional concerns about algorithms: experience mitigates rational concerns about manipulation, but emotional beliefs that machines cannot understand human needs do not change with technical experience. Hypotheses testing information asymmetry and transparency impact provided the strongest empirical correlations ($\rho$ up to 0.855) supporting theoretical frameworks. An interesting paradox emerged from the "I feel control over my data" item showing the weakest correlations with all trust dimensions ($\rho$ = 0.244 to 0.376). Cognitive understanding of algorithms is a stronger predictor of trust than perceived sense of control. Consumers are relatively resigned to real control over data but view secure understanding of data use as essential. The principal-agent problem hypothesis was supported by several correlations ($\rho$ = 0.289 to 0.693). The strongest correlations appeared for the advertiser influence item suggesting more sophisticated users who understand digital platform business models and accept this reality but still trust AI technical quality. The item about persuading toward purchases regardless of benefit showed the weakest correlations, possibly reflecting normalization of manipulation techniques in e-commerce.

## Conclusion

This study identified and quantified factors determining trust among Slovak consumers in AI recommendations. Age is the strongest demographic predictor ($\varepsilon^2$ up to 0.468), but

generational differences are less pronounced in the dimension of perceiving individual relevance. Gender differences are subtle but consistent. Education has lower impact and reflects a paradox where educated respondents combine higher trust with greater scepticism. AI experience has differentiated effects on trust: it reduces rational concerns about manipulation but does not change emotional beliefs. Transparency and cognitive understanding are the strongest predictors (ρ up to 0.855) confirming information asymmetry theory. Principal-agent problem is a relevant factor with complex correlation patterns.

Practical implications focus on prioritizing increased algorithm transparency and explanation quality which is not merely "nice-to-have" but a fundamental factor in building trust. Communication should be differentiated by demographic groups. Regulation should focus on transparency obligations rather than consumer control requirements. Implementation of "right to explanation" confirmed as critically important. Regulation should distinguish between rational and emotional aspects of aversion. Educational initiatives to increase algorithmic literacy should be a priority. Future studies could test causal relationships through experimental designs, extend analysis to other Central European countries, combine quantitative and qualitative data, and track trust dynamics over time. Consumer trust in AI is not a simple "yes or no" phenomenon, but a dynamic construct formed by mutual interaction of age, technology experience, perceived algorithm transparency, and perception of platform intentions. This study provides empirical evidence for the claim that transparency of digital processes and ability to understand these processes are key pillars of trust and responsible AI in the digital economy.

**Limits of the Study**

This study has several important limitations. First, although the sample size of 204 respondents is adequate for statistical analysis, it may be considered relatively small for generalization to the entire Slovak consumer population and likely represents more digitally literate users. Second, the cross-sectional design captures data at a single point in time and does not allow for causal inference or examination of trust dynamics over time. Third, all data were self-reported through questionnaires, potentially introducing social desirability bias. Fourth, findings are specific to the Slovak market and may not generalize to other countries with different regulatory frameworks or cultural contexts. Despite these limitations, the study provides evidence for the relationship between information asymmetry, algorithm transparency, and consumer trust in AI recommendations.

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**References**

Afroogh, S., Jalali, M. S., & Holm, M. (2024). Trust in AI: Progress, challenges, and future directions. Scientific Reports, 14, Article 27312. https://doi.org/10.1038/s41598-024-78490-4

Arrieta, A. B., Díaz-Rodríguez, N., Del Ser, J., Bennetot, A., Tabik, S., Barbado, A., García, S., Gil-López, S., Molina, D., Benjamins, R., Chatila, R., & Herrera, F. (2020). Explainable artificial intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. Information Fusion, 58, 82–115. https://doi.org/10.1016/j.inffus.2019.12.012

Bauer, K., Hinz, O., van der Aalst, W., & Weinhardt, C. (2023). Expl(AI)ned: The impact of explainable artificial intelligence on users' information processing. Information Systems Research, 34(1), 1–22. https://doi.org/10.1287/isre.2023.1199

Board Foundation. (2025, September 9). From information asymmetry to intelligence symmetry: How AI will reshape corporate governance. Board Foundation Research. https://boardfoundation.org/en/insight/from-information-asymmetry-to-intelligence-symmetry-how-ai-will-reshape-corporate-governance/

Buder, J., & Badali, S. (2024). Beyond mere algorithm aversion: Are judgments about algorithms more variable than about humans? Cognitive Science, 48(12), Article e13542. https://doi.org/10.1177/00936502241303588

Castelo, N., Bos, M. W., & Lehmann, D. R. (2019). Task-dependent algorithm aversion. Journal of Marketing Research, 56(5), 809–825. https://doi.org/10.1177/0022243719851788

CEDMO Hub. (2025, June 24). 62% of Czechs and 57% of Slovaks do not consciously use generative AI tools in their work or school. CEDMO Trends. https://cedmohub.eu/study-generative-ai-czech-republic-slovakia/

Dietvorst, B. J., Simmons, J. P., & Massey, C. (2015). Algorithm aversion: People erroneously avoid algorithms after seeing them err. Journal of Experimental Psychology: General, 144(1), 114–126. https://doi.org/10.1037/xge0000033

Gu, C., Zhou, Z., Lv, Y., & Gong, Z. (2024). Exploring the mechanism of sustained consumer trust in AI chatbots following service failures. Humanities and Social Sciences Communications, 11, Article 1358. https://doi.org/10.1057/s41599-024-03879-5

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning. https://eli.johogo.com/Class/CCU/SEM/_Multivariate%20Data%20Analysis_Hair.pdf

Hardcastle, K., Jones, P., & Comfort, D. (2025). Understanding customer responses to AI-driven recommendations and personalized advertisements. Journal of Strategic Marketing, 33(3), 412-429. https://doi.org/10.1080/00913367.2025.2460985

Ibrahim, F., Ali, D. N., & Saputri, M. E. (2025). The technology acceptance model and adopter type differences in artificial intelligence adoption for e-commerce. Frontiers in Artificial Intelligence, 8, Article 1496518. https://doi.org/10.3389/frai.2024.1496518

International Monetary Fund. (2023). Advances in artificial intelligence: Implications for capital markets (Staff Discussion Note No. 2023/00x). https://www.imf.org/en/-/media/files/publications/gfsr/2024/october/english/ch3.pdf

Kim, E. S. (2020). Deep learning and principal–agent problems of algorithmic governance. Technology in Society, 63, Article 101374. https://doi.org/10.1016/j.techsoc.2020.101374

Koroye, T., & Alaekwe, S. (2025). The AI paradox in central banking: New powers, new vulnerabilities. Journal of Central Banking Law and Institutions, 4(3), 533–566. https://doi.org/10.21098/jcli.v4i3.441

Kozak, M., Hicks, R. E., & Rowe, E. (2024). How sociodemographic factors relate to trust in artificial intelligence: A study of university students. Computers in Human Behavior, 152, Article 108081. https://doi.org/10.1016/j.chb.2023.108081

Lee, A. T. (2025). Understanding psychosocial barriers to healthcare technology adoption: A review of TAM and UTAUT frameworks. Healthcare Technology Letters, 12(1), 84-96. https://doi.org/10.3390/healthcare13030250

Li, J., & Park, S. (2023). Determinants affecting consumer trust in communication with AI chatbots. Journal of Consumer Marketing, 40(2), 154-172. https://doi.org/10.4018/JOEUC.328089

Logg, J. M., Minson, J. A., & Moore, D. A. (2019). Algorithm appreciation: People prefer algorithmic to human judgment. Organizational Behavior and Human Decision Processes, 151, 90-103. https://doi.org/10.1016/j.obhdp.2018.12.005

Magasi, C. (2025). Review of dynamic structural equation models for real-time consumer behaviour: Methodological advances and applications insights. Management Dynamics in the Knowledge Economy, 13(1), 50-68. https://doi.org/10.2478/mdke-2025-0003

National Telecommunications and Information Administration (NTIA). (2024). Artificial intelligence accountability policy report. U.S. Department of Commerce. https://www.ntia.gov/sites/default/files/publications/ntia-ai-report-final.pdf

Reich, T., & Savary, J. (2020). How to overcome algorithm aversion: Learning from mistakes. Journal of Consumer Psychology, 30(4), 597-618. https://doi.org/10.1002/jcpy.1155

Rejali, S., Aghabayk, K., Esmaili, A., & Shiwakoti, N. (2023). Comparison of technology acceptance model, theory of planned behavior, and unified theory of acceptance and use of technology to assess a priori acceptance of fully automated vehicles. Transportation Research Part A: Policy and Practice, 168, 103565. 103565 https://doi.org/10.1016/j.tra.2022.

Rix, J., Breur, T., & Stumpf, S. (2025). The algorithm discount: Explaining consumers' valuation of algorithmic labor. Journal of Consumer Research, 51(4), 673-695. https://doi.org/10.1093/jcr/ucae012

Ryan, K., Dockray, S., & Linehan, C. (2025). Users' perceptions and trust in AI in direct-to-consumer mHealth applications: Qualitative study. JMIR mHealth and uHealth, 13, Article e51234. https://doi.org/10.2196/51234

Saxborn, M., Said, A., & Brandes, U. (2024). Trust through recommendation in e-commerce: An empirical investigation. ACM Transactions on Recommender Systems, 2(1), 1-32. https://doi.org/10.1145/3630106

Singh, N., Sinha, N., & Liébana-Cabanillas, F. J. (2024). An analysis of consumer's trusting beliefs towards the use of e-commerce platforms. Humanities and Social Sciences Communications, 11, Article 896. https://doi.org/10.1057/s41599-024-03395-6

Syifa, A., & Vanany, I. (2023). Determinants of consumer behavior towards purchase intention of halal cosmetic product using structural equation modelling approach. In Proceedings of the 4th International Conference on Advanced Engineering and Technology (pp. 354–359). SCITEPRESS. https://doi.org/10.5220/0012111100003680

Xue, L., Liang, H., & Zhang, Y. (2024). The unified theory of acceptance and use of technology (UTAUT): A decade of validation and extension in higher education. SAGE Open, 14(1). https://doi.org/10.1177/21582440241229570

Yang, H. J., Chen, Y., & Lee, S. H. (2025). Factors influencing health care technology acceptance in aging populations: Systematic review and meta-analysis. Journal of Medical Internet Research, 27(3), Article e45678. https://doi.org/10.2196/45678

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# BUSINESS R&D EXPENDITURE IN SLOVAKIA POSITION IN COMPARISON AND EUROPEAN UNION FOR YEARS 2015-2024

*Jozef Kovács – Natália Mišíková – Ivana Mišúnová Hudáková – Nadežďa Jankelová*

***Abstract***
The objective of this study is to examine differences in business enterprise expenditure on research and development between Slovakia with direct comparison with the European Union over the period 2015–2024. The analysis is based on secondary data obtained from the Eurostat database, ensuring comparability across countries and over time. Descriptive statistical methods are used to analyse the development and variability of business R&D expenditure, while graphical methods are applied to illustrate long-term trends. To test the statistical significance of differences between Slovakia and the EU average, inferential statistical analysis is employed. Given the characteristics of the data and the limited number of observations, the Mann–Whitney U test is used. The results confirm the existence of statistically significant differences in the level of business enterprise expenditure on research and development between Slovakia and the European Union.

***JEL classification**: C12, O31, O12*
***Keywords**: business enterprise expenditure on R&D, Slovakia, European Union, innovation, Eurostat*

## Introduction

In the current global economic environment, corporate investment in research and development of new technologies is a key element of competitiveness. New technologies and innovations drive economic growth and help countries remain competitive. For Slovakia, the gradual shift from manufacturing to a modern knowledge-based economy is currently crucial. Companies play an important role in this process because their innovations bring real results directly into practice and to the global market.

In this article, we therefore focus on Slovakia's position in comparison with the European Union average in 2015-2024. We work mainly with data from Eurostat, which allowed us to make a simple comparison of this development over time. In addition to monitoring development trends, we also focused on statistical testing. Due to the limited number of comparison sources available to us, we chose the non-parametric Mann-Whitney U test to verify the differences. Our goal was to determine whether Slovakia is actually lagging behind the EU average in the area under review or whether it has managed to catch up in the last decade.

## 1 Current state of the solved problem at home and abroad

Research on corporate expenditure on research and development (R&D) in the V4 countries has emerged as a critical area of inquiry due to its central role in fostering innovation, economic growth, and competitiveness in the region (Roszko-Wójtowicz et al., 2022; Sofrankova et al., 2018). Since the accession of the Visegrad Group countries to the European Union in 2004, their research and development activities have evolved under the influence of EU structural funds and cohesion policy, which aim to enhance innovation capacity (Bočková, 2013).

Over the past two decades, studies have documented the growing importance of investments in research and development in shaping the innovation ecosystems of the Czech Republic, Hungary, Poland, and Slovakia, albeit with varying degrees of progress and notable structural differences among them ( Szuflita-Żurawska & Basińska, 2021). The practical relevance of this research lies in addressing regional disparities and informing policy measures designed to strengthen the knowledge-based economy and the global competitiveness of these countries (Kiselakova et al., 2018; Csugány & Tanczós, 2025).

For example, corporate expenditure on research and development as a percentage of GDP remains below the EU average, highlighting the need for targeted interventions (Brandová et al., 2024).

The specific problem addressed in this review concerns the determinants, dynamics, and impacts of corporate research and development (R&D) expenditure in the V4 countries, particularly in light of heterogeneous innovation performance and economic structures (Ivanová & Žárská, 2023; Odei et al., 2021). Despite extensive research, a knowledge gap persists regarding the spatial and sectoral disparities in R&D investments, the interaction between public support and private funding, and the effectiveness of fiscal policies in stimulating corporate R&D (Klímová et al., 2020; Pisár et al., 2024; Shakhmuradyan, 2022).

There are competing perspectives on whether public support for R&D complements or crowds out private investment, with some studies emphasizing complementarity while others suggest ambiguous or context-dependent effects (Pisár et al., 2020; Mikołajczyk, 2018). Moreover, the role of foreign direct investment and international collaboration in shaping R&D outcomes remains contested (Owczarczuk, 2013; Hintošová et al., 2020). This gap has significant policy implications, as insufficient understanding may lead to suboptimal resource allocation and hinder innovation-driven growth (Ratinger et al., 2020).

The conceptual framework underpinning this review integrates the concepts of corporate R&D expenditure, innovation performance, and economic competitiveness, drawing on endogenous growth theory and innovation system perspectives (Szarowská, 2018; Prokop et al., 2021). Corporate R&D expenditure is conceptualized as a key input driving innovation output, such as patents and new products, which in turn enhance firm-level and regional competitiveness (Huňady & Pisár, 2021; Pleticha, 2021). The framework acknowledges the mediating role of public support, human capital, and

international linkages in shaping these relationships (Vokoun & Dvouletý, 2022; Prokop et al., 2021). This integrated approach guides the systematic examination of the determinants and effects of corporate R&D expenditure in the V4 context.

## 2 Research design and methodology

This study focuses on analysing the position of Slovakia in the area of business research and development within the European Union over the period 2015 – 2024, comparing it with the European Union average (EU27). The main objective of the study is to identify differences in the level and development of business enterprise expenditure on research and development (BERD) between Slovakia and the European Union and to assess whether these differences are statistically significant. The analysis is based on harmonised secondary data obtained from Eurostat, which provides internationally comparable statistics on research and development activities across EU member states.

The following indicators were included in the analysis:

- Business enterprise expenditure on R&D (BERD), total (million euro).
- BERD as a percentage of GDP (%).
- Annual development of BERD over time.

The data cover the period 2015 – 2024, with data for 2024 reported as provisional, in accordance with Eurostat methodology. The analysis focuses on total BERD across all NACE Rev. 2 economic activities and total sources of funding.

Descriptive and inferential statistical methods were applied to process the data. Within descriptive statistics, basic parameters such as mean values, medians, standard deviations, minimum and maximum values, and year-on-year changes were calculated for Slovakia and the European Union average. To illustrate the development and differences in business R&D expenditure, bar charts and time-series graphs were used. Inferential statistical methods were applied to test the statistical significance of differences in business R&D expenditure between Slovakia and the European Union average. Prior to hypothesis testing, the normality of data distribution was verified using the Shapiro–Wilk test. If the assumption of normality was met, an independent samples t-test was used to compare the average values of BERD between Slovakia and the European Union. If the normality assumption was not satisfied, a non-parametric Mann–Whitney U test was applied as an alternative.

All statistical analyses were conducted using the JAMOVI statistical software, while Microsoft Excel was used for data preparation and graphical visualisation.

### Research assumption

We expect, that Slovakia exhibits a lower level of business enterprise expenditure on research and development than the European Union average over the period 2015 – 2024, and that this difference is persistent over time and statistically significant.

**Research question**

*Are there statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024?*

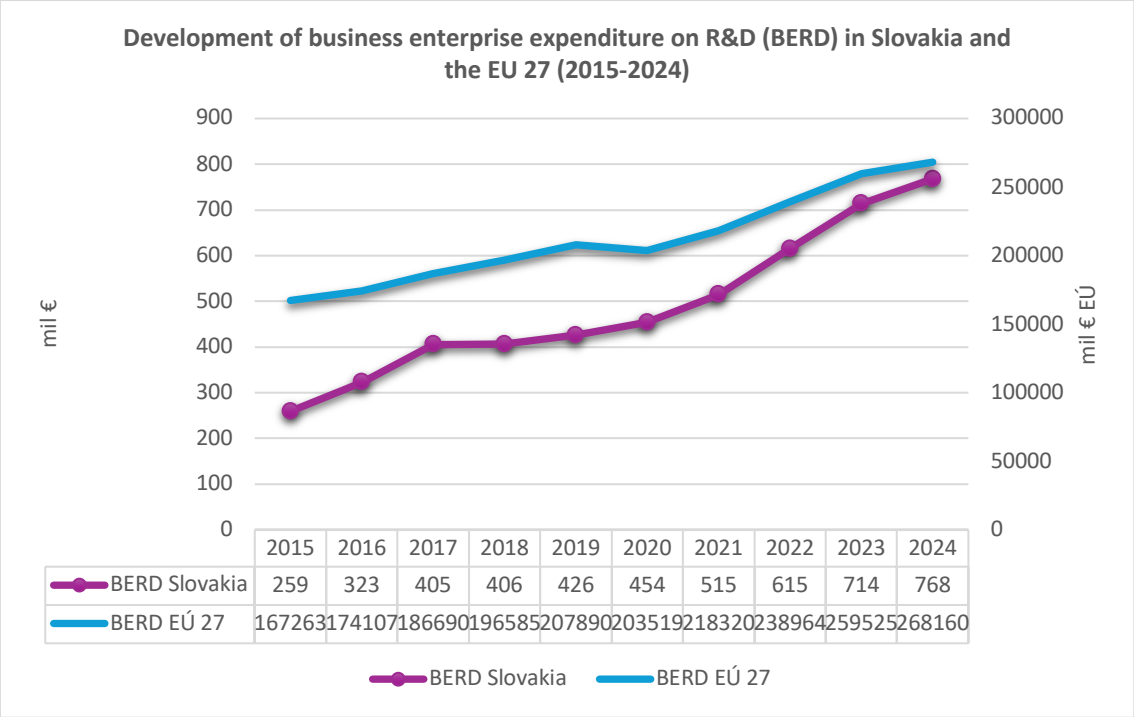
Following the research question, 2 hypotheses were set:

- $H_0$: There are no statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024.
- $H_1$: There are statistically significant differences in in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024.

## 3 Research results

We set a research question and two research hypotheses, which we empirically test. In the next part of the partial analysis and conclusion construction to test the research hypotheses, we examined each variable using descriptive statistics.

**Figure 1**
Development of business enterprise expenditure on R&D (BERD) in Slovakia and the EU 27 (2015-2024)




*Source: Own processing*

The figure 1 illustrates the long-term trend in corporate expenditure on research and development. Although both Slovakia and the EU average show stable growth in the long term, the absolute difference remains quite noticeable. Slovakia's BERD increased from

€259,000 in 2015 to €767,000 in 2024. Despite this positive development, there is still a significant gap between the domestic business environment and the European Union average. To verify the significance, we used descriptive statistics, which are shown in the tables below.

**Table 1**
Results of the Mann–Whitney U test comparing business enterprise expenditure on R&D in Slovakia and the EU (2015-2024)

| Independent Samples T-Test | | Statistic | p |
|---|---|---|---|
| C | Mann-Whitney U | 0.00 | 0.002 |

*Source: Own processing based on JAMOVI output*

**Table 2**
Descriptive statistics of business enterprise expenditure on R&D in Slovakia and the EU (2015-2024)

| Group Descriptives | | | | | |
|---|---|---|---|---|---|
| | Group | N | Mean | Median | SD |
| Value | Slovakia | 10 | 199 055 | 180 398 | 46 767 |
| | EU 27 | 4 | 488 | 440 | 165 |

*Source: Own processing based on JAMOVI output*

Figure 1 presents the results of the Mann–Whitney U test comparing business enterprise expenditure on research and development between Slovakia and the European Union over the period 2015–2024. The results indicate a statistically significant difference between the two groups (U = 0.00, p = 0.002). This finding confirms that the level of business R&D expenditure in Slovakia differs significantly from the EU average during the analysed period. Based on the test results, the null hypothesis was rejected.

Figure 2 summarises the descriptive statistics of business enterprise expenditure on R&D for Slovakia and the European Union. Over the analysed period, Slovakia recorded an average BERD of 199,055 million euro, with a median value of 180,398 million euro, indicating a gradual increase in business R&D expenditure over time. The relatively high standard deviation (46,767 million eur) reflects notable variability in annual expenditure levels.

In contrast, the European Union exhibits substantially higher average and median values of business enterprise expenditure on R&D, confirming a pronounced gap between Slovakia and the EU average. Overall, the descriptive statistics support the inferential results, demonstrating persistent differences in the level of business R&D investment between Slovakia and the European Union throughout the period 2015-2024.

## 4 Discussion

The empirical findings of this study confirm statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average over the period 2015–2024. The rejection of the null hypothesis is consistent with previous empirical evidence documenting the persistent lag of Slovakia and other V4 countries in terms of business-sector R&D intensity (Roszko-Wójtowicz et al., 2022; Sofrankova et al., 2018). The results thus reinforce the argument that insufficient corporate R&D investment remains a structural feature of innovation systems in Central and Eastern Europe rather than a temporary deviation.

The descriptive statistics indicate that, despite a gradual increase in business R&D expenditure in Slovakia, the gap relative to the EU average remains substantial throughout the analysed period. Similar patterns have been identified by Szuflita-Żurawska and Basińska (2021), who emphasise that innovation convergence within the EU is uneven and strongly influenced by national economic structures and institutional settings. The relatively high variability of Slovak business R&D expenditure observed in this study further supports the view that innovation performance in smaller economies is sensitive to external shocks and policy changes, as suggested by Kiselakova et al. (2018).

From a theoretical perspective, the results align with endogenous growth theory, which posits that sustained economic growth depends on continuous investment in knowledge creation and innovation (Szarowská, 2018). However, the persistent underperformance of Slovakia in comparison with the EU average indicates that corporate R&D expenditure alone may be insufficient to generate strong innovation outcomes in the absence of complementary factors. Prokop et al. (2021) and Huňady and Pisár (2021) highlight the importance of absorptive capacity, human capital, and institutional quality in translating R&D inputs into measurable innovation outputs. The findings of this study indirectly support these arguments by demonstrating that higher aggregate economic integration does not automatically lead to higher business R&D intensity.

The observed disparities may also be interpreted in light of the debate on public support for research and development. Previous studies offer mixed evidence regarding whether public R&D funding complements or crowds out private investment (Pisár et al., 2020; Mikołajczyk, 2018). While the present study does not directly assess this relationship, the persistent gap in business R&D expenditure suggests that existing policy instruments in Slovakia may not be sufficiently effective in stimulating sustained private-sector engagement in research activities. Klímová et al. (2020) and Shakhmuradyan (2022) similarly argue that the design and targeting of fiscal incentives play a critical role in shaping firms' innovation behaviour.

Furthermore, the results may reflect the specific role of foreign direct investment in the Slovak economy. Owczarczuk (2013) and Hintošová et al. (2020) point out that high inflows of foreign investment do not necessarily translate into increased domestic R&D expenditure unless strong linkages with local firms and research institutions are established. The findings of this study are consistent with this perspective, suggesting

that Slovakia's integration into global value chains has not yet resulted in a proportional strengthening of indigenous corporate R&D capacity.

Overall, the discussion of results confirms that the lower level of business enterprise expenditure on research and development in Slovakia is a persistent and structurally embedded phenomenon. In line with Ratinger et al. (2020), this has important policy implications, as insufficient understanding of the underlying determinants may lead to ineffective allocation of public resources and limit innovation-driven growth. These findings provide a direct bridge to the concluding section, which summarises the main implications and outlines directions for future policy and research.

**Conclusion**

*Verification of research hypotheses and answer to the research question*

Based on the results of the empirical analysis and the application of the Mann–Whitney U test, the following conclusions we can state:

- We **reject** the hypothesis $H_0$. There are no statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024.

Hypothesis $H_1$ – we **accept.** There are statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024.

Based on the analysis we can answer the research question – *Are there statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average in the period 2015 – 2024?*

*Based on these findings, the research question can be answered as follows:*

*Yes, there are statistically significant differences in business enterprise expenditure on research and development between Slovakia and the European Union average over the period 2015–2024. The results confirm that Slovakia exhibits a persistently lower level of business R&D expenditure compared to the EU average throughout the analysed period.*

The objective of this study was to analyse the position of Slovakia in terms of business enterprise expenditure on research and development in comparison with the European Union average over the period 2015–2024 and to assess whether the observed differences are statistically significant. Based on harmonised Eurostat data and the application of descriptive and inferential statistical methods, the study confirms the existence of persistent and statistically significant disparities between Slovakia and the EU average.

The results demonstrate that, despite a gradual increase in business R&D expenditure in Slovakia, the country continues to lag behind the European Union in terms of both absolute levels and relative intensity. These findings underline the structural nature of the gap and suggest that convergence towards the EU average remains a long-term challenge rather than an automatic outcome of economic growth or EU membership.

From a policy perspective, the conclusions of this study emphasise the need for more targeted and effective measures aimed at stimulating private-sector investment in research and development. Enhancing the efficiency of public support instruments, strengthening human capital, and fostering stronger linkages between enterprises, research institutions, and international partners appear crucial for improving the innovation performance of the Slovak economy.

By providing empirical evidence on the magnitude and persistence of differences in business R&D expenditure, this study contributes to the broader literature on innovation and competitiveness in Central and Eastern Europe and offers a basis for more informed policy discussions on innovation-driven growth.

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**References**

Bobenič Hintošová, A., Bruothová, M., & Vasková, I. (2020). Does Foreign Direct Investment Boost Innovation? The Case of the Visegrad and Baltic Countries. *Quality, Innovation, Prosperity*, Vol. *24, No.* 3, pp. 106–121. https://doi.org/10.12776/QIP.V24I3.1519 ISSN: 1335-1745.

Bočková, N. (2013). Visegrad Four countries: evaluation in R&D sectors of performance. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. *61, No.* 4, pp. 873–880. https://doi.org/10.11118/ACTAUN201361040873 ISSN: 2464-8310.

Brandová, B., Nedomlelová, I., & Sojková, L. (2024). The Czech Republic Within the Context of Meeting the R&D&I Targets Set Out in the Europe 2020 Strategy. *ACC Journal*, Vol.*30, No.*2, pp.7–23. https://doi.org/10.2478/acc-2024-0004 ISSN: 2571-0613.

Csugány, J., & Tanczós, T. (2025). Changes in the Innovation Performance of the Visegrad Countries During Their EU Membership. *Balkans Journal of Emerging Trends in Social Sciences*, Vol.*8, No.* 1. https://doi.org/10.31410/balkans.jetss.2025.8.1.1-16 ISSN: 2620 – 164X.

Huňady, J., & Pisár, P. (2021). Innovation and invention in the EU business sector: the role of the R&D expenditures. *Interdisciplinary Description of Complex Systems*, Vol. *19, No.*2, pp. 168–188. https://doi.org/10.7906/INDECS.19.2.1 ISSN: 1334-4676.

Ivanová, E., & Žárská, V. (2023). R&D expenditure as a determinant of the aggregate innovation index in the V4 countries. *Innovative Marketing*, Vol.*19, No.2*, pp. 87–100. https://doi.org/10.21511/im.19(2).2023.08 ISSN:1816-6326.

Kiselakova, D., Sofrankova, B., Čabinová, V., Onuferová, E., & Soltesova, J. (2018). The Impact of R&D Expenditure on the Development of Global Competitiveness within the CEE EU Countries. *Journal of Cryptology*, Vol. *10, No.3*, pp. 34–50. https://doi.org/10.7441/JOC.2018.03.03 ISSN: 0933-2790.

Klímová, V., Žítek, V., & Králová, M. (2020). How Public R&D Support Affects Research Activity of Enterprises: Evidence from the Czech Republic. *Journal of The Knowledge Economy*, Vol. *11, No.*3, pp. 888–907. https://doi.org/10.1007/S13132-019-0580-2 ISSN: 1868-7873.

Mikołajczyk, K. (2018). Public R&D expenditure and their impact on private R&D: complementarity or substitution? Analysis for Central and East European countries. *Acta Universitatis Lodziensis. Folia Oeconomica*, Vol. *3, No.* 335, pp.171–188. https://doi.org/10.18778/0208-6018.335.12 ISSN: 2353 - 7663.

Odei, S. A., Stejskal, J., & Prokop, V. (2021). Revisiting the Factors Driving Firms' Innovation Performances: the Case of Visegrad Countries. *Journal of The Knowledge Economy*, Vol. *12, No.3*, pp. 1331–1344. https://doi.org/10.1007/S13132-020-00669-7 ISSN: 1868-7873.

Owczarczuk, M. (2013). Government Incentives and FDI inflow into R&D: The Case of Visegrad Countries. *Entrepreneurial Business and Economics Review*, Vol. *1, No.* 2,pp.73–86. https://doi.org/10.15678/EBER.2013.010207 ISSN: 2353-8821.

Pisár, P., Huňady, J., & Honzova, S. (2024). Business Research and Development: Is there a Substitution Effect of Public Support? *Proceedings of the European Conference on Innovation and Entrepreneurship, ECIE*, Vol. *19, No.*1, pp. 634–642. https://doi.org/10.34190/ecie.19.1.2448

Pleticha, P. (2021). *Heterogeneity of Returns to Business R&D: What Makes a Difference? Prague Economics Papers* Vol.*30,No.*3,pp.253–271. https://doi.org/10.18267/J.PEP.767 ISSN: 0371 - 443.

Prokop, V., Stejskal, J., Klímová, V., & Zitek, V. (2021). The role of foreign technologies and R&D in innovation processes within catching-up CEE countries. *PLOS ONE*, *16*(4). https://doi.org/10.1371/JOURNAL.PONE.0250307 ISSN: 1932 - 6203.

Ratinger, T., Čadil, V., & Agyemang, S. A. (2020). Are There Any Economic Impacts of Business R&D Support? The Case of the Czech Republic. *Central European Business Review*, *9*(5), 45–62. https://doi.org/10.18267/J.CEBR.251 ISSN: 1805-4862.

Roszko-Wójtowicz, E., Dańska-Borsiak, B., Grzelak, M. M., & Pleśniarska, A. (2022). In search of key determinants of innovativeness in the regions of the Visegrad group countries. *Oeconomia Copernicana*, vol. *13, No.* 4, pp. 1015–1045. https://doi.org/10.24136/oc.2022.029 ISSN: 2353-1827.

Sofrankova, B., Kiselakova, D., Čabinová, V., & Onuferová, E. (2018). The Importance of Research and Development Spending In the Context of Global Competitiveness and the Innovation Potential of the V4 Countries. 2018, *Journal of Eastern Europe Research in Business and Economics*. pp. 1–13. https://doi.org/10.5171/2018.916196 ISSN: 2169 - 0367.

Szarowská, I. (2018). Importance of R&D expenditure for economic growth in selected CEE countries. *E & M Ekonomie A Management*, Vol. *21, No.* 4, pp. 108–124. https://doi.org/10.15240/TUL/001/2018-4-008 ISSN: 2336-5064.

Szuflita-Żurawska, M., & Basinska, B. A. (2021). Visegrád countries' scientific productivity in the European context: A 10-year perspective using Web of Science and Scopus. *Learned Publishing*, Vol. *34, No.* 3, pp. 347–357. https://doi.org/10.1002/LEAP.1370 ISSN: 0953-1513.

Vokoun, M., & Dvouletý, O. (2022). *International, national and sectoral determinants of innovation: evolutionary perspective from the Czech, German, Hungarian and Slovak community innovation survey data*. 1–41. https://doi.org/10.1080/13511610.2022.2158309 ISSN: 1351-1610.

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# HODNOTENIE PERCEPCIA RIZIKA VO VYBRANÝCH RODINNÝCH PODNIKOCH ZAMERANÝCH NA UBYTOVANIE A STRAVOVANIE

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***Abstract***
Information technology (IT) plays a significant role in shaping the processes surrounding family business sales, particularly in the context of succession. When a family business transitions ownership to an external buyer, IT can serve as a critical enabler by supporting operational continuity, transparency and the transfer of business knowledge. This paper draws on a literature review to examine succession in the specific context of a family business sale to an external buyer. It analyses how IT supports the transition process, particularly through data management, communication between stakeholders, process automation and the integration of information systems. The aim of the paper is to advance the theoretical understanding of the role of IT in family business succession. The literature review identifies key areas related to technological readiness, including IT infrastructure, data security, business intelligence systems, technology adoption, IT personnel competencies, integration capabilities, cost efficiency and customer relationship management systems. The findings indicate that the combined effectiveness of these areas can reduce transaction risks, facilitate knowledge transfer and support the long-term continuity of the business after the sale.

***JEL classification**: D23, G34, M15*
***Keywords**: family business, information technology, succession factors*

## Úvod

Podľa Európskej komisie rodinné podniky tvoria viac ako 60 % všetkých podnikov v Európe. Firemné nástupníctvo a predaj rodinného podniku vyžadujú dôkladné plánovanie a strategické myslenie. Úspešné firemné nástupníctvo v kontexte predaja rodinného podniku si vyžaduje nielen identifikáciu vhodných kupujúcich a správne určenie hodnoty podniku, ale aj komplexné porozumenie právnych aspektov a postupov spojených s predajom. Strategické vyjednávanie a uzatváranie obchodných dohôd sú rovnako dôležité, ako aj schopnosť efektívne komunikovať s potenciálnymi kupujúcimi a zúčastnenými stranami. IT dnes predstavujú zásadný pilier moderného podnikateľského prostredia, pričom ich dôležitosť spočíva v optimalizácii prevádzkovej efektívnosti, zefektívnení komunikačných procesov a poskytovaní podpory pre kvalifikované strategické rozhodovanie.

# 1 Súčasný stav riešenej problematiky doma a v zahraničí

## 1.1 Nástupníctvo v kontexte predaja rodinného podniku

V súvislosti s predajom rodinného podniku je nástupníctvo považované za jeden z kľúčových faktorov, ktoré ovplyvňujú hladký prechod vlastníctva a riadenia. Proces plánovania nástupníctva sa považuje za nevyhnutnú súčasť udržateľnosti rodinných podnikov, pričom jeho cieľom je zabezpečiť pripravenosť budúcej generácie alebo potenciálnych kupujúcich na prevzatie vedúcich pozícií. Je známe, že dobre navrhnutý plán nástupníctva pomáha minimalizovať riziká spojené s prechodom, akými sú strata kľúčových vzťahov, narušenie prevádzky a zvýšená fluktuácia zamestnancov (Whitman-Rector, 2024). Napriek dôležitosti tejto oblasti sa zistilo, že len približne 15 % rodinných podnikov má vypracovaný formálny plán nástupníctva (Saymaz & Lambert, 2019). Tento nedostatok je často pripisovaný emocionálnym väzbám, ktoré členovia rodiny majú k podniku, a ktoré môžu komplikovať rozhodovací proces. Napríklad majitelia, ktorí do budovania podniku investovali značné množstvo času a úsilia, môžu mať problém s akceptovaním myšlienky predaja. Navyše, prechod vlastníctva a riadenia je často sprevádzaný emocionálnym vypätím, ktoré postihuje ako súčasného vlastníka, tak aj budúceho nástupcu, pričom efektívne riadenie vzťahov a očakávaní je v tomto kontexte považované za zásadné (Kechli, 2023; Whitman-Rector, 2024). Pri predaji rodinného podniku sa vyžaduje identifikácia a príprava potenciálnych nástupcov, či už ide o rodinných príslušníkov alebo externých záujemcov. Výber nástupcu je často označovaný ako rozhodujúci krok pre zabezpečenie kontinuity a dlhodobej udržateľnosti podniku (Kechli, 2023). Tento proces obvykle zahŕňa komplexné posúdenie schopností, záujmov a pripravenosti vybraných osôb prevziať riadenie podniku (Saymaz & Lambert, 2019). Zároveň je podčiarkovaná dôležitosť jasnej a transparentnej komunikácie plánu nástupníctva, ktorá má za cieľ predchádzať potenciálnym konfliktom medzi zainteresovanými stranami. Takáto transparentnosť prispieva k budovaniu dôvery a zvyšuje pravdepodobnosť, že všetci aktéri budú súhlasiť s budúcim smerovaním organizácie (Kechli, 2023; De Boer, 2024). Okrem toho sa proces predaja rodinného podniku často spája s právnymi a finančnými aspektmi, akými sú plánovanie majetku, daňové dôsledky a ocenenie podniku. Na zjednodušenie týchto komplikovaných úvah sa odporúča zapojenie odborníkov, ako sú právni poradcovia alebo účtovníci, ktorí môžu zabezpečiť, že predaj prebehne efektívne a bez výrazných problémov (Saymaz & Lambert, 2019). Úspešný plán nástupníctva musí byť zosúladený s dlhodobou víziou a strategickými cieľmi podniku. Toto zosúladenie zahŕňa analýzu schopnosti podniku prispôsobiť sa budúcim výzvam a príležitostiam, pričom je nevyhnutné, aby nástupca disponoval zručnosťami potrebnými na efektívne vedenie organizácie (Lecounte, 2018; Kechli, 2023).

Súhrnne možno konštatovať, že problematika nástupníctva v kontexte predaja rodinného podniku si vyžaduje starostlivé plánovanie, zvládanie emocionálnych aspektov, efektívnu komunikáciu a strategické riadenie. Riešením týchto faktorov sa výrazne zvyšuje pravdepodobnosť úspešného prechodu vlastníctva a dlhodobej prosperity podniku.

## 1.2 Dôvody predaja rodinného podniku

Rozhodnutie predať rodinný podnik je často považované za komplexný proces, ktorý je ovplyvnený množstvom rôznorodých faktorov. Tento krok je vo viacerých prípadoch iniciovaný situáciou, keď majitelia dosiahnu vek dôchodku, pričom v rodine chýba vhodný nástupca. Takáto absencia nástupníctva vedie k tomu, že podnik je odpredaný, čím sa zabezpečuje jeho kontinuita a súčasne aj finančná budúcnosť predávajúcich (Kechli, 2023). Ďalšia generácia je často nezainteresovaná v prevzatí podniku, čo môže byť spôsobené ich osobnými kariérnymi cieľmi, nedostatkom manažérskych schopností alebo motivácie na riadenie. Táto situácia má za následok, že podnik je predaný, aby sa predišlo jeho možnému úpadku (Kechli, 2023). Okrem toho sú rodinné podniky niekedy vystavené finančným ťažkostiam, ktoré komplikujú udržanie prevádzky. Predaj tak môže byť vnímaný ako riešenie na okamžitú finančnú úľavu a zároveň umožňuje vlastníkom získať späť svoje investície (Rothwell, 2015). Zvýšenie hodnoty podniku alebo priaznivé podmienky na trhu bývajú tiež rozhodujúcimi faktormi pre predaj. Ak sa vyskytne atraktívna ponuka od kupujúceho, ktorá naznačuje lukratívnu príležitosť, vlastníci sú často motivovaní k odpredaju, najmä ak hodnota podniku za uplynulé obdobie výrazne vzrástla (Pahnke, Schlepphorst & Schlömer-Laufen, 2024). Rodinné konflikty, ktoré sa môžu týkať riadenia či strategického smerovania podniku, sú ďalším dôvodom, prečo sa rodiny rozhodnú podnikať tento krok. Predaj podniku sa v takýchto prípadoch javí ako spôsob na elimináciu ďalších sporov a na umožnenie priateľského rozchodu medzi členmi rodiny (Ip & Jacobs, 2006). Motiváciou môže byť aj túžba majiteľov realizovať nové projekty či záujmy mimo rodinného podniku. Predaj im dáva možnosť preskúmať tieto príležitosti bez bremena trvalých manažérskych povinností (Kechli, 2023). Osobné zdravotné problémy, ktoré majú vplyv na schopnosť efektívne riadiť podnik, môžu rovnako viesť k záveru, že predaj je najlepšou možnosťou, aby sa podnik dostal do schopných rúk (Rothwell, 2015). V niektorých prípadoch je predaj realizovaný v rámci strategickej reorganizácie, kedy majitelia prehodnocujú svoje portfólio a rozhodujú sa zamerať na iné podnikateľské aktivity alebo odpredať vedľajšie činnosti s cieľom dosiahnuť vyššiu efektivitu (Kechli, 2023).

Na základe uvedených skutočností možno konštatovať, že rozhodnutie o predaji rodinného podniku je výsledkom kombinácie osobných, finančných a strategických aspektov. Každá situácia je špecifická a vyžaduje si dôkladnú analýzu možností, ako aj zváženie dôsledkov tohto rozhodnutia.

## 1.3 Proces predaja podniku

Proces predaja rodinného podniku pozostáva z niekoľkých nevyhnutných krokov, ktorých cieľom je zabezpečiť hladký prechod vlastníctva a zároveň maximalizovať hodnotu podniku. Pred samotným začiatkom procesu je potrebné, aby podnik bol dôkladne pripravený na predaj. V tejto fáze sa vykonáva posúdenie finančného zdravia podniku, implementácia opatrení na zvýšenie prevádzkovej efektívnosti a zabezpečenie súladu so všetkými právnymi a regulačnými požiadavkami. Takáto príprava zvyšuje atraktivitu podniku z pohľadu potenciálnych kupujúcich (Saymaz & Lambert, 2019). Ďalším krokom je určenie spravodlivej trhovej hodnoty podniku, ktoré sa realizuje prostredníctvom

profesionálneho odhadu alebo využitím rôznych oceňovacích metód. Tieto metódy zohľadňujú hodnotu aktív, príjmy a aktuálne trhové podmienky. Presnosť ocenenia je považovaná za kľúčovú, pretože umožňuje stanovenie realistickej požadovanej ceny (Ip & Jacobs, 2006). Špecifickou požiadavkou pre rodinné podniky je vytvorenie jasného plánu nástupníctva. Tento plán má za cieľ definovať spôsob prechodu vlastníctva, určiť osoby, ktoré prevezmú vedúce pozície, a analyzovať dopady predaja na zamestnancov a ďalšie zainteresované strany. Efektívne plánovanie nástupníctva je považované za faktor zvyšujúci hodnotu podniku v očiach potenciálnych kupujúcich (Kechli, 2023). Pri identifikácii potenciálnych kupujúcich sa zvyčajne uvažuje o rôznych skupinách vrátane rodinných príslušníkov, zamestnancov, konkurentov či externých investorov. Dôležité je, aby kupujúci zdieľali hodnoty a víziu podniku. Na prilákanie serióznych záujemcov a zároveň zachovanie dôvernosti sa často využíva diskrétny marketing (Pahnke, Schlepphorst & Schlömer-Laufen, 2024). Po výbere vhodného kupujúceho sa začínajú rokovania o podmienkach predaja. Táto fáza zahŕňa diskusiu o cene, štruktúre platieb a ďalších zmluvných podmienkach. Aby boli zabezpečené záujmy predávajúceho, odporúča sa angažovanie právnych a finančných poradcov (LeCounte, 2018). Po dosiahnutí predbežnej dohody sa vykonáva hĺbková kontrola podniku, známa ako „due diligence“. Prostredníctvom tohto procesu sa overujú finančné údaje, prevádzkové postupy a právny status podniku. Identifikované problémy musia byť riešené pred uzavretím transakcie (Davenport, 2012). Na záver transakcie sa vypracúva konečná zmluva o predaji, ktorá obsahuje podrobné ustanovenia o prevode aktív, záväzkov a ďalších povinnostiach predávajúceho. Po uzavretí predaja sa často odporúča zavedenie prechodného obdobia, počas ktorého predávajúci poskytuje podporu novému vlastníkovi. Tento krok uľahčuje adaptáciu a udržiavanie vzťahov s kľúčovými zákazníkmi a dodávateľmi (Patterson, 2024). Po ukončení predaja je vhodné, aby predávajúci prehodnotil svoje ďalšie finančné a osobné ciele. Medzi možnosti patrí plánovanie odchodu do dôchodku alebo realizácia nových obchodných aktivít. Udržiavanie vzťahov s novým vlastníkom môže byť navyše prospešné pre obe strany (Estedadi & Hamidi, 2015).

Záverom je možné konštatovať, že proces predaja rodinného podniku predstavuje komplexný a mnohostranný postup. Zahŕňa starostlivé plánovanie, presné oceňovanie, efektívne vyjednávanie a dôkladné riadenie prechodu vlastníctva. Každý krok hrá rozhodujúcu úlohu pri maximalizácii hodnoty podniku a zároveň pri zabezpečení kontinuity pre zamestnancov a ďalšie zainteresované strany.

### 1.4 Úloha informačných technológií v podnikaní

IT sú v súčasnosti považované za kľúčový prvok moderného podnikania, pričom ich význam spočíva v zvyšovaní prevádzkovej efektívnosti, zlepšovaní komunikácie a podpore strategického rozhodovania. Prostredníctvom IT sú obchodné procesy postupne zefektívňované, čo umožňuje organizáciám fungovať na vyššej úrovni efektívnosti. Napríklad, rutinné úlohy sú automatizované, čím sa znižujú časové a materiálne náklady potrebné na prevádzku, čo následne vedie k úsporám a zvýšeniu produktivity (Fang, 2024). Prostredníctvom IT je umožnený zber, ukladanie a analýza veľkého objemu údajov. Táto schopnosť sa využíva na získavanie poznatkov o trendoch na trhu, správaní

zákazníkov a výkonnosti podniku, čo následne slúži ako základ pre strategické rozhodovanie (Paye Sr, 2024). Rôzne nástroje na komunikáciu, ako sú e-maily, okamžité správy a platformy na videokonferencie (napríklad Zoom a Microsoft Teams), sú poskytované IT systémami s cieľom zlepšiť spoluprácu medzi zamestnancami a podporiť budovanie vzťahov so zákazníkmi a obchodnými partnermi (Fang, 2024). Významnú úlohu zohráva aj podpora systémov business intelligence (BI), ktoré integrujú a analyzujú údaje pochádzajúce z rozličných zdrojov. Vďaka tejto integrácii sú organizácie schopné prijímať informované rozhodnutia, rýchlo sa prispôsobovať dynamickým zmenám na trhu a udržiavať si konkurenčnú výhodu (Setiawati, 2022). Navyše, prostredníctvom digitálneho marketingu a platforiem elektronického obchodu je umožnené oslovovať širšie publikum. Týmto spôsobom sa spoločnostiam poskytuje príležitosť efektívnejšie komunikovať so zákazníkmi a okamžite reagovať na ich potreby (Paye Sr, 2024). Za účelom maximalizácie účinnosti IT je nevyhnutné jeho zosúladenie s celkovými obchodnými stratégiami. Tento prístup zabezpečuje, že investície do IT podporujú organizačné ciele a vedú k zlepšeniu prevádzkových aj strategických výsledkov (Carter, 2015). Zavádzanie inovatívnych technológií môže navyše prinášať nové produkty a služby, ktoré organizáciám poskytujú konkurenčnú výhodu. Podniky, ktoré efektívne využívajú IT, sú schopné flexibilne reagovať na meniace sa trhové podmienky a rastúce požiadavky zákazníkov (Drnevich & Croson, 2013).

Na záver, je potrebné zdôrazniť, že informačné technológie zohrávajú nenahraditeľnú úlohu v podnikových aktivitách, pričom ovplyvňujú všetky oblasti od efektívnosti a komunikácie až po strategické plánovanie a dosahovanie konkurenčných výhod.

### 1.5 IT v kontexte predaja rodinného podniku

V kontexte predaja rodinného podniku je kľúčová úloha IT v procese zvyšovania hodnoty podniku a jeho atraktívnosti pre potenciálnych kupujúcich neprehliadnuteľná. Prostredníctvom implementácie efektívnych IT systémov je možné zefektívniť prevádzku, minimalizovať náklady a zvýšiť produktivitu. Takéto zlepšenia prispievajú k tomu, že podnik sa javí ako prevádzkovo efektívny, čo je faktor často oceňovaný kupujúcimi, keďže prevádzková efektívnosť môže priamo korelovať s vyššími ziskovými maržami. Ako ilustruje výskum (Prayitno, 2020), implementácia systémov na podporu rozhodovania môže významne zvýšiť hodnotu podniku vďaka zlepšeniu procesov rozhodovania. Schopnosť podniku zhromažďovať, analyzovať a efektívne využívať údaje je čoraz častejšie považovaná za nevyhnutnú. IT riešenia zamerané na integráciu a analýzu údajov umožňujú generovanie cenných prehľadov o správaní zákazníkov, trhových trendoch a výkonnosti prevádzky. Tieto poznatky môžu byť kľúčové počas rokovaní, keďže zdôrazňujú potenciál podniku pre rast a adaptabilitu (Setiawati, 2022). Okrem toho je prostredníctvom IT možné rozšíriť dosah podniku na trh, a to využitím platforiem elektronického obchodu a digitálnych marketingových stratégií. Silná online prítomnosť, ktorá zahŕňa efektívne využívanie sociálnych médií a digitálneho marketingu, môže prilákať širšiu zákaznícku základňu, zvýšiť predaj a tým zvýšiť atraktivitu podniku pre kupujúcich (Paye Sr, 2024). Podniky, ktoré využívajú moderné IT technológie, majú tiež možnosť odlíšiť sa od konkurencie. Napríklad zavedenie cloud computingu a analýzy veľkých dát umožňuje rýchlu reakciu na trhové zmeny a efektívnu implementáciu

stratégií, čo vedie k udržaniu konkurenčnej výhody (Setiawati, 2022). Zároveň bývajú kupujúcimi preferované podniky, ktorých IT systémy sú navrhnuté tak, aby boli ľahko integrované do existujúcich činností ich vlastnej organizácie. V tomto kontexte je dobre zdokumentovaná IT infraštruktúra spolu s jasne definovanými procesmi prechodu IT systémov významnou výhodou, keďže uľahčuje hladší priebeh akvizície a minimalizuje riziko porúch po predaji (Prayitno, 2020). Počas procesu predaja sú IT aktíva a kapacity podniku často predmetom dôkladného hodnotenia. Znalosť technológií, zahŕňajúca softvér, hardvér a postupy správy údajov, zohráva dôležitú úlohu pri formovaní vnímanej hodnoty podniku (Prayitno, 2020). Tento proces zdôrazňuje význam komplexného pochopenia IT prostredia podniku pre dosiahnutie optimálneho ocenenia.

Na záver možno konštatovať, že efektívne využívanie informačných technológií v rodinnom podniku nielenže podporuje prevádzkovú efektívnosť a konkurencieschopnosť, ale taktiež významne ovplyvňuje hodnotu a atraktivitu podniku počas procesu jeho predaja.

### 1.6 Faktory nástupníctva súvisiace s IT

Faktory nástupníctva, ktoré súvisia s IT v kontexte predaja podniku, sú považované za zásadné pri ovplyvňovaní úspešnosti samotnej transakcie a vnímanej hodnoty podniku. Táto problematika môže byť analyzovaná prostredníctvom niekoľkých kľúčových aspektov spojených s IT nástupníctvom, pričom jednotlivé faktory sú vzájomne prepojené a priamo ovplyvňujú rozhodovanie kupujúceho.

IT infraštruktúra: Robustnosť a škálovateľnosť existujúcej IT infraštruktúry bývajú často posudzované ako kritické. Kupujúcimi sa skúma, či súčasné systémy dokážu podporiť očakávaný budúci rast a či sú zosúladené s aktuálnymi priemyselnými štandardmi (Fang, 2024). Neadekvátna IT infraštruktúra môže totiž predstavovať bariéru pri realizácii strategických zmien.

Správa a bezpečnosť údajov: Osobitná pozornosť býva venovaná implementovaným procesom správy a ochrany údajov. Silné protokoly kybernetickej bezpečnosti sa považujú za nevyhnutné na ochranu citlivých informácií, pričom prípadné zlyhania v tejto oblasti môžu vyústiť do značných právnych záväzkov alebo finančných strát (Fang, 2024).

Systémy Business Intelligence (BI): Prítomnosť BI systémov, ktoré umožňujú analýzu prevádzkovej efektívnosti a zákazníckeho správania, býva kupujúcimi hodnotená ako výhodná. Tieto systémy poskytujú strategické prehľady, ktoré môžu podporiť rozhodovacie procesy a zvýšiť konkurenčnú výhodu podniku (Attaran, 2004).

Prijímanie technológií: Hodnotí sa aj úroveň prijatia moderných technológií, ako je cloud computing alebo mobilné riešenia. Tieto prvky sú často spájané so zvýšením prevádzkovej efektívnosti a adaptability podniku na meniace sa trhové podmienky (Paye Sr, 2024).

Kompetencie personálu IT: Odbornosť a zručnosti personálu IT sa považujú za kritické z pohľadu podpory technologických systémov a zabezpečenia plynulého prechodu počas akvizície. Tím so znalosťami v tejto oblasti môže zásadne prispieť k dlhodobej stabilite podniku (Bani, 2011).

Integračné schopnosti: Schopnosť IT systémov integrovať sa s platformami potenciálnych kupujúcich sa často posudzuje ako jeden z kľúčových ukazovateľov technologickej pripravenosti podniku. Flexibilné systémy, ktoré umožňujú jednoduchú adaptáciu, sú kupujúcimi preferované (Drnevich & Croson, 2013).

Nákladová efektívnosť: Hodnotí sa aj, do akej miery IT investície prispievajú k znižovaniu nákladov a zvyšovaniu produktivity. Efektívne využívanie technológií na optimalizáciu nákladov a marží zvyšuje atraktívnosť podniku (Fang, 2024).

Systémy riadenia vzťahov so zákazníkmi (CRM): Efektívne CRM systémy, ktoré umožňujú zlepšenie interakcií so zákazníkmi a posilňujú ich lojalitu, sa považujú za významný faktor. Poskytujú cenné informácie o preferenciách zákazníkov, čo môže podporiť strategické rozhodovanie kupujúceho (Attaran, 2004).

Na záver možno uviesť, že integrácia IT do strategického a prevádzkového rámca podniku býva vnímaná ako rozhodujúci faktor pri procese nástupníctva. Prostredníctvom posúdenia vyššie uvedených aspektov dokážu potenciálni kupujúci lepšie zhodnotiť nielen súčasnú hodnotu podniku, ale aj jeho budúci potenciál.

## 2 Výskumný dizajn a metodológia

Hlavnou výskumnou otázkou príspevku je, či a akým spôsobom sú faktory nástupníctva - konkrétne predaj podniku kupujúcemu - ovplyvnené informačnými technológiami (IT). Cieľom príspevku je analyzovať a systematicky preskúmať aktuálny stav poznania o faktoroch nástupníctva, ktoré sú determinované alebo ovplyvnené modernými technológiami. Takáto analýza umožňuje nielen lepšie pochopenie interakcie medzi procesom nástupníctva a IT, ale môže tiež poskytnúť základ pre ďalší výskum v tejto oblasti a navrhnúť praktické odporúčania pre manažérov rodinných podnikov alebo odborníkov na podnikové plánovanie.

Príspevok je založený na literárnej rešerši, ktorá sa zameriava na faktory nástupníctva s dôrazom na ich prepojenie s informačnými technológiami. Metodológia rešerše bola postavená na dôkladnom preskúmaní odborných zdrojov, pričom boli aplikované jasne definované kritériá na výber relevantnej literatúry. Za účelom spracovania praktickej časti príspevku boli analyzované teoretické aj empirické zdroje týkajúce sa nasledovných oblastí nástupníctvo v kontexte predaja rodinných podnikov, dôvody a proces predaja podniku, úloha informačných technológií v podnikaní a faktory nástupníctva súvisiace s IT.

Výber zdrojov bol realizovaný na základe kľúčových slov ako corporate succession planning, factors influencing business succession, information technology in business a sale-to-buyer process. Dôležitými kritériami výberu bola relevantnosť obsahu k skúmanej téme a dátum vydania, pričom boli zahrnuté iba zdroje publikované od roku 2000 a novšie. Navyše, príspevky, ktoré neboli v anglickom jazyku alebo ktorých abstrakty neboli v súlade s hlavnou výskumnou otázkou, boli vylúčené z analýzy. Duplicity v zdrojoch boli odstránené na základe abecedného zoradenia zdrojov, pričom príspevky s rovnakým názvom a číslom na konci boli porovnané a duplicitné záznamy boli

eliminované. Následne boli príspevky zoradené podľa veľkosti, pričom v prípade rovnakej veľkosti boli jednotlivé položky porovnané a duplicitné boli odstránené.

Zdroje pre literárnu rešerš boli získané prostredníctvom renomovaných databáz, ako sú Google Scholar, Web of Science, Scopus a ProQuest, a taktiež z knižných publikácií autorov špecializujúcich sa na problematiku nástupníctva a IT. Medzi významné osobnosti, ktorých práce boli analyzované v kontexte tejto témy, patria autori ako Attaran, Bani, Fang a Paye Sr.

## 3 Výsledky výskumu

Cieľom analýzy bolo identifikovať, systematizovať a porovnať faktory informačných technológií, ktoré súvisia s nástupníctvom pri predaji rodinného podniku externému kupujúcemu. Výsledky uvedené v tejto kapitole predstavujú autorskú syntézu a komparáciu odborných zdrojov analyzovaných a citovaných v kapitole 2. Za vlastný výsledok práce sa považuje najmä vytvorenie kategorizácie IT faktorov, ich porovnanie podľa charakteru pôsobenia, identifikovanie spoločných znakov a formulovanie záverov o ich význame pre proces predaja podniku.

Analýzou bolo identifikovaných osem hlavných oblastí: IT infraštruktúra, správa a bezpečnosť údajov, systémy Business Intelligence, prijímanie moderných technológií, kompetencie IT personálu, integračné schopnosti informačných systémov, nákladová efektívnosť IT a systémy riadenia vzťahov so zákazníkmi. Na účely komparácie boli tieto oblasti rozdelené do troch skupín podľa ich dominantného pôsobenia: technické faktory, informačné a zákaznícke systémy a faktory súvisiace s využívaním technológií a ľudskými kompetenciami.

### 3.1 Porovnanie technických faktorov

V rámci prvej skupiny boli identifikované tri technické faktory: stav IT infraštruktúry, správa a bezpečnosť údajov a integračné schopnosti informačných systémov. Ich spoločným znakom je priame prepojenie s technologickou pripravenosťou podniku na zmenu vlastníka.

Komparácia ukázala, že jednotlivé faktory ovplyvňujú odlišné oblasti transakcie. IT infraštruktúra súvisí predovšetkým s prevádzkovou stabilitou podniku a s rozsahom budúcich investícií, ktoré môže kupujúci potrebovať. Správa a bezpečnosť údajov ovplyvňujú najmä informačné, právne a reputačné riziká. Integračné schopnosti určujú náročnosť prepojenia informačných systémov predávaného podniku so systémami kupujúceho.

Výsledkom porovnania je zistenie, že technickú pripravenosť nemožno posudzovať iba podľa existencie informačných systémov. Rozhodujúci je ich stav, bezpečnosť, dokumentácia, kompatibilita a možnosť ďalšieho rozvoja. Nedostatok v jednej z uvedených oblastí môže obmedziť prínos ostatných technických faktorov a zvýšiť náročnosť prechodu podniku na nového vlastníka.

### 3.2 Porovnanie informačných a zákazníckych systémov

V druhej skupine boli porovnávané systémy Business Intelligence a systémy riadenia vzťahov so zákazníkmi. Spoločným znakom oboch faktorov je využívanie podnikových údajov a ich transformácia na informácie použiteľné pri rozhodovaní a hodnotení podniku.

Rozdiel medzi nimi spočíva v dominantnom predmete ich využitia. Systémy Business Intelligence poskytujú širší pohľad na výkonnosť, procesy, náklady a vývoj podniku. CRM systémy sa orientujú predovšetkým na zákaznícke vzťahy, obchodnú históriu a hodnotu zákazníckej základne.

Výsledkom komparácie je zistenie, že BI systémy podporujú najmä transparentnosť a hodnotenie celkovej výkonnosti podniku, zatiaľ čo CRM systémy podporujú kontinuitu obchodných vzťahov po zmene vlastníka. Oba faktory zároveň znižujú závislosť podniku od osobných znalostí pôvodného vlastníka, pretože umožňujú uchovávať a odovzdávať informácie v systematizovanej podobe.

### 3.3 Moderné technológie, efektívnosť a ľudský faktor

Tretiu skupinu tvoria prijímanie moderných technológií, nákladová efektívnosť IT a kompetencie IT personálu. Ich spoločným znakom je, že nehodnotia iba technické vybavenie podniku, ale aj schopnosť technológie účelne využívať, rozvíjať a prispôsobovať meniacim sa podmienkam.

Komparáciou bolo zistené, že prijímanie technológií vyjadruje inovačnú pripravenosť podniku, nákladová efektívnosť poukazuje na ekonomický prínos IT a kompetencie personálu určujú schopnosť zabezpečiť prevádzku, rozvoj a prenos technologických znalostí. Jednotlivé faktory sa preto navzájom dopĺňajú: moderné riešenie bez hospodárskeho prínosu alebo bez pracovníkov schopných zabezpečiť jeho používanie nemusí predstavovať výhodu pre kupujúceho.

Výsledky zároveň ukazujú, že samotná existencia moderného technologického riešenia ešte nepredstavuje technologickú pripravenosť podniku. Technológia má význam pre proces predaja vtedy, keď je funkčne využívaná, primeraná potrebám podniku, ekonomicky odôvodnená a podporovaná pracovníkmi s potrebnými kompetenciami.

### 3.4 Identifikácia spoločných znakov

Syntézou jednotlivých oblastí bolo identifikovaných päť spoločných znakov. Prvým je znižovanie rizika pre kupujúceho, pretože pripravené IT prostredie obmedzuje pravdepodobnosť prerušenia prevádzky, straty údajov a vzniku neočakávaných nákladov. Druhým znakom je zvyšovanie transparentnosti podniku prostredníctvom dostupnosti a systematického spracovania údajov o jeho fungovaní. Tretím spoločným znakom je podpora kontinuity podnikania. IT umožňujú uchovávať podnikové znalosti, štandardizovať procesy a uľahčovať ich prevzatie novým vlastníkom. Štvrtým znakom je znižovanie závislosti podniku od pôvodného vlastníka alebo od jednotlivých zamestnancov, ktorí môžu disponovať kľúčovými znalosťami a kontaktmi. Piatym

spoločným znakom je vplyv na atraktivitu podniku a na náročnosť jeho následnej integrácie. Výsledky ukazujú, že pozitívny účinok nevytvára jeden izolovaný faktor, ale ich vzájomná kombinácia. Kvalitná infraštruktúra bez bezpečných údajov, kompetentného personálu alebo integračných možností neposkytuje rovnakú úroveň pripravenosti ako koordinované pôsobenie všetkých oblastí.

## 4 Diskusia

Výsledky analýzy ukazujú, že faktory súvisiace s informačnými technológiami nie je vhodné posudzovať izolovane. Medzi jednotlivými oblasťami existujú vzájomné väzby a nedostatok jedného faktora môže znižovať využiteľnosť ostatných. Analytické a zákaznícke systémy sú závislé od kvality údajov a infraštruktúry, integračné schopnosti od technickej kompatibility a dokumentácie a dlhodobá udržateľnosť všetkých riešení od kompetencií personálu.

Z hľadiska bezprostredného rizika transakcie boli ako osobitne relevantné identifikované bezpečnosť údajov, stav IT infraštruktúry a integračné schopnosti informačných systémov. Tieto oblasti bezprostredne súvisia so stabilitou prevádzky, ochranou informačných aktív a s náročnosťou technologického prechodu. Uvedené rozdelenie nepredstavuje jednoznačné poradie faktorov podľa ich významnosti, ale poukazuje na ich rozdielne pôsobenie v jednotlivých etapách predaja a integrácie podniku.

Z hľadiska dlhodobej kontinuity a rozvoja boli identifikované systémy Business Intelligence, CRM systémy, prijímanie moderných technológií, nákladová efektívnosť a kompetencie IT personálu. Ich význam sa prejavuje najmä v schopnosti podniku zachovať znalosti a zákaznícke vzťahy, podporovať rozhodovanie, reagovať na zmeny a ďalej rozvíjať technologické riešenia po uskutočnení predaja.

Na základe uskutočnenej komparácie možno výskumnú otázku zodpovedať kladne. Faktory nástupníctva pri predaji rodinného podniku súvisia s informačnými technológiami prostredníctvom ich vplyvu na hodnotu podniku, rozsah transakčných rizík, kvalitu dostupných informácií, kontinuitu prevádzky, prenos znalostí a následnú integráciu podniku do prostredia kupujúceho.

Za hlavný výsledok analýzy možno považovať zistenie, že technologickú pripravenosť podniku nevytvára jeden samostatný faktor, ale koordinované pôsobenie viacerých oblastí. Rodinný podnik je lepšie pripravený na predaj vtedy, keď disponuje spoľahlivou infraštruktúrou, bezpečnými a kvalitnými údajmi, funkčnými analytickými a zákazníckymi systémami, primerane využívanými technológiami, kvalifikovaným personálom a informačnými systémami, ktoré možno integrovať do prostredia nového vlastníka.

Z praktického hľadiska výsledky poukazujú na potrebu zahrnúť technologickú prípravu do plánu nástupníctva ešte pred začatím samotného predaja. Predmetom prípravy by malo byť posúdenie stavu infraštruktúry, bezpečnosti a kvality údajov, dokumentácie systémov, prenosu znalostí, ekonomickej účelnosti IT a možností integrácie. Takýto prístup môže znížiť neistotu kupujúceho a podporiť plynulejší priebeh transakcie a následného prechodu vlastníctva.

## Záver

Rodinné podniky tvoria významnú časť podnikov v Európe a nástupníctvo predstavuje jeden z kľúčových predpokladov ich dlhodobej kontinuity. Napriek významu tejto problematiky má formálny plán nástupníctva vypracovaný len obmedzený podiel rodinných podnikov, približne 15 % (Saymaz & Lambert, 2019). Keďže úspešné nástupníctvo predstavuje dlhodobý a systematický proces, je potrebné venovať jeho príprave primeranú pozornosť. Na základe realizovanej literárnej rešerše a komparácie identifikovaných faktorov možno konštatovať, že informačné technológie významne ovplyvňujú nástupníctvo v kontexte predaja rodinného podniku. Hlavným zistením je, že technologickú pripravenosť podniku neurčuje jeden samostatný IT faktor, ale vzájomná kombinácia viacerých oblastí. Ide najmä o spoľahlivú IT infraštruktúru, bezpečnú správu kvalitných údajov, efektívne analytické a zákaznícke systémy, integračné schopnosti informačných systémov, nákladovú efektívnosť technológií a odborné kompetencie IT personálu. Ich spoločným pôsobením sa znižujú prevádzkové, finančné, právne a informačné riziká transakcie, podporuje sa kontinuita podnikania a zvyšuje sa transparentnosť a atraktivita podniku pre potenciálneho kupujúceho. Technologicky pripravený rodinný podnik je zároveň schopný jednoduchšie preniesť znalosti, zákaznícke vzťahy a prevádzkové procesy na nového vlastníka a efektívnejšie integrovať svoje systémy do technologického prostredia kupujúceho. Moje odporúčanie pre podnikateľov je mať vypracovaný plán nástupníctva a využívať všetky výhody, ktoré IT v tomto smere poskytujú. Moje odporúčanie pre vládu je zmapovať koľko rodinných podnikov je na Slovensku a stimulovať podnikateľov k vypracovaniu plánu nástupníctva. Moje odporúčanie pre ďalší výskum je rozšíriť skúmanie tejto relatívne málo prebádanej problematiky, pričom osobitnú pozornosť by bolo vhodné venovať potenciálnym prínosom umelej inteligencie (AI) pri navrhovaní plánov nástupníctva. Výskum odporúčam orientovať na jednotlivé krajiny, a to najmä s ohľadom na ich špecifické právne a daňové systémy. Zároveň je potrebné venovať pozornosť rozdielom medzi odvetviami, ako aj špecifikám vyplývajúcim z veľkosti podnikov. Osobitnú dôležitosť treba prikladať identifikácii a analýze nových trendov v oblasti IT a hľadaniu inovatívnych prístupov, ktoré by mohli napomôcť rodinným podnikom pri efektívnom

## Poznámka o riešenom projekte

Tento príspevok je výstupom vedeckého projektu VEGA č. 1/0109/24.

## Použitá literatúra (References)

ATTARAN, Mohsen. Exploring the relationship between information technology and business process reengineering. *Information & management*, 2004, 41.5: 585-596. Dostupné na https://www.researchgate.net/profile/Mohsen-Attaran/publication/222407738_Exploring_the_relationship_between_information_technology_and_business_process_reengineering/links/5b32bbf84585150d23d58a79/Exploring-the-relationship-between-information-technology-and-business-process-reengineering.pdf

BANI, Jordan. *Assessing the relationships among information technology flexibility, IT-business strategic alignment, and information technology effectiveness: An investigation of business intelligence implementation*. Capella University, 2011. Dostupné na: https://www.proquest.com/dissertations-theses/assessing-relationships-among-information/docview/862076363/se-2?accountid=32253

CARTER, Stephanie. *Impact of cloud based computing on business-information technology alignment in small businesses*. Colorado Technical University, 2015. Dostupné na: https://www.proquest.com/dissertations-theses/impact-cloud-based-computing-on-business/docview/1712374897/se-2?accountid=32253

DAVENPORT, Shameka W. *The impact of succession planning on employee satisfaction, engagement, and loyalty*. Walden University, 2012. Dostupné na: https://www.proquest.com/dissertations-theses/impact-succession-planning-on-employee/docview/1282583865/se-2?accountid=32253

DE BOER, Fred. THE HOLY GRAIL OF EFFECTIVE LEADERSHIP SUCCESSION PLANNING. *Accountancy SA*, 03, 2024. pp. 30-35 Dostupné na: https://www.proquest.com/trade-journals/holy-grail-effective-leadership-succession/docview/2954296743/se-2?accountid=32253

DRNEVICH, Paul L.; CROSON, David C. Information technology and business-level strategy: Toward an integrated theoretical perspective. *MIS quarterly*, 2013, 483-509. Dostupné na: http://eli.johogo.com/Class/p9.pdf

ESTEDADI, Ershad; HAMIDI, Kambiz. The importance of succession planning in organizations. *Advanced Social Humanities and Management*, 2015, 2.3: 41-47. Dostupné na: https://scholar.archive.org/work/mqdgahsvcfcbfey4jkm2uztuvi/access/wayback/http://amiemt-journal.com/test2/vol2-no3/9.pdf

FANG, Fuechee. *A Phenomenological Study: Small Business and Technology Integration Challenges*. 2024. PhD Thesis. California Southern University. Dostupné na: https://www.proquest.com/dissertations-theses/phenomenological-study-small-business-technology/docview/3131669511/se-2?accountid=32253

IP, Barry; JACOBS, Gabriel. Business succession planning: a review of the evidence. *Journal of small business and enterprise development*, 2006, 13.3: 326-350. Dostupné na: http://www.nurimamah.lecture.ub.ac.id/files/2009/07/business-succession-planning-a-review-of-the-evidence.pdf

KECHLI, Wael. *Family business succession planning into the second generation*. The University of Liverpool (United Kingdom), 2023. Dostupné na: https://www.proquest.com/dissertations-theses/family-business-succession-planning-into-second/docview/2800163886/se-2?accountid=32253

LECOUNTE, John Fitzpatrick. *Best Practices in Succession Planning for CEOs Leading Family-Owned Small and Medium-Sized Enterprises*. 2018. PhD Thesis. Texas A&M University. Dostupné na: https://www.proquest.com/dissertations-theses/best-practices-succession-planning-ceos-leading/docview/2666933760/se-2?accountid=32253

PAHNKE, André; SCHLEPPHORST, Susanne; SCHLÖMER-LAUFEN, Nadine. Family business successions between desire and reality. *Journal of Business Venturing Insights*, 2024, 21: e00457. Dostupné na: https://www.sciencedirect.com/science/article/pii/S235267342400009X/pdfft?md5=463dc52d557112f8b6465a92d094fb59&pid=1-s2.0-S2352
67342400009X-main.pdf

PATTERSON, Lesley David. *"DON'T ASK ME ABOUT MY BUSINESS": An Exploration of Intrafamily, Intergenerational Succession Through Narrative Analysis of The Godfather*. 2024. PhD Thesis. The Chicago School of Professional Psychology. Dostupné na: https://www.proquest.com/dissertations-theses/don-t-ask-me-about-my-business-exploration/
docview/3133034664/se-2?accountid=32253

PAYE SR, Lawrence Nyayowagbian. The Adoption of Information Technology Use in Small Businesses. 2024. Dostupné na: https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=16784&context=dissertations

PRAYITNO, Agus. Increasing the Impacts of Information Technology Usage on Business Value. *International Journal of Business and Society*, 2020, 21.2: 679-692. Dostupné na: https://publisher.unimas.my/ojs/index.php/IJBS/article/view/3282/1224

ROTHWELL, William J. *Effective succession planning: Ensuring leadership continuity and building talent from within*. HarperChristian+ ORM, 2015. Dostupné na: https://thuvienso.dau.edu.vn:88/bitstream/DHKTDN/6416/1/Effective%20succession%20planning%2C%203rd%20edition.5982.pdf

SAYMAZ, Savas; LAMBERT, Hugh H. Family business succession planning opportunities. *The CPA Journal*, 2019, 64. Dostupné na: https://fisherpub.sjf.edu/cgi/viewcontent.cgi?article=1091&context=business_facpub

SETIAWATI, Rini, et al. The Role of Information Technology in Business Agility: Systematic Literature Review. *Calitatea*, 2022, 23.189: 144-149. Dostupné na: https://www.researchgate.net/profile/Endri-Endri/publication/362536847_The_Role_of_Information_Technology_in_Business_Agility_Systematic_Literature_Review/links/62ef2aaa505511283e98f837/The-Role-of-Information-Technology-in-Business-Agility-Systematic-Literature-Review.pdf

WHITMAN-RECTOR, Amy M. *The Challenges of Succession Planning for Small Family-Owned Businesses: A Qualitative Descriptive Case Study*. 2024. PhD Thesis. University of Phoenix. Dostupné na: https://www.proquest.com/dissertations-theses/challenges-succession-planning-small-family-owned/docview/3049991437/se-2?accountid=32253

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# HODNOTENIE PERCEPCIA RIZIKA VO VYBRANÝCH RODINNÝCH PODNIKOCH ZAMERANÝCH NA UBYTOVANIE A STRAVOVANIE

*Roman Lacko – Diana Gombitová*

***Abstrakt***
Štúdia sa zaoberá problematikou krízového manažmentu v odvetví cestovného ruchu, ktoré je vzhľadom na svoj multi-sektorový charakter mimoriadne náchylné na krízové situácie rôzneho druhu – od prírodných katastrof, cez občianske konflikty a epidémie, až po technologické zlyhania. Teoretická časť práce vymedzuje základné typológie kríz v cestovnom ruchu a zdôrazňuje význam včasnej pripravenosti, krízového plánovania a efektívnej komunikácie pre minimalizáciu ich dopadov. Empirická časť práce je založená na dotazníkovom prieskume realizovanom prostredníctvom platformy Google Forms medzi ubytovacími a stravovacími zariadeniami, ktorého cieľom bolo zistiť, ako manažéri a zamestnanci podnikov cestovného ruchu vnímajú pravdepodobnosť vzniku a potenciálny dopad jedenástich kategórií rizík. Na základe získaných dát bola zostavená matica rizík a vypočítaná celková miera rizika (súčin pravdepodobnosti a dopadu) pre jednotlivé kategórie. Výsledky ukázali, že respondenti vnímajú ako najvýznamnejšie ekonomické riziká, ktoré dosiahli najvyššiu mieru pravdepodobnosti aj dopadu spomedzi všetkých sledovaných kategórií, nasledované personálnymi rizikami. Naopak, technologické, hygienicko-sanitárne a prírodné riziká boli respondentmi hodnotené ako menej pravdepodobné a menej závažné, čo môže súvisieť s ich nižšou frekvenciou výskytu v praxi respondentov. Zistenia poukazujú na potrebu, aby podniky cestovného ruchu venovali pozornosť najmä budovaniu ekonomickej odolnosti a riešeniu personálnych výziev, no zároveň nepodceňovali menej pravdepodobné, no potenciálne vysoko závažné riziká, na ktoré je odvetvie z hľadiska krízovej pripravenosti dlhodobo najmenej pripravené.

***JEL classification**: D81, H12, L83*
***Keywords**: manažment rizika, cestovný ruch, mapa rizika, Slovenská republika, ubytovacie zariadenia*

## Úvod

Cestovný ruch patrí medzi odvetvia, ktoré sú mimoriadne citlivé na vonkajšie vplyvy a otrasy, či už ide o prírodné katastrofy, politické nepokoje, epidémie alebo technologické zlyhania. Práve táto zraniteľnosť robí z krízového manažmentu v cestovnom ruchu tému, ktorej venovanie pozornosti je nevyhnutné – nielen z pohľadu jednotlivých podnikov, ale aj celých destinácií a národných ekonomík. Na rozdiel od iných odvetví sa cestovný ruch vyznačuje výraznou previazanosťou s množstvom ďalších sektorov (doprava, ubytovanie, stravovanie, služby), a preto sa akákoľvek kríza v tomto odvetví prejavuje nielen priamo, ale aj prostredníctvom rozsiahleho multiplikačného efektu na celú ekonomiku.

Cieľom nasledujúcich odsekov a podkapitol je priblížiť špecifiká krízového manažmentu v cestovnom ruchu – od typológie kríz, ich pôvodu a miery predvídateľnosti, cez konkrétne kategórie krízových udalostí, až po otázku pripravenosti podnikov na ich zvládanie. Osobitná pozornosť bude venovaná tomu, prečo napriek preukázateľnej dôležitosti krízového plánovania mnohé podniky cestovného ruchu túto oblasť dlhodobo podceňujú, a akým spôsobom by mala vyzerať efektívna príprava na krízové situácie.

## 1 Súčasný stav riešenej problematiky doma a v zahraničí

Ghaderi et al. (2022) upozorňujú, že napriek všetkým poznatkom o dôležitosti krízovej prípravy vedenia podnikov cestovného ruchu dlhodobo prejavujú nízky záujem o krízové plánovanie. Ich prieskum medzi hotelmi ukázal, že manažéri a zamestnanci sa cítia pomerne pripravení zvládať menšie krízy, ktoré už v minulosti zažili, no pri neznámych a závažných udalostiach im chýbajú plány, rozpočet aj kompetencie. Za touto neochotou stojí najmä skepticizmus voči tomu, či sa dá kríza vôbec predpovedať – vyčleňovanie zdrojov na udalosť, ktorá možno ani nenastane, tak vedenie vníma ako neefektívne (Ghaderi et al., 2014).

Pritom práve funkčná krízová príprava by mala zahŕňať niekoľko základných krokov: zostavenie krízového tímu, ktorý priebežne monitoruje dianie na trhu a vo svete, stanovenie rozpočtu na protikrízové opatrenia, zabezpečenie poistenia, pravidelné testovanie pripravených scenárov a vypracovanie krízových a komunikačných plánov (Wang & Wu, 2018). Dôvodom, prečo je táto príprava v cestovnom ruchu obzvlášť náročná, je skutočnosť, že krízy tu prichádzajú takmer vždy nečakane a podniky nemajú dostatok času reagovať (Theobald, 2011). Odvetvie v posledných rokoch zažilo rad závažných otrasov – vojny, teroristické útoky, ekonomické recesie či pandémie (Chen, 2011; Duan et al., 2022) – pričom ich nepredvídateľnosť z hľadiska miesta, času aj rozsahu kladie na manažérov mimoriadne nároky. Aj bez možnosti presného plánovania by však mali vedieť odhadnúť, aké riziká sú pre ich podnik najrelevantnejšie, a mať pripravený komplexný krízový plán umožňujúci rýchlu reakciu (Evans & Elphick, 2005). Zvládanie krízy si navyše vyžaduje koordináciu mnohých strán – obyvateľov, návštevníkov, partnerských organizácií i zamestnancov – čo z krízového manažmentu v tomto odvetví robí mimoriadne komplexnú úlohu (Theobald, 2011).

Samotná citlivosť cestovného ruchu na krízy vyplýva z jeho multi-sektorového charakteru (ÇiFtçi et al., 2017; Duan et al., 2022; Evans & Elphick, 2005; Theobald, 2011). Destinácie totiž ovplyvňuje nielen politická a bezpečnostná situácia, ale aj fungovanie dopravy, stravovacích a ubytovacích služieb, či širšie spoločenské trendy ako demografický vývoj alebo úroveň príjmov. Práve pre túto prepojenosť má kríza v cestovnom ruchu multiplikačný dosah na celú ekonomiku – od poľnohospodárstva až po textilný priemysel (ÇiFtçi et al., 2017; Duan et al., 2022).

Podľa Tse (2006) možno krízy ovplyvňujúce cestovný ruch rozdeliť do štyroch skupín:

1. Technologické zlyhania – keďže väčšina dopravy a infraštruktúry funguje digitálne, k výpadku (napr. elektriny) alebo nehode môže dôjsť kedykoľvek a znepríjemniť tak zážitok z cesty.

2. Epidémie – ich šírenie nemožno spoľahlivo predvídať ani úplne zastaviť, ako dokázali SARS v roku 2003 aj Covid-19 v roku 2020.
3. Občianske konflikty – nepokoje, protesty či násilie v rámci krajiny, pričom najhoršie pôsobia teroristické útoky práve pre nemožnosť predpovedať ich čas, rozsah a dopad.
4. Prírodné katastrofy – živly ako povodne, zemetrasenia či hurikány narúšajú dopravu a infraštruktúru a spôsobujú, že turisti dlhšie váhajú s návratom do destinácie.

Theobald (2011) navyše krízy triedi podľa štyroch hľadísk – motívu vzniku, dĺžky trvania, dosahu (od lokálneho po medzinárodný) a pôvodu (destinácia, trh, konkurencia) – pričom platí, že čím širší je geografický dosah krízy, tým náročnejšie je zmierniť jej následky. Rozdiel medzi typmi kríz spočíva najmä v miere ich predvídateľnosti: kým prírodné katastrofy možno predpovedať nanajvýš deň či dva vopred, trendy je možné sledovať a vyhodnocovať dlhodobo. Prvým a najvýraznejším signálom, že kríza prichádza alebo už prebieha, je spravidla náhly pokles návštevnosti destinácie (Pappas, 2018).

Podniky pôsobiace v cestovnom ruchu majú oproti výrobcom tovarov jednu zásadnú odlišnosť – ponúkajú služby, ktoré sú závislé od bezprostredného kontaktu so zákazníkom, a preto si vyžadujú aj odlišný prístup ku krízovému manažmentu. Na rozdiel od chybného tovaru totiž chybný turistický produkt nemožno jednoducho stiahnuť z trhu, keďže spotrebiteľ ho spotrebúva v tom istom okamihu, v akom je poskytovaný (Henderson, 2007; Lehtinen & Järvinen, 2015). V prípadoch, keď takáto chyba ohrozuje priamo ľudské životy, je preto nevyhnutné, aby mal podnik vopred pripravené bezpečnostné postupy. Realita krízovej situácie však býva spravidla oveľa chaotickejšia, než predpokladajú vopred pripravené plány, a manažéri musia byť schopní priebežne sledovať vývoj a rozhodovať sa aj tam, kde im žiadny plán jasný postup neponúka (Henderson, 2007).

Citlivosť odvetvia na negatívne udalosti potvrdzuje aj Floyd et al. (2004), ktorý si všimol jasný vzorec v správaní turistov – s rastúcim vnímaním rizika spojeným s destináciou klesá záujem o jej návštevu. Práve táto zvýšená zraniteľnosť stojí za rastúcim počtom odborných publikácií venovaných krízam v cestovnom ruchu, pričom sa v nich najčastejšie rieši pripravenosť podnikov a ich prvotná reakcia na vzniknutú situáciu. Medzi kľúčové faktory úspešného zvládnutia krízy patrí najmä kvalitná komunikácia, dostatočná informovanosť a udržanie dôvery v destináciu (Pforr, 2006).

Odlišný charakter jednotlivých kríz opísali Clarke & Varma (1999) prostredníctvom dvoch typológií – „kobra“ a „pytón“. Kým kríza typu kobra prichádza náhle a bez akéhokoľvek varovania, čo výrazne obmedzuje možnosť prípravy a môže mať katastrofálne dôsledky, kríza typu pytón sa naopak vyvíja postupne, vďaka čomu má podnik väčší priestor na jej rozpoznanie a zmiernenie následkov. Zatiaľ čo na krízu typu kobra podniky spravidla reagujú defenzívne a opierajú sa pri tom o osvedčené postupy, kríza typu pytón si zvyčajne vyžaduje skôr byrokratickejší prístup (C. Pforr & Hosie, 2008).

Pri krízach, ktoré prichádzajú nečakane, môže byť čas na reakciu minimálny alebo dokonca žiadny, pričom úplný návrat do stavu pred krízou často ani nie je reálny. Paradoxne to však nemusí byť len negatívum – podniky sa z takýchto skúseností často poučia a v dôsledku toho zlepšia kvalitu svojich služieb (Henderson, 2007). Základom účinnej prevencie je predovšetkým dostatočná informovanosť o možných rizikách, pričom pri závažnejších krízach je nevyhnutná aj spolupráca naprieč viacerými odvetviami. Cestovný ruch totiž funguje ako prepojený systém, ktorý zahŕňa hotely, dopravu, atrakcie, samosprávy, zdravotníctvo a ďalšie zainteresované subjekty – a keď nastane kríza, dotýka sa spravidla viacerých z nich súčasne. Práve preto teória zdôrazňuje význam spoločného, koordinovaného plánovania medzi jednotlivými aktérmi (Agbaba & Jurdana, 2025).

Nemenej dôležitú úlohu v krízovom manažmente zohráva aj komunikácia, ktorá sa v moderných organizáciách stala jedným z rozhodujúcich faktorov úspechu či zlyhania krízového riadenia – ovplyvňuje totiž reputáciu podniku, dôveru zainteresovaných strán aj jeho ďalšie fungovanie. Efektívna krízová komunikácia by preto mala zabezpečiť rýchly, jasný a plynulý tok informácií smerom dovnútra aj navonok organizácie (Ciekanowski et al., 2024). Jej hlavným cieľom je predovšetkým ochrana bezpečnosti zamestnancov, zákazníkov aj širokej verejnosti prostredníctvom včasného poskytovania informácií o prijatých opatreniach, pričom overené a presné informácie zároveň pomáhajú predchádzať panike a šíreniu dezinformácií (Diers-Lawson, 2019). Rovnako dôležitá je aj ochrana reputácie organizácie, ktorá úzko súvisí s transparentnosťou komunikácie – firmy komunikujúce otvorene si totiž dokážu udržať pozitívnejší obraz u svojich stakeholderov aj v náročných obdobiach. Práve takáto komunikácia napokon umožňuje organizácii vrátiť sa k štandardnému fungovaniu (Valackiene, 2010).

## 2 Výskumný dizajn a metodológia

Dotazník s názvom Prieskum vnímania rizík bol vytvorený prostredníctvom online platformy Google Forms. Cieľov prieskumu bolo viacero ale pre potreby tohto príspevku sme sa zamerali na vytvorenie mapy rizík pre podniky rodinného typu so zameraním na hotely a reštaurácie.

Prieskum bol realizovaný v anonymnej forme s cieľom zabezpečiť vyššiu mieru otvorenosti a úprimnosti respondentov pri poskytovaní odpovedí. Anonymita zároveň slúžila na elimináciu prípadných obáv respondentov z dôsledkov zverejnenia poskytnutých informácií, čím sa zvýšila aj objektivita získaných údajov. Zber dát prostredníctvom dotazníka prebiehal od októbra 2025 do marca 2026. Výskumnú vzorku, po vyfiltrovaní rodinných podnikov a hotelov vyššej úrovne, tvorilo celkovo 11 respondentov, pričom všetky získané odpovede boli vyhodnotené ako platné. Respondenti hodnotili pravdepodobnosť a dopad rizika podľa rôznych typov rizík. Tieto hodnotili na škále 1 až 5, pričom 5 je vysoká pravdepodobnosť a vysoký dopad.

Dotazník bol distribuovaný formou elektronickej pošty ubytovacím a stravovacím zariadeniam, ktorých kontaktné e-mailové adresy boli vyhľadané prostredníctvom internetu. Súčasťou sprievodného e-mailu bol aj informovaný súhlas, v rámci ktorého boli respondenti oboznámení so skutočnosťou, že vyplnením dotazníka udeľujú súhlas

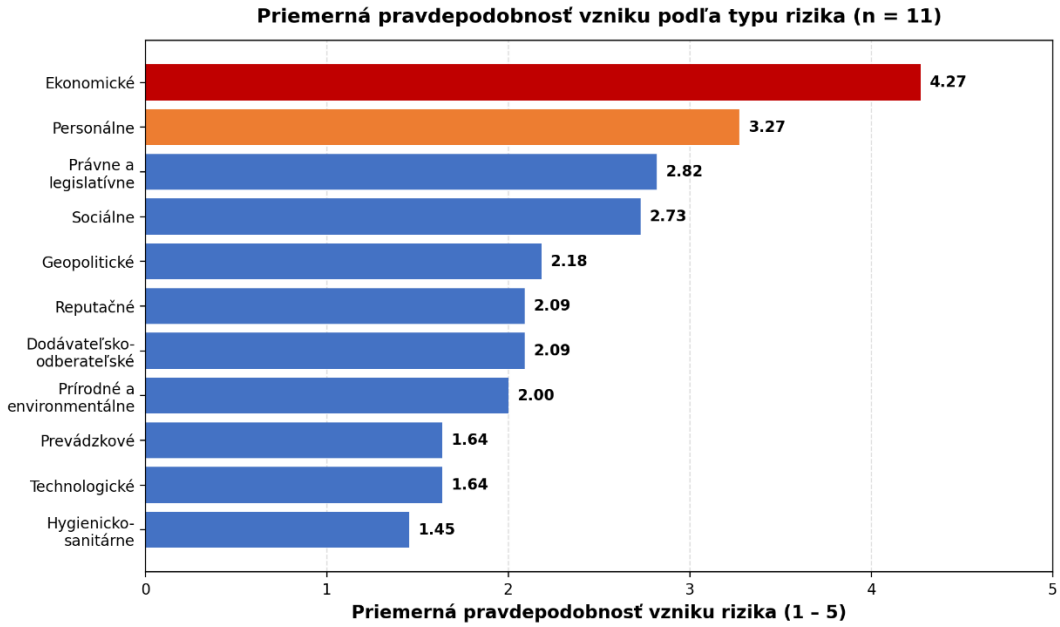
so spracovaním poskytnutých údajov na vedecké účely, ako aj s informáciami týkajúcimi sa anonymného spracovania ich odpovedí.

Výsledky prieskumu boli spracované v programe RStudio prostredníctvom programovacieho jazyka R.

## 3 Výsledky výskumu

V tejto časti charakterizujeme výsledky prieskumu vnímania rizík vo vybranej vzorke respondentov.

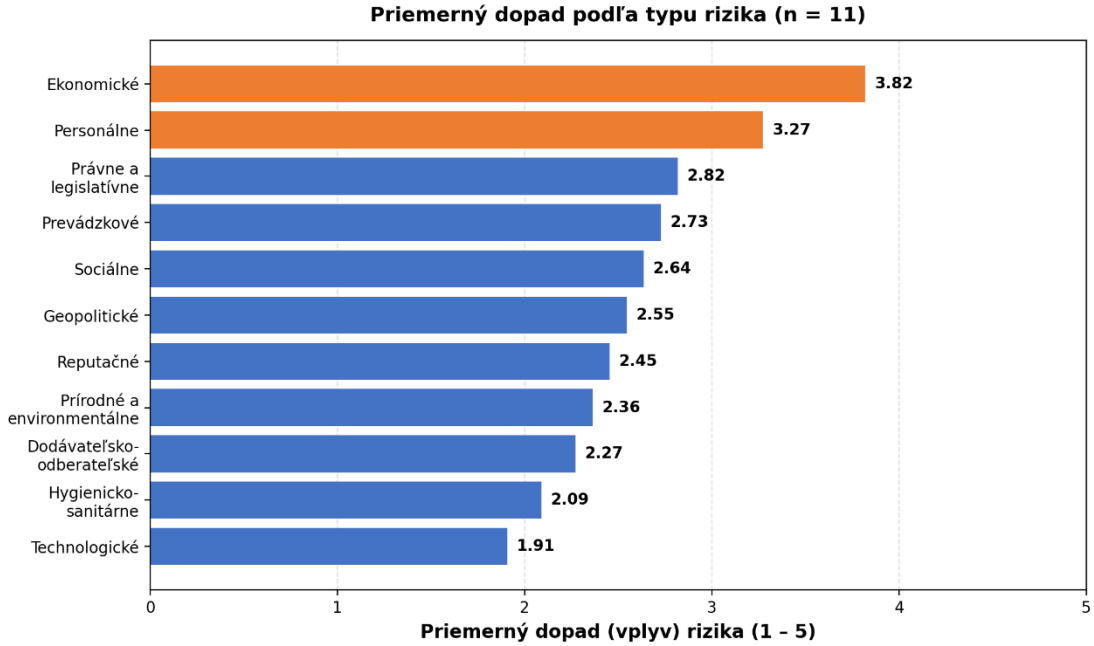
**Graf 1**
Pravdepodobnosť vzniku rizika




*Zdroj: vlastné spracovanie*

Z grafu 1 vyplýva, že respondenti vnímajú ako najpravdepodobnejšie ekonomické riziká (priemerná hodnota 4,27 z 5), čo výrazne prevyšuje všetky ostatné kategórie. Druhé miesto zaujímajú personálne riziká (3,27), ktoré súvisia najmä s nedostatkom kvalifikovanej pracovnej sily v odvetví cestovného ruchu. Stredne pravdepodobné sú právne a legislatívne (2,82) a sociálne riziká (2,73). Naopak, najnižšiu pravdepodobnosť vzniku respondenti pripisujú hygienicko-sanitárnym (1,45), technologickým a prevádzkovým rizikám (obe 1,64) – teda kategóriám, ktoré sú síce potenciálne závažné, no v bežnej prevádzke sa vyskytujú zriedkavo.

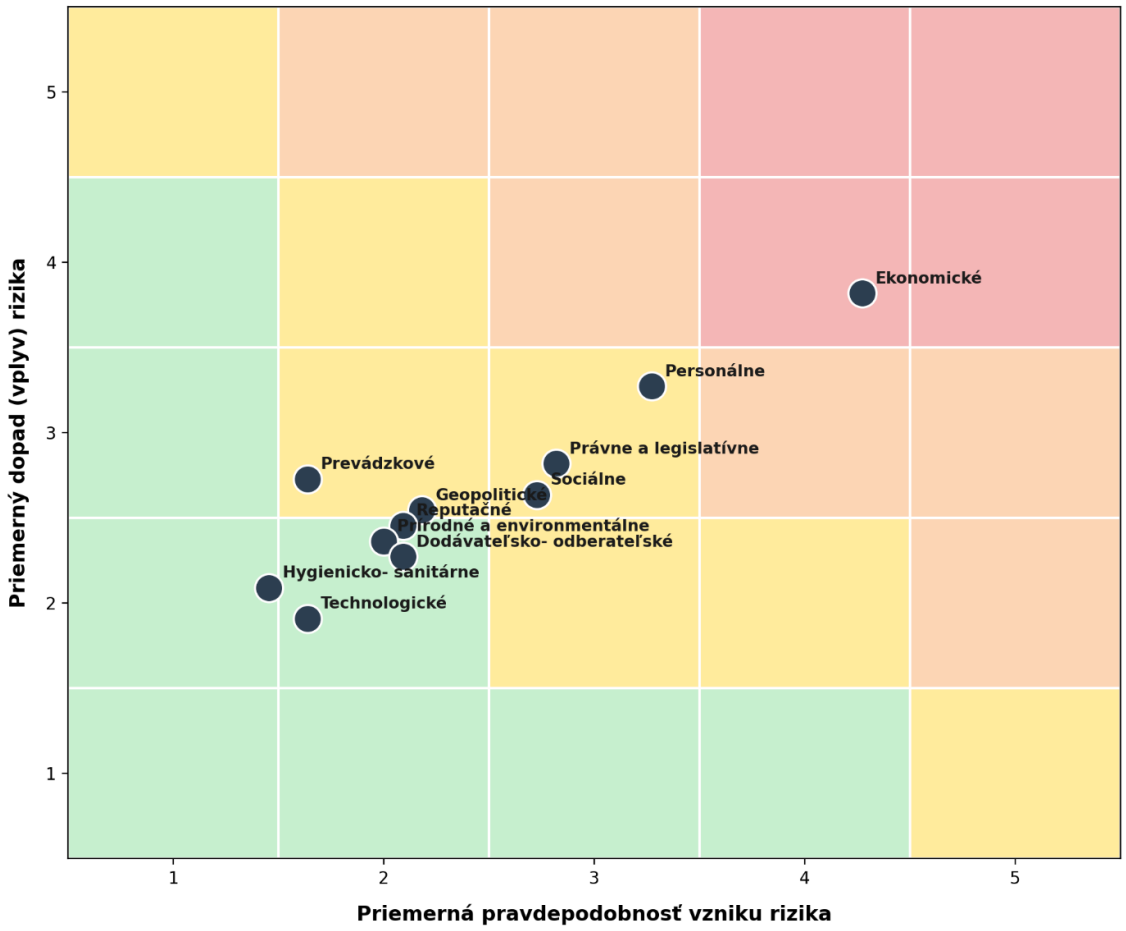
**Graf 2**
Dopad rizika na podnik




*Zdroj: vlastné spracovanie*

Poradie kategórií podľa dopadu uvedené v grafe 2 je vo veľkej miere podobné poradiu podľa pravdepodobnosti, čo naznačuje, že respondenti vnímajú riziká konzistentne – teda tie, ktoré považujú za pravdepodobnejšie, im zároveň pripisujú aj vyšší potenciálny dopad. Aj tu jednoznačne dominujú ekonomické riziká (3,82) a personálne riziká (3,27), čo potvrdzuje, že ide o dvojicu rizík, ktorá je z pohľadu respondentov najzávažnejšia tak z hľadiska frekvencie výskytu, ako aj z hľadiska závažnosti následkov. Naopak, najnižší dopad je pripisovaný technologickým rizikám (1,91), čo môže súvisieť s tým, že technologické zlyhania (napr. výpadok internetu či rezervačného systému) sú síce nepríjemné, no zvyčajne rýchlo riešiteľné a nemajú dlhodobý vplyv na fungovanie podniku.

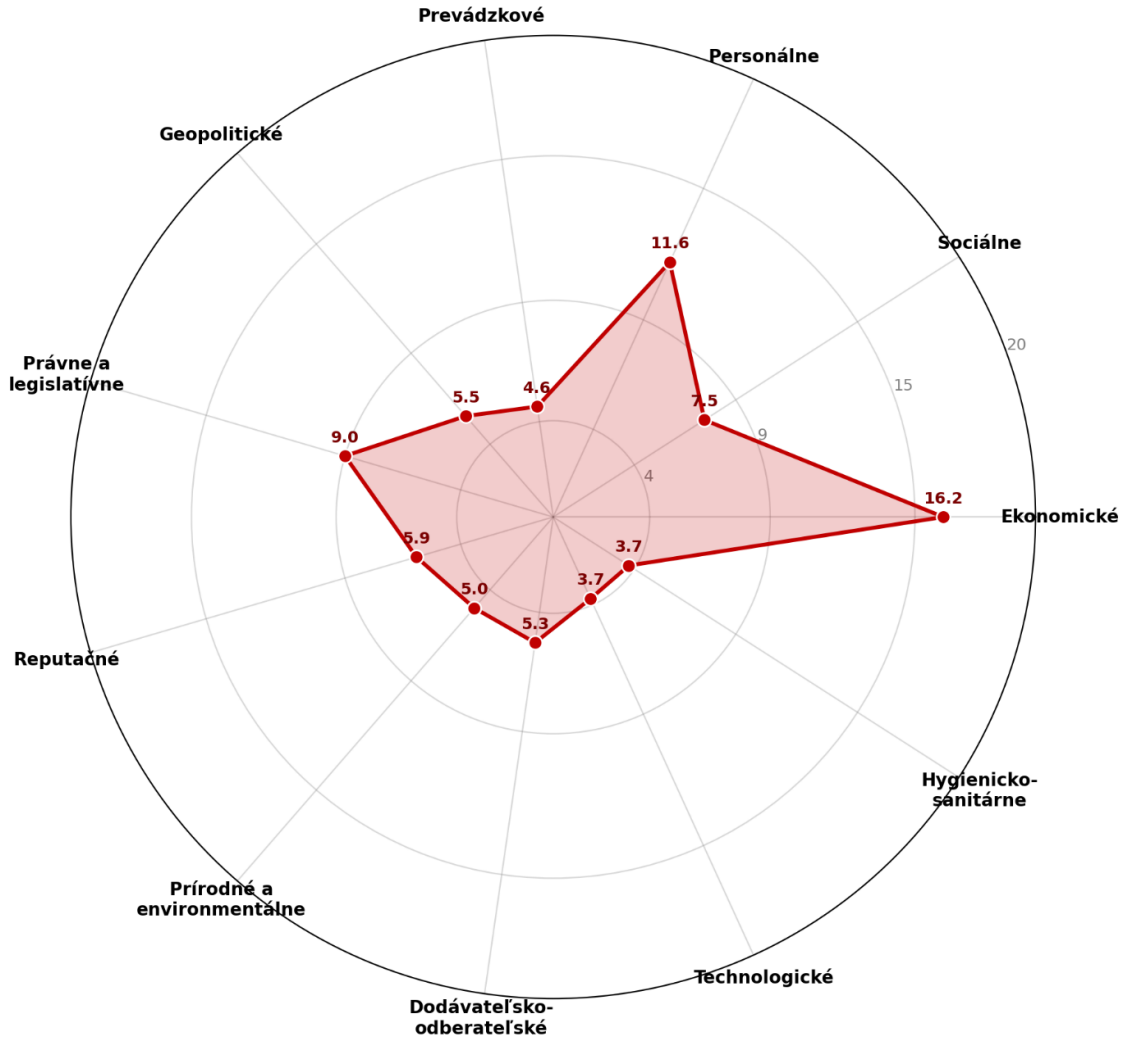
**Graf 3**
Matica rizík




*Zdroj: vlastné spracovanie*

Matica rizík kombinuje obe predchádzajúce dimenzie do jedného prehľadu a umožňuje identifikovať, ktoré riziká si vyžadujú najvyššiu prioritu v rámci krízového manažmentu. Ekonomické riziká sa nachádzajú jednoznačne v pásme vysokého až kritického rizika (pravdepodobnosť aj dopad nad hodnotou 3,8), čím sa potvrdzujú ako kľúčová oblasť, na ktorú by sa mali podniky cestovného ruchu sústrediť pri tvorbe krízových plánov. Personálne riziká sa nachádzajú tesne pod touto hranicou, v pásme vysokého rizika. Väčšina ostatných kategórií (technologické, hygienicko-sanitárne, prírodné a environmentálne, dodávateľsko-odberateľské) sa koncentruje v ľavej dolnej časti matice, teda v pásme nízkeho až stredného rizika, čo naznačuje, že respondenti ich vnímajú ako menej naliehavé z hľadiska krízovej pripravenosti.

**Graf 4**
Spider graf miery rizika




*Zdroj: vlastné spracovanie*

Radarový graf zobrazuje celkovú mieru rizika ako súčin pravdepodobnosti a dopadu, čím poskytuje jednoduchý súhrnný ukazovateľ závažnosti jednotlivých kategórií. Tvar grafu jasne poukazuje na výrazný „výbežok“ smerom k ekonomickým rizikám (16,18), ktorý viac ako dvojnásobne prevyšuje druhú najzávažnejšiu kategóriu – personálne riziká (11,64). Zvyšné kategórie sa pohybujú v podstatne užšom pásme hodnôt (3,7 – 9,0), čo naznačuje, že z pohľadu respondentov predstavuje ekonomická nestabilita jednoznačne najvýznamnejšiu hrozbu pre podniky cestovného ruchu, zatiaľ čo ostatné riziká sú vnímané ako relatívne porovnateľné a menej naliehavé.

## 4 Diskusia a záver

Výsledky prieskumu vnímania rizík v podnikoch cestovného ruchu potvrdzujú viacero poznatkov, ktoré sa objavujú aj v odbornej literatúre. Skutočnosť, že respondenti vnímajú ekonomické riziká ako najpravdepodobnejšie aj najzávažnejšie, je v súlade s tvrdením, že

kríza v cestovnom ruchu má výrazný multiplikačný efekt na celú ekonomiku a naopak – ekonomická nestabilita sa priamo premieta do dopytu po cestovaní (ÇiFtçi et al., 2017; Duan et al., 2022). Vzhľadom na to, že cestovný ruch je odvetvie závislé od disponibilného príjmu domácností, je logické, že práve ekonomické výkyvy (inflácia, rast cien energií, pokles kúpyschopnosti) vnímajú manažéri ako hrozbu s najvyššou frekvenciou výskytu aj najsilnejším dopadom na fungovanie podniku.

Druhé miesto personálnych rizík korešponduje s dlhodobo diskutovaným problémom nedostatku kvalifikovanej pracovnej sily v sektore ubytovacích a stravovacích služieb. Na rozdiel od náhlych, ťažko predvídateľných kríz typu „kobra“ (Clarke & Varma, 1999) ide v tomto prípade skôr o pomaly narastajúci problém typu „pytón“ – teda o riziko, ktoré sa dá do určitej miery očakávať a manažovať prostredníctvom dlhodobejších personálnych stratégií, čo môže vysvetľovať, prečo respondenti aj napriek vysokej miere rizika túto kategóriu nevnímajú až tak kriticky ako ekonomické riziká.

Naopak, pomerne nízke hodnotenie prírodných, technologických a hygienicko-sanitárnych rizík môže súvisieť s tým, že ide o udalosti, ktoré sa v praxi respondentov vyskytujú zriedkavo, alebo že ich dôsledky – napriek potenciálnej závažnosti – vnímajú ako riešiteľné v krátkom čase (napr. výpadok rezervačného systému). Tento výsledok je však potrebné interpretovať opatrne, keďže práve tieto typy kríz (napr. pandémie) patria z hľadiska literatúry medzi najťažšie predvídateľné a potenciálne najničivejšie pre celé odvetvie (Tse, 2006; Theobald, 2011). Nízka miera vnímaného rizika tak môže odrážať skôr nedostatočnú historickú skúsenosť s týmito krízami než ich reálny potenciál spôsobiť škody, čo je v súlade so zisteniami Ghaderi et al. (2022), podľa ktorých sú manažéri v odvetví cestovného ruchu relatívne pripravení na známe, opakujúce sa krízy, no vykazujú výrazný nedostatok pripravenosti na neznáme a vysoko závažné udalosti.

Celkovo možno konštatovať, že vnímanie rizika u respondentov je pomerne konzistentné naprieč oboma dimenziami (pravdepodobnosť aj dopad), čo naznačuje racionálne a skúsenosťou podložené hodnotenie situácie. Zároveň sa však potvrdzuje riziko, na ktoré upozorňuje literatúra – že podniky majú tendenciu podceňovať práve tie krízy, ktoré sa v minulosti ešte nevyskytli, čo môže v prípade ich reálneho nástupu viesť k výraznému nedostatku pripravenosti.

Cieľom tejto časti práce bolo zhodnotiť, ako respondenti z radov podnikov cestovného ruchu vnímajú jednotlivé typy rizík z hľadiska ich pravdepodobnosti vzniku a potenciálneho dopadu. Na základe spracovaných dát možno konštatovať, že najvýznamnejšou rizikovou kategóriou sú z pohľadu respondentov ekonomické riziká, ktoré dosahujú najvyššie hodnoty tak v pravdepodobnosti, ako aj v dopade, a v celkovej matici rizík sa jednoznačne nachádzajú v pásme vysokého až kritického rizika. Druhou najvýznamnejšou kategóriou sú personálne riziká, zatiaľ čo ostatné typy rizík (sociálne, právne, geopolitické, reputačné, prírodné, dodávateľsko-odberateľské, technologické a hygienicko-sanitárne) sa pohybujú v pásme nízkeho až stredného rizika a z pohľadu respondentov nepredstavujú bezprostrednú prioritu.

Tieto zistenia majú praktický význam pre tvorbu krízových plánov v podnikoch cestovného ruchu – naznačujú, že pozornosť manažmentu by sa mala primárne sústrediť na budovanie finančnej odolnosti a flexibility podniku voči ekonomickým výkyvom, ako

aj na riešenie dlhodobých personálnych výziev. Zároveň však výsledky potvrdzujú potrebu neopomínať ani nízko hodnotené riziká, keďže práve nedostatočná pripravenosť na menej pravdepodobné, no potenciálne vysoko závažné udalosti (napr. pandémie či prírodné katastrofy) patrí medzi hlavné limity krízového manažmentu v odvetví cestovného ruchu. Vzhľadom na obmedzený rozsah výskumnej vzorky (n = 11) je potrebné výsledky vnímať skôr ako orientačný obraz vnímania rizík než ako všeobecne platný záver za celé odvetvie, pričom pre budúci výskum by bolo prínosné overiť tieto zistenia na väčšej a diverzifikovanejšej vzorke podnikov.

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**Použitá literatúra (References)**

Agbaba, R., & Jurdana, D. S. (2025). Crisis Situations in Tourism and Cooperation with External Stakeholders—Tourist Organization Managers' Perception. WSEAS Transactions on Business and Economics, 22, 1663–1679. https://doi.org/10.37394/23207.2025.22.133

Chen, M.-H. (2011). The response of hotel performance to international tourism development and crisis events. International Journal of Hospitality Management, 30(1), 200–212. https://doi.org/10.1016/j.ijhm.2010.06.005

Ciekanowski, Z., Chrzaszcz, A., Wysokinska, A., & Marciniak, S. (2024). Crisis Management in Modern Organisations. European Research Studies Journal, XXVII(3), 610–620. https://doi.org/10.35808/ersj/3455

ÇiFtçi, G., Küçükaltan, D., & Menteş, S. A. (2017). Turizm işletmelerinde kriz yönetimi uygulamalarının örgütsel öğrenme açısından ampirik olarak analizi. Business & Management Studies: An International Journal, 5(1), 42–57. https://doi.org/10.15295/bmij.v5i1.98

Clarke, C. J., & Varma, S. (1999). Strategic risk management: The new competitive edge. Long Range Planning, 32(4), 414–424. https://doi.org/10.1016/S0024-6301(99)00052-7

Diers-Lawson, A. (2019). Crisis Communication: Managing Stakeholder Relationships (1st ed.). Routledge. https://doi.org/10.4324/9780429437380

Duan, J., Xie, C., & Morrison, A. M. (2022). Tourism Crises and Impacts on Destinations: A Systematic Review of the Tourism and Hospitality Literature. Journal of Hospitality & Tourism Research, 46(4), 667–695. https://doi.org/10.1177/1096348021994194

Evans, N., & Elphick, S. (2005). Models of crisis management: An evaluation of their value for strategic planning in the international travel industry. International Journal of Tourism Research, 7(3), 135–150. https://doi.org/10.1002/jtr.527

Floyd, M. F., Gibson, H., Pennington-Gray, L., & Thapa, B. (2004). The Effect of Risk Perceptions on Intentions to Travel in the Aftermath of September 11, 2001. Journal of Travel & Tourism Marketing, 15(2–3), 19–38. https://doi.org/10.1300/J073v15n02_02

Ghaderi, Z., Mat Som, A. P., & Wang, J. (2014). Organizational Learning in Tourism Crisis Management: An Experience From Malaysia. Journal of Travel & Tourism Marketing, 31(5), 627–648. https://doi.org/10.1080/10548408.2014.883951

Ghaderi, Z., King, B., & Hall, C. M. (2022). Crisis preparedness of hospitality managers: Evidence from Malaysia. Journal of Hospitality and Tourism Insights, 5(2), 292–310. https://doi.org/10.1108/JHTI-10-2020-0199

Henderson, J. C. (2007). Tourism Crises: Causes, consequences and management. Butterworth-Heinemann.

Lehtinen, U., & Järvinen, R. (2015). The Role of Service Characteristics in Service Innovations. 64(3). https://njb.fi/wp-content/uploads/2016/01/Lehtinen_3-15.pdf

Pappas, N. (2018). Hotel decision-making during multiple crises: A chaordic perspective. Tourism Management, 68, 450–464. https://doi.org/10.1016/j.tourman.2018.04.009

Pforr, C. (2006). Tourism in post crisis is tourism in pre-crisis: a review of the literature on crisis management in tourism. Crisis Management in Tourism, 1–11.

Pforr, C., & Hosie, P. J. (2008). Crisis Management in Tourism: Preparing for Recovery. Journal of Travel & Tourism Marketing, 23(2–4), 249–264. https://doi.org/10.1300/J073v23n02_19

Theobald, W. F. (2011). Global Tourism (3rd ed.). Taylor & Francis Group.

Tse, T. S. M. (2006). Crisis Management in Tourism. Tourism Management Dynamics, 28–38. https://doi.org/10.1016/B978-0-7506-6378-6.50014-7

Valackiene, A. (n.d.). Efficient Corporate Communication: Decisions in Crisis Management. Engineering Economics, 21(1). https://www.inzeko.ktu.lt/index.php/EE/article/view/11657/6339

Wang, J., & Wu, X. (2018). Top-down or outside-in? Culturally diverse approaches to hotel crisis planning. Journal of Hospitality and Tourism Management, 36, 76–84. https://doi.org/10.1016/j.jhtm.2018.08.002

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# TRENDY VO VÝSKUME DEI V DODÁVATEĽSKÝCH REŤAZCOCH V POST-PANDEMICKOM OBDOBÍ: BIBLIOMETRICKÁ ANALÝZA

*Samuel Mihalčín – Juraj Mišún*

***Abstrakt***
Štúdia predkladá bibliometrickú analýzu 164 recenzovaných vedeckých článkov z databázy Web of Science, publikovaných začiatkom tretej dekády 21. storočia, (2021 – 2025), so zameraním na problematiku diverzity, rovnosti a inklúzie (DEI) v dodávateľských reťazcoch. Cieľom príspevku je identifikovať kľúčové akademické trendy, tematické klastre a posun v strategickom vnímaní DEI po kríze COVID-19. Výskum využíva kvantitatívne metódy bibliometrie vrátane analýzy kľúčových slov, citačných sietí a tematického mapovania pomocou softvéru Biblioshiny. Výsledky ukazujú výrazný nárast záujmu o túto tému s ročnou mierou rastu 28,78%. Kľúčové zistenia potvrdzujú posun od vnímania DEI ako etického záväzku smerom k strategickému faktoru, ktorý pozitívne ovplyvňuje finančnú výkonnosť, inovácie a odolnosť dodávateľských reťazcov. Analýza identifikovala dominanciu tém ako výkonnosť, udržateľnosť a rodová diverzita v manažmente, pričom poukázala na potrebu „humanizácie“ výskumu a lepšej operacionalizácie sociálnych metrík. Závery poskytujú akademikom a manažérom prehľad o aktuálnom stave poznania a definujú smery pre budúci výskum, najmä v oblasti merania dopadov inklúzie na operatívne riadenie.

***JEL classification**: J71, L91, M14*
***Keywords**: diverzita, rovnosť, inklúzia, riadenie dodávateľského reťazca, podniková výkonnosť*

## Úvod

Pandémia COVID-19 zásadne zmenila operácie dodávateľských reťazcov a odhalila ich zraniteľnosti. V post-pandemickom období (2021–2025) sa z tejto krízy vynorila nová perspektíva: diverzita, rovnosť príležitostí a inklúzia (DEI) sa prestali vnímať iba ako etické záväzky a stali sa strategickými faktormi budovania odolnosti a inovácií.

Voľba tohto obdobia má však aj ďalší politicko-spoločenský kontext. Tematika DEI sa v posledných rokoch stala predmetom intenzívnych verejných a politických diskusií, vrátane kritiky zo strany popredných politických predstaviteľov, ktorí spochybňujú jej relevantnosť a vplyv. Tieto debaty motivujú potrebu objektívnej akademickej analýzy, ktorá by príspevkom empirickej evidencie prispela k diskusii o tom, ako diverzita a inklúzia skutočne vplývajú na výkonnosť a udržateľnosť organizácií v dodávateľských reťazcoch.

Predložená bibliometrická analýza skúma 164 recenzovaných článkov z databázy Web of Science publikovaných v rokoch 2021–2025. Cieľom je identifikovať hlavné akademické trendy, výskumné otázky a zmeny v ponímaní diverzity, rovnosti a inklúzie v

dodávateľských reťazcoch v post-covidovom kontexte a vzhľadom na rastúcu spoločenskú polarizáciu okolo tejto tematiky.

## 1 Súčasný stav riešenej problematiky doma a v zahraničí

Diverzita, rovnosť a inklúzia (DEI) v dodávateľských reťazcoch prešla v posledných rokoch výraznou transformáciou. Kým pred pandémiou COVID-19 bola táto téma vnímaná primárne cez optiku compliance a etickej zodpovednosti, súčasný akademický diskurz ju čoraz častejšie rámuje ako kľúčový strategický imperatív pre budovanie odolnosti a výkonnosti. Odborná literatúra v rokoch 2021 – 2025 naznačuje, že integrácia DEI do operačného riadenia už nie je len otázkou ľudských zdrojov, ale stáva sa integrálnou súčasťou riadenia rizík a inovácií v globálnych sieťach.

Napriek rastúcemu záujmu o DEI v podnikovej praxi vykazuje akademický výskum v oblasti operačného manažmentu (OM) a riadenia dodávateľských reťazcov (SCM) stále známky istej fragmentácie. Johnson et al. (2025) vo svojej publikácii upozorňujú, že hoci sa DEI stáva ústredným bodom kritickej analýzy, v oblasti OM a SCM často absentujú štandardizované metriky na meranie skutočného dopadu inkluzívnych praktík. Autori zdôrazňujú potrebu rozšíriť výskumné zameranie nad rámec jednoduchého demografického zastúpenia a skúmať, ako princípy spravodlivosti a inklúzie reálne ovplyvňujú operačné rozhodovanie a dizajn dodávateľských sietí.

Významná časť post-pandemickej literatúry sa sústreďuje práve na empirické overovanie vzťahu medzi týmito princípmi a podnikovou výkonnosťou. V špecifickom kontexte logistického sektora Govindan et al. (2021) preukázali, že rodová diverzita v predstavenstvách má priamy pozitívny vplyv na výkonnosť podnikov v oblasti spoločenskej zodpovednosti (CSR). Ich zistenia naznačujú, že rodovo zmiešané riadiace orgány sú pri implementácii sociálnych stratégií efektívnejšie, hoci priamy dopad na environmentálny pilier nebol v ich štúdii jednoznačne potvrdený. Na tieto závery nadväzujú Kuzey et al. (2022), ktorí v analýze transportného a logistického sektora identifikovali, že prítomnosť žien v riadiacich orgánoch významne podporuje ekologické inovácie. Ich výskum zároveň odhalil, že CSR stratégia v tomto kontexte funguje ako dôležitý moderujúci mechanizmus, čo znamená, že diverzita sama o sebe nemusí stačiť, pokiaľ nie je podporená formálnou stratégiou udržateľnosti. Tieto štúdie spoločne potvrdzujú, že v post-covidovej ére je diverzita kľúčovým predpokladom pre inovácie v inak tradične konzervatívnom odvetví logistiky.

Okrem strategického rozmeru pandémia COVID-19 naplno odhalila aj zraniteľnosť pracovníkov v globálnych reťazcoch, čo viedlo k obnovenému tlaku na sociálnu udržateľnosť. Soundararajan et al. (2021) v tejto súvislosti kritizujú doterajší výskum pracovných podmienok za jeho „dehumanizovanú“ perspektívu, ktorá sa príliš sústredí na optiku nákupcov a produktovú efektivitu. Autori preto vyzývajú na „humanizáciu“ výskumu, ktorá by do centra pozornosti postavila koncept „dôstojnej práce“ a skúmala sociálno-kultúrne kontexty dodávateľov, najmä v rozvojových krajinách. Tento prúd literatúry naznačuje, že skutočná inklúzia v dodávateľskom reťazci musí presahovať hranice vlastného podniku a zahŕňať aj férové zaobchádzanie s pracovníkmi na nižších stupňoch reťazca.

Implementácia týchto programov však v praxi naráža na viaceré prekážky. Shalpegin et al. (2025) vo svojej štúdii identifikujú bariéry, ktoré bránia efektívnemu nasadeniu DEI iniciatív, pričom poukazujú na rozdiely medzi verejne obchodovanými a súkromnými spoločnosťami. Medzi hlavné identifikované prekážky patrí nedostatok povedomia o benefitoch DEI, interná opozícia, ale aj geografická roztrieštenosť operácií, ktorá sťažuje presadzovanie jednotných štandardov rovnosti a inklúzie naprieč celým reťazcom.

## 2 Metodika a metódy výskumu

Predložený článok sa zameriava na bibliometrickú analýzu problematiky diverzity, rovnosti a inklúzie (DEI) v kontexte globálnych dodávateľských reťazcov. Analyzuje publikačné trendy s cieľom identifikovať najčastejšie skúmané témy a výskumné otázky v tejto oblasti v post-pandemickom období (2021 – 2025). Výskum bol vykonaný na základe publikácií vybraných vydavateľstiev indexovaných v databáze Web of Science. Výsledky tejto štúdie môžu prispieť k lepšiemu pochopeniu komplexných faktorov, ktoré vplývajú na prepojenie sociálnej udržateľnosti s podnikovou výkonnosťou a odolnosťou, a poskytnúť základ pre ďalší výskum a praktické aplikácie v oblasti strategického manažmentu dodávateľských sietí.

V prvej fáze výskumu sa identifikoval rozsah výskumu vrátane jeho demografických charakteristík a očakávaných výsledkov. Na zber údajov sa využila databáza Web of Science. Na vyfiltrovanie najrelevantnejších publikácií sa využili kľúčové slová. Získané údaje sa preberali vo formáte BibTeX na následnú analýzu. Po identifikácii súboru údajov sa posúdila vhodnosť publikácií pomocou bibliometrického softvéru Biblioshiny. Následne pomocou toho istého softvéru sa vykonala analýza údajov. Prostredníctvom relevantnej analýzy sa identifikoval význam zistení. Kroky spojené s identifikáciou publikácií prostredníctvom databázy sú znázornené v tabuľke 1.

Zvolený postup umožnil vyťažiť z analyzovaných článkov relevantné informácie a odhaliť medzi nimi existujúce podobnosti a rozdiely. Systematický prehľad literatúry sa ukázal ako efektívny prístup na komplexné zmapovanie a štruktúrovanie súčasných naliehavých oblastí výskumu.

**Tabuľka 1**
Proces systematického preskúmania literatúry

| | |
|---|---|
| **Krok 1:** Kritériá na analýzu existujúcej literatúry (zahrnutie a vylúčenie) | **Klasifikácia**: Články z recenzovaných časopisov na tému diverzity, rovnosti a inklúzie (DEI) v kontexte riadenia dodávateľských reťazcov a logistiky.<br>**Vylúčenie**: dizertačné práce, recenzie kníh a prípadové štúdie |
| **Krok 2:** Literárny výskum | **Databáza**: Web of Science,<br>**Výrazy**: „diverzita", „inklúzia", „rovnosť príležitostí v zamestnaní", „dodávateľský reťazec", „logistika", „finančný dopad", „ekonomické benefity" |
| **Krok 3:** Upresnenie výberu literárnych štúdií | **Analýza**: článkov publikovaných v post-pandemickom období s výnimkou štúdií, ktoré neanalyzovali dodávateľský reťazec<br>Finálna vzorka analyzovaných článkov: 324 |
| **Krok 4:** Zmenšenie rozsahu skúmanej vzorky | Tento proces zahŕňal vylúčenie štúdií, ktoré boli publikované pred pandémiou COVID-19, alebo nespĺňali vopred definované kritériá zaradenia, ako napríklad tie, ktoré sa zameriavajú iba na teoretické perspektívy bez empirických údajov. Následne sme do výskumnej vzorky zaradili len vedecké štúdie publikované v 6 najlepších vydavateľstvách (Emerald Group Publishing, Elsevier, Springer Nature, Sage, Taylor & Francis, Wiley), ktoré svojimi štandardmi zaručujú kvalitu vybraných publikácií. Výsledkom bolo, že konečný základ bibliometrickej analýzy tvorilo **164** dokumentov. |
| **Krok 5:** Analýza vybraných článkov | Vybrané články boli systematicky analyzované pomocou bibliometrických metód so zameraním na publikačné trendy, frekvenciu kľúčových slov a autorské vzorce. Identifikovali sa témy súvisiace s diverzitou zamestnancov pracujúcich v dodávateľskom reťazci. |
| **Krok 6:** Prezentácia výsledkov | Zistenia odhalili kľúčové smery výskumu: vplyv diverzity na výkonnosť dodávateľského reťazca, strategický význam inklúzie pre budovanie odolnosti, úlohu rodovej diverzity v manažmente udržateľnosti a prepojenie sociálnej zodpovednosti s inováciami. |

*Zdroj: vlastné spracovanie na základe Senyo et al. (2019)*

## 3 Výsledky výskumu

Výskum poskytuje štatistický súhrn akademických publikácií od roku 2021 do roku 2025. Zahŕňa 87 zdrojov s 164 dokumentmi a ročnú mieru rastu 28,78 %. Priemerný vek dokumentu je 1,52 roka a každý dokument má v priemere 10,38 citácií s celkovým počtom 12 350 citácií. V analyzovanej vzorke sa nachádza 746 kľúčových slov poskytnutých autormi. Celkovo prispelo 578 autorov, z toho 12 boli autormi jedno autorských dokumentov. Spolupráca vykazuje 12 jedno-autorských dokumentov, s priemerom 3,71 spoluautora na dokument a 43,29 % medzinárodným spoluautorstvom. Typy dokumentov pozostávajú zo 139 článkov a 25 článkov, ktoré ešte neboli formálne publikované, ale sú dostupné v online predbežnej verzii.

**Tabuľka 2**
Súhrnné informácie o súbore údajov

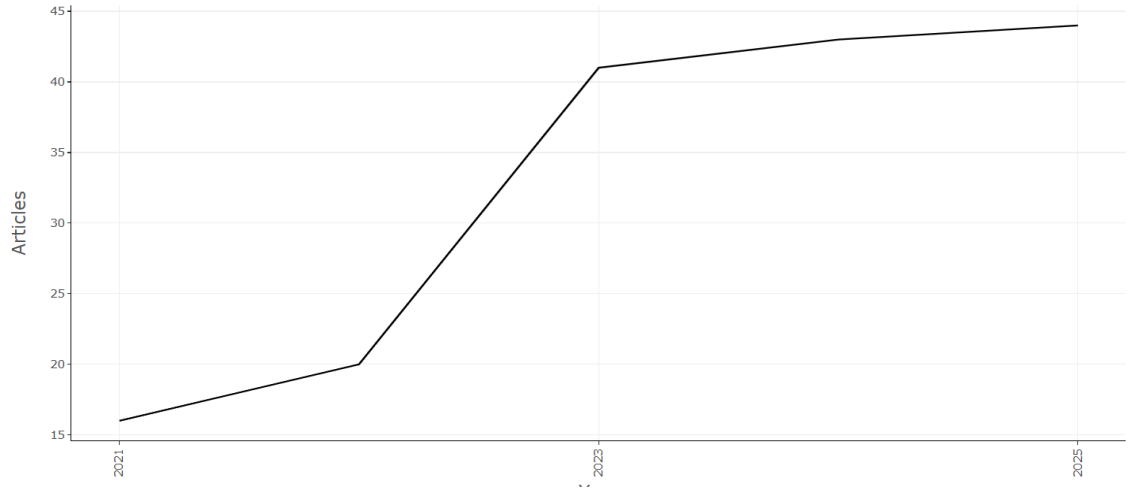
| Description | Results |
|---|---|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 2021:2025 |
| Sources (Journals, Books, etc) | 87 |
| Documents | 164 |
| Annual Growth Rate % | 28.78 |
| Document Average Age | 1.52 |
| Average citations per doc | 10.38 |
| References | 12350 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 625 |
| Author's Keywords (DE) | 746 |
| AUTHORS | |
| Authors | 578 |
| Authors of single-authored docs | 12 |
| AUTHORS COLLABORATION | |
| Single-authored docs | 14 |
| Co-Authors per Doc | 3.71 |
| International co-authorships % | 43.29 |
| DOCUMENT TYPES | |
| article | 139 |
| article; early access | 25 |

*Zdroj: vlastné spracovanie na základe Biblioshiny*

## 3.1 Výskumné trendy v analyzovanej oblasti

Graf 1 predstavuje rast v počte vedeckých článkov publikovaných medzi rokmi 2021 a 2025. Údaje ukazujú celkový nárast publikácií s vrcholom v roku 2025. Tento trend naznačuje čoraz väčší záujem o túto problematiku v post-pandemickom období.

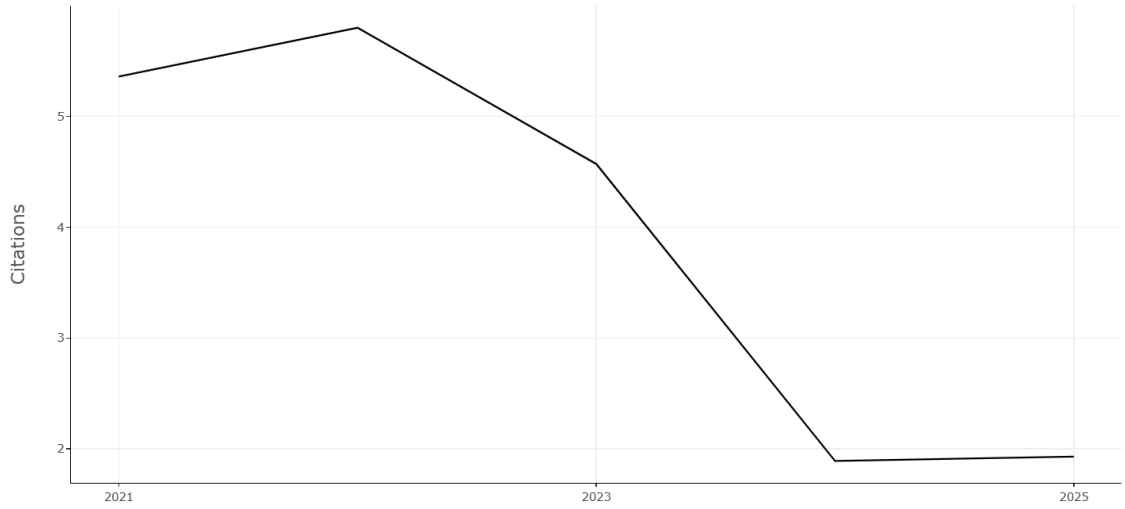
**Graf 1**
Ročná vedecká produkcia




*Zdroj: Web of Science*

Údaje nachádzajúce sa v grafe 2 odhaľujú priemernú mieru rastu 28,78 %, čo naznačuje všeobecný vzostupný trend vo vedeckých citáciách v priebehu rokov. Priemerný citačný vrchol nastal v roku 2022, kedy bolo dosiahnutý najvyšší priemer citácií za obdobie jedného roka.

**Graf 2**
Priemerný počet citácií za rok



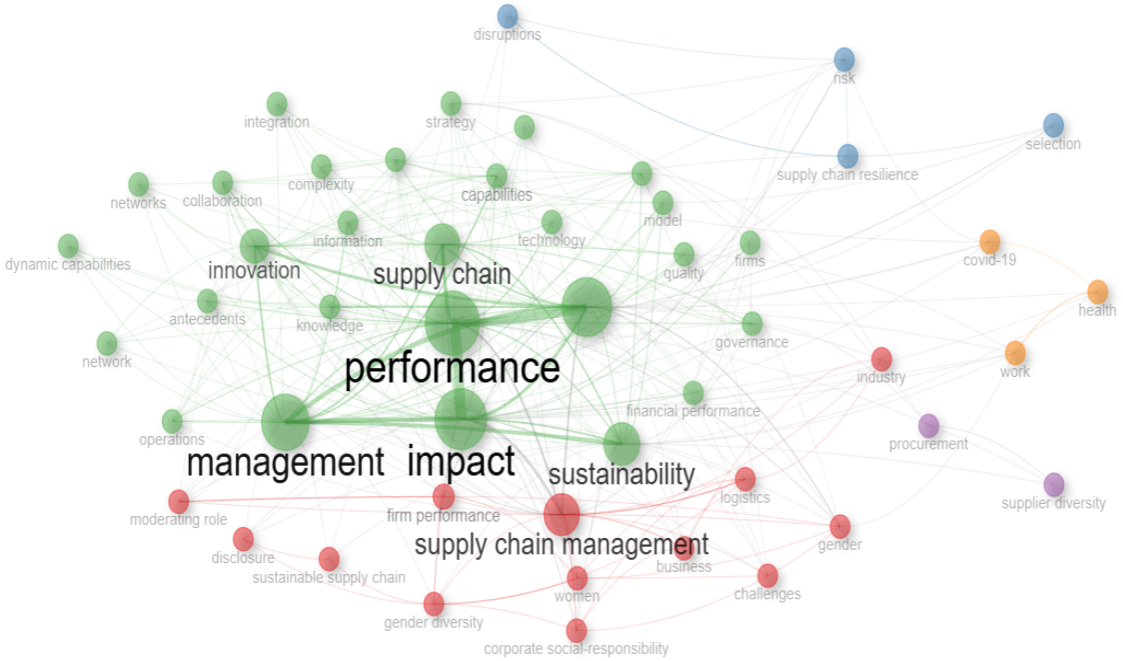

*Zdroj: Web of Science*

Graf 2 poskytuje pohľad na akademický vplyv publikácií v priebehu času, pričom poukazuje na obdobia, kedy výskum získal väčšie uznanie. Potenciálny pokles v posledných rokoch môže odrážať buď oneskorenie v akumulácii citácií pre novšie publikácie, alebo pokles celkového výkonu výskumu v tejto oblasti.

## 3.2 Sieť spoločných výskytov a analýza kľúčových slov

Aby sa identifikovalo budúce smerovanie výskumu v oblasti diverzity, rovnosti a inklúzie v dodávateľských reťazcoch, bolo potrebné analyzovať kľúčové a tematické trendy v tejto oblasti. Vďaka tomu získajú vedci prehľadnejší obraz o hlavných témach a potenciálnych smeroch ďalšieho bádania v danej disciplíne. Interaktívna mapa spoločného výskytu názorne ilustruje vzájomné prepojenia medzi kľúčovými slovami, autormi a výrazmi v rámci skúmaného súboru publikácií. Tento nástroj umožňuje efektívne identifikovať frekventované termíny a zároveň poukazuje na súvislosti medzi rôznymi výskumnými oblasťami a konceptmi.

**Obrázok 2**
Sieť spoločného výskytu




*Zdroj: vlastné spracovanie na základe Biblioshiny*

Sieť spoločného výskytu nášho súboru údajov, znázornená na obr. 2, zvýrazňuje kľúčové pojmy v oblasti diverzity v dodávateľskom reťazci, pričom do popredia kladie termíny ako „performance“, „supply chain“, „management“, „impact“ a „sustainability“, ktoré úzko súvisia so zameraním výskumu na ekonomické a sociálne aspekty. Veľkosť každého uzla predstavuje frekvenciu výskytu kľúčového slova v analyzovaných publikáciách publikovaných v rokoch 2021-2025, pričom sa objavuje niekoľko významných zhlukov.

Najvýraznejší klaster, zobrazený zelenou farbou a sústredený okolo „performance (výkon)“ a „supply chain (dodávateľský reťazec)“, zahŕňa témy súvisiace so strategickým riadením, ako sú innovation (inovácie), capabilities (schopnosti), strategy (stratégia), integration (integrácia), technology (technológia) a network (spolupráca).

Červený klaster sa zameriava na „supply chain management (riadenie dodávateľského reťazca)“, pričom špecificky rieši sociálne a rodové aspekty prostredníctvom tém ako gender (pohlavie), women (ženy), challenges (výzvy), corporate social responsibility

(spoločenská zodpovednosť podnikov), logistics (logistika) a sustainable supply chain (udržateľný dodávateľský reťazec).

Modrá, oranžová a fialová skupina predstavujú špecifickejšie podtémy: modrá sa orientuje na riziká a odolnosť (odolnosť dodávateľského reťazca, riziko, narušenia), oranžová reflektuje dopady pandémie (covid-19, zdravie) a fialová sa špecializuje na oblasť obstarávania a diverzity dodávateľov (obstarávanie, diverzita dodávateľov).

Na základe obrázku 2 je možné povedať, že väčšina výskumov z oblasti manažmentu a výkonnosti dodávateľských reťazcov sa zameriava na prepojenie stratégie s udržateľnosťou a inováciami, z ktorej sa následne dostávajú autori aj do iných tém, ako sú rodová diverzita či odolnosť voči globálnym rizikám.

Na obrázku 3 sa nachádzajú najvyužívanejšie slová autorov z článkov.

**Obrázok 3**
Mapa najvyužívanejších slov


*Zdroj: vlastné spracovanie na základe Biblioshiny*

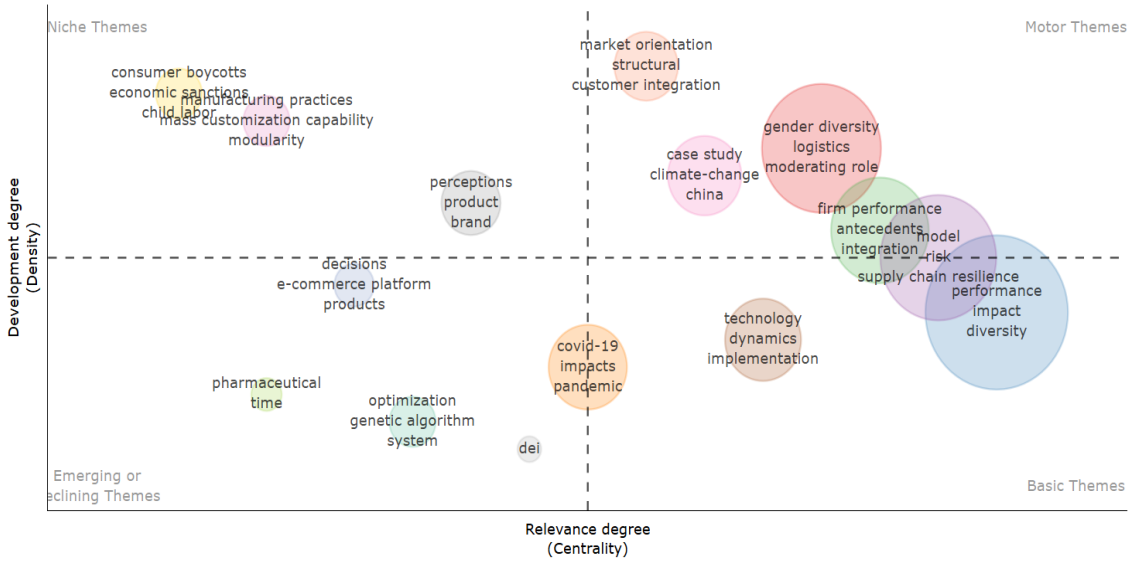
Najčastejšie používané slovo bolo „performance“, po ňom nasledoval „impact“, „diversity“, „management“, „supply chain“.

- Slovo **PERFORMANCE** naznačuje, že veľká časť článkov zameraných na diverzitu v dodávateľskom reťazci sa prioritne sústreďuje na analýzu výkonnosti. Väčšina autorov označuje meranie dopadov diverzity na výkonnosť (finančnú aj nefinančnú) za kľúčový prvok výskumu, pričom často skúmajú vzťahy medzi inklúziou a efektivitou podniku.
- Slovo **DIVERSITY** je úzko spojené s termínmi ako „supply chain“ a „management“, zahŕňa rôzne formy rozmanitosti (vrátane rodovej, ktorá je zastúpená slovami

„gender“ a „women“) a vo výskumoch sa často prepája s inováciami a sociálnou zodpovednosťou podnikov (CSR), čím zdôrazňuje strategický význam inklúzie.

- **SUSTAINABILITY** a **IMPACT** sú vo výskumoch spájané práve s dlhodobou udržateľnosťou a širším dopadom podnikania. Ide o koncepty, ktoré prepájajú ekonomické ciele so sociálnymi a environmentálnymi aspektmi. Ich význam je obzvlášť dôležitý v kontexte odolnosti dodávateľských reťazcov (resilience), kde udržateľné a etické praktiky pomáhajú podnikom lepšie zvládať globálne výzvy a disrupcie.
- **SUPPLY CHAIN MANAGEMENT** je v analyzovaných článkoch najčastejšie spájaný s pojmami ako „strategy“, „collaboration (spolupráca)“, „logistics“ a „governance (správa a riadenie)“. Predstavuje centrálnu tému, ktorá integruje otázky diverzity a výkonnosti do operatívneho a strategického riadenia tokov, pričom sa kladie dôraz na budovanie odolných a flexibilných sietí schopných reagovať na dynamické zmeny trhu.

**Obrázok 4**
Tematická mapa




*Zdroj: vlastné spracovanie na základe Biblioshiny*

Tematická mapa slúži na vizualizáciu hlavných tém v oblasti výskumu. Je to dvojrozmerná mapa s hustotou na osi y (miera rozvoja) a strednosťou na osi x (miera relevantnosti). Horizontálna os vyjadruje relevantnosť alebo centralitu témy. Čím ďalej je bod vpravo, tým je téma dôležitejšia a častejšie sa objavuje v súvislosti s danou problematikou. Vertikálna os vyjadruje stupeň vývoja témy. Čím vyššie je bod, tým viac sa daná téma v súčasnosti vyvíja a je predmetom aktuálneho výskumu. Mapa rozdeľuje jednotlivé témy do štyroch kvadrantov na základe ich vnútornej súdržnosti a relevantnosti: Motorické témy, Špeciálne témy, Základné témy a Vznikajúce/ustupujúce témy. Tento prístup sa spolieha na strategické mapovanie na zachytenie vyvíjajúcich sa vzťahov medzi témami vo výstupoch výskumu (Callon et al., 1983).

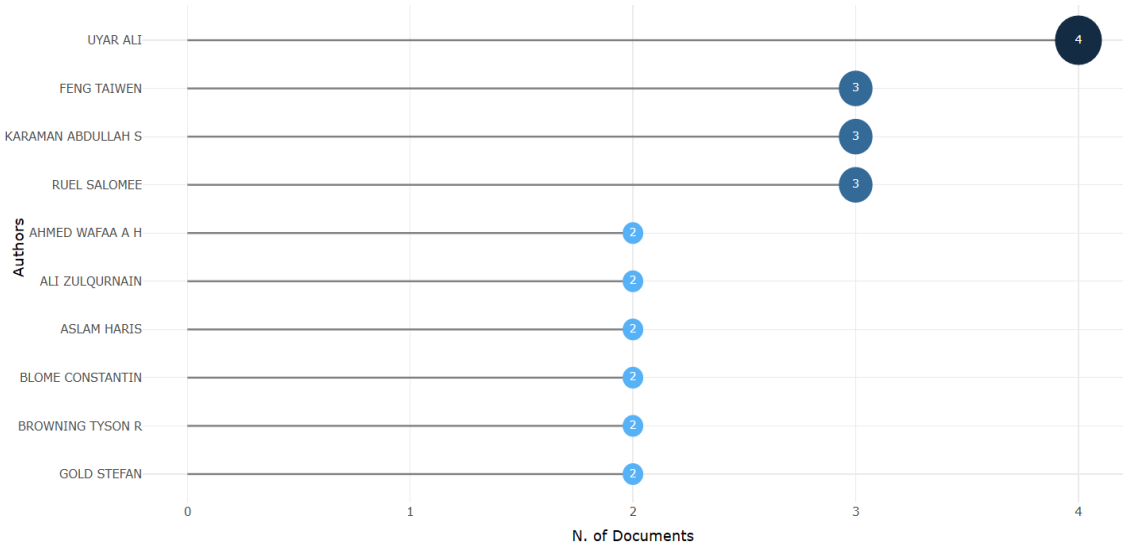
- **Niche témy:** nachádzajú sa v ľavom hornom rohu. Sú to špecifické, menej preskúmané témy, ktoré majú potenciál sa v budúcnosti viac rozvíjať.
- **Emerging or declining themes:** táto zóna sa nachádza v ľavom dolnom rohu a zahŕňa témy, ktoré sú buď nové a ešte sa nerozvíjali, alebo naopak, ich význam postupne klesá.
- **Basic themes:** umiestnené sú v pravom dolnom rohu. Sú to základné, dobre etablované témy, ktoré sú už dlhšie súčasťou výskumu.
- **Motor themes:** Označujú kľúčové témy alebo koncepty, ktoré "poháňajú" alebo "vedú" výskum v oblasti informačnej bezpečnosti pri práci z domu. Sú to témy, ktoré sa objavujú najčastejšie, sú najviac prepojené s inými témami a majú najväčší vplyv na smerovanie výskumu.

Na základe tmatickej mapy sa dá povedať, že témy ako gender diversity, firm performance, supply chain resilience climate-change, market orientation a pod. sú kľúčovými témami v oblasti dodávateľského reťazca a sú stále predmetom aktuálneho výskumu. Témy impact, diversity, performance a pod. sa zaradujú medzi bežné témy, ktoré sú dôležité, ale menej rozvinuté. Tieto témy, hoci sú pre túto oblasť kľúčové z dôvodu ich vysokej centrálnosti, si vyžadujú ďalšie skúmanie, pretože nemajú hustotu potrebnú na plnú podporu súdržných výskumných prúdov. Témy economic sanctions, consumer boycotts, perceptions product brand, manufacturing practices sú v súčasnosti radené medzi málo preskúmané témy, ktoré by mohli v budúcnosti mať potenciál na rozvoj. Tieto témy majú vysokú vnútornú súdržnosť, ale nižšiu ústrednosť, čo naznačuje, že sú vysoko špecializované a relevantné v špecifických podpoliach. Zaoberajú sa špecifickými problémami a často sa hlboko ponoria do konkrétnych štúdií. Medzi vznikajúce, alebo klesajúce témy sa v súvislosti s dodávateľským reťazcom zaraďujú témy e-commerce platform products, covid impacts, dei a pod. Sú umiestnené v kvadrante nízkej hustoty a nízkej centrálnosti, čo naznačuje, že tieto oblasti môžu strácať význam alebo neboli v posledných výskumoch dostatočne preskúmané. Tento kvadrant poukazuje na oblasti, ktoré by mohli profitovať z obnoveného záujmu o výskum alebo prehodnotenia, aby sa pochopil ich význam pre danú oblasť. Tematická mapa celkovo zdôrazňuje, že ústredné témy, ako je gender diversity a firm performance, zostávajú životne dôležitými piliermi v rámci výskumného prostredia, zatiaľ čo oblasti v základnom a rozvíjajúcom sa/klesajúcom kvadrante napríklad téma DEI zdôrazňuje príležitosti na hlbšie preskúmanie alebo presuny v zameraní.

### 3.3 Analýza najvýznamnejších autorov a najvplyvnejších publikácií

V tejto analýze sa identifikovali kľúčoví výskumníci. Medzi popredných prispievateľov z hľadiska počtu publikácií patrí Uyar A., s celkovým počtom 4 príspevkov. Za ním nasledujú Feng T., Karaman A. S. a Ruel S. (PP=3).

**Graf 4**
Najrelevantnejší autori z hľadiska počtu publikácií




*Zdroj: vlastné spracovanie na základe Biblioshiny*

V tabuľke 3 sa nachádzajú kľúčoví autori hodnotených z hľadiska ich individuálneho vplyvu na výskum pomocou metrík H-Index, G-Index, M-Index, Celkový počet citácií (TC), Počet publikácií (NP) a začiatočný rok publikovania.

**Tabuľka 3**
Lokálny vplyv autorov

| Author | h_index | g_index | m_index | TC | NP | PY_start |
|---|---|---|---|---|---|---|
| UYAR ALI | 2 | 4 | 0.400 | 140 | 4 | 2021 |
| FENG TAIWEN | 2 | 3 | 0.500 | 13 | 3 | 2022 |
| RUEL SALOMEE | 2 | 3 | 0.400 | 27 | 3 | 2021 |
| KARAMAN ABDULLAH S | 1 | 3 | 0.200 | 118 | 3 | 2021 |
| AHMED WAFAA A H | 2 | 2 | 0.500 | 93 | 2 | 2022 |
| ALI ZULQURNAIN | 2 | 2 | 0.667 | 38 | 2 | 2023 |
| ASLAM HARIS | 2 | 2 | 0.667 | 38 | 2 | 2023 |
| BLOME CONSTANTIN | 2 | 2 | 0.400 | 37 | 2 | 2021 |
| GOLD STEFAN | 2 | 2 | 2.000 | 13 | 2 | 2025 |
| IVANOV DMITRY | 2 | 2 | 1.000 | 32 | 2 | 2024 |

*Zdroj: vlastné spracovanie na základe web of science*

Na základe tabuľky 3 sa dá zhodnotiť, že najvyšší lokálny vplyv má autor Uyar A. indikovaný H-indexom (2) a G-indexom (4). Tento autor zároveň nazbieral najvyššie množstvo citácií (TC=140). Karaman A. S. dosiahol vo svojej 1 publikácii celkový počet citácií (TC=118). Podľa priemernej ročnej miery citovanosti na publikáciu, hodnotenej M-Indexom, má autor Gold S. najvyšší M-index v hodnote 2,000. Celkovo tieto metriky odhaľujú viacero úspešných a vplyvných autorov v rámci tohto segmentu výskumu, z ktorých každý významne prispieva vyšším počtom citácií a vplyvnými publikáciami.

Po analýze autorov sa identifikovali a dôkladne preskúmali najrelevantnejšie publikácie v oblasti diverzity v dodávateľských reťazcoch. Zistenia viedli k identifikácii 10 najrelevantnejších publikácií zaoberajúcimi sa oblasťou nášho výskumu.

**Tabuľka 4**
Najrelevantnejšie články v súbore

| Názov publikácie | Autor | Počet citácií | Rok vydania |
|---|---|---|---|
| Drivers and value-relevance of CSR performance in the logistics sector: A cross-country firm-level investigation | Govindan, K. et al. | 133 | 2021 |
| Board gender diversity, CSR strategy, and eco-friendly initiatives in the transportation and logistics sector | Kuzey, C. et al. | 83 | 2022 |
| Open supply chain innovation: an extended view on supply chain collaboration | Solaimani, S., Van der Veen J. | 67 | 2022 |
| Humanizing Research on Working Conditions in Supply Chains: Building a Path to Decent Work | Soundararajan, V., Wilhelm, M. M., Crane, A. | 51 | 2021 |
| The political economy and dynamics of bifurcated world governance and the decoupling of value chains: An alternative perspective | Vertinsky, I. et al. | 48 | 2023 |
| Supply chain resilience strategies and their impact on sustainability: an investigation from the automobile sector | Singh, J. et al. | 36 | 2023 |
| Marketing in the metaverse: Moving forward - What's next? | Cheah, I., Shimul, AS. | 31 | 2023 |
| Board structure policy, board diversity and social sustainability in the logistics and transportation sector | Fernandes, V. et al. | 24 | 2023 |
| Gender diversity in supply chains: towards more sustainable decisions? evidence from interviews | Ruel, S., Fritz, MMC. | 24 | 2021 |
| Board diversity and performance in a masculine, aged and glocal supply chain: new empirical evidence | Colabrese, GG., Manello, A. | 22 | 2021 |
| Measuring supplier diversity, equity and inclusion (DEI): scale development and empirical validation | Silva, M. E. et al. | 15 | 2024 |

*Zdroj: vlastné spracovanie na základe web of science*

Poznámky:

1. (Govindan, K., et al. 2021) Článok analyzuje faktory ovplyvňujúce výkon spoločenskej zodpovednosti (CSR) v logistickom sektore. Štúdia zistila, že diverzita žien v predstavenstve a existencia komisie pre udržateľnosť sú silné faktory, ktoré pozitívne ovplyvňujú celkový výkon CSR a najmä riadenie a sociálny pilier. Naopak, nezistila sa žiadna významná spojitosť medzi charakteristikami predstavenstva a environmentálnym pilierom (E). Pre investorov je kľúčové zistenie, že výkon CSR sa v sledovanom období neprejavil významným pozitívnym vplyvom na trhovú hodnotu podniku podnikajúceho v logistickom sektore.
2. (Kuzey, C., et al. 2022) Autori v tomto výskume zistili, že rodová diverzita v predstavenstve a zavedenie CSR stratégie sú kľúčové faktory, ktoré pozitívne ovplyvňujú ekologické iniciatívy v logistickom sektore. Ženy v predstavenstve majú najväčší vplyv na ekologické inovácie. Zistenia potvrdili, že CSR stratégia funguje ako moderujúci mechanizmus posilňujúci vzťah medzi diverzitou a inováciami, čím sa preukázala dôležitosť interných systémov riadenia pre udržateľnosť v tomto sektore.
3. (Solaimani, S., van der Veen, J. 2022) Autori skúmajú, ako otvorená inovácia a spolupráca v dodávateľskom reťazci vedú k inováciám. Zistenia ukazujú, že pre dosiahnutie radikálnych inovácií musí byť v dodávateľskom reťazci zabezpečený ambidextrózny rozsah spolupráce. Ten si vyžaduje

kooperáciu s horizontálnymi aj vertikálnymi partnermi a zároveň zahŕňa vyváženú diverzitu medzi partnermi z rôznych kultúrnych etník, čo je nevyhnutné na efektívne využívanie externých zdrojov.

4. (Soundararajan, V., Wilhelm, M.M., Crane, A. 2021) Autori tvrdia, že súčasný výskum udržateľného dodávateľského reťazca je nedostatočný pre riešenie dôstojnej práce, pretože má „dehumanizovanú“ perspektívu. Tá je daná prehnaným zameraním na kupujúcich a produkty namiesto na ľudskosť pracovníkov (ktorí sú často chápaní len ako „vstup“) a na technické riešenia namiesto na socio-kultúrne kontexty. Navrhujú preto novú „humanizačnú“ výskumnú agendu, ktorá má postaviť ľudské a pracovné práva do centra pozornosti výskumu v dodávateľskom reťazci.
5. (Vertinsky, I. et al. 2023) Článok uvádza, že súčasná rivalita medzi USA a Čínou vedie k rozdeľovaniu globálneho riadenia a k odpájaniu hodnotových reťazcov. Upozorňujú však, že potenciálne náklady tohto rozdelenia sú neúnosné pre obe strany. Preto predpovedajú rastúci odpor zo strany nadnárodných spoločností, čo si vyžaduje zachovanie otvorenej globálnej ekonomiky namiesto eskalácie tzv. disengagementu.

## 4 Diskusia a záver

Tento článok sa zameral na bibliometrickú analýzu pomocou programu Biblioshiny, kde sa preskúmalo 164 jednotlivých publikácií zozbieraných z vybraných vydavateľstiev indexovaných v databáze Web of Science, filtrovaných podľa vopred stanovených parametrov. Analýza zdôrazňuje, že výskumná oblasť týkajúca sa diverzity v dodávateľskom reťazci získala v rokoch 2021 – 2025 značnú pozornosť, s výrazným rastom publikačnej činnosti a ročnou mierou nárastu 28,78%.

Na identifikáciu hlavných výskumných tém v tejto oblasti sa použili nástroje, ako je mapovanie spoločného výskytu, zoskupovanie slov a tematické mapovanie. K prevládajúcim témam v tejto oblasti výskumu patria výkonnosť (performance), riadenie dodávateľského reťazca (supply chain management), vplyv (impact), diverzita a udržateľnosť.

Po analýze najrelevantnejších publikácií sa zistilo, že integrácia diverzity a inklúzie do dodávateľských reťazcov prináša nové strategické príležitosti, ale aj výzvy pre manažment. Autori sa zhodujú v tom, že diverzita už nie je len etickou otázkou, ale kľúčovým faktorom pre zvyšovanie výkonnosti a inovácií.

Medzi hlavné zistenia zaraďujeme nasledovné:

- **Prepojenie diverzity a výkonnosti:** Štúdie preukázali silnú koreláciu medzi diverzitou v dodávateľskom reťazci a podnikovou výkonnosťou (finančnou aj nefinančnou), pričom inkluzívne praktiky často vedú k lepším hospodárskym výsledkom.
- **Význam rodovej diverzity v riadení:** Rodová diverzita v predstavenstvách a manažmente logistiky pozitívne ovplyvňuje prijímanie ekologických iniciatív a stratégií spoločenskej zodpovednosti (CSR).
- **Odolnosť dodávateľského reťazca:** Diverzifikácia dodávateľov sa ukazuje ako kľúčová stratégia pre budovanie odolnosti (resilience) voči globálnym disrupciám a rizikám v post-pandemickom období.
- **Udržateľnosť a sociálny dopad:** Výskum potvrdzuje, že riadenie dodávateľského reťazca sa posúva od čisto nákladovej efektívnosti k širšiemu chápaniu udržateľnosti, ktoré zahŕňa sociálne a etické aspekty.

- **Potreba ľudského prístupu:** Autori zdôrazňujú nutnosť "humanizácie" výskumu, teda posun pozornosti od technických riešení k socio-kultúrnym kontextom a pracovným podmienkam v globálnych reťazcoch.
- **Nedostatočné ukotvenie konceptu DEI:** Hoci je téma diverzity populárna, špecifický koncept DEI (Diversity, Equity, Inclusion) ešte v akademickej literatúre dodávateľského reťazca nedosiahol plnú centrálnu pozíciu a vyžaduje si ďalšie skúmanie.

Kľúčovým prvkom pre podniky by malo byť vnímanie diverzity zamestnancov a partnerov ako strategického aktíva, ktoré podporuje inovácie a dlhodobú udržateľnosť, a nie len ako povinnosti v rámci compliance.

### 4.1 Návrhy pre budúce smerovanie výskumu a limity výskumu

Na základe vykonanej bibliometrickej analýzy a identifikácie tematických klastrov (Obrázok 2 a 4) sa črtá niekoľko perspektívnych oblastí, ktorým by mala akademická obec v nasledujúcom období venovať zvýšenú pozornosť:

- **Operacionalizácia a meranie konceptu DEI v dodávateľských reťazcoch:** Keďže téma „DEI“ (Diversity, Equity, Inclusion) sa na tematickej mape objavila v kvadrante vznikajúcich alebo klesajúcich tém s nízkou hustotou, existuje potreba prejsť od všeobecných deklarácií k exaktnému meraniu. Budúci výskum by sa mal zamerať na vývoj štandardizovaných metrík a KPI, ktoré dokážu kvantifikovať nielen diverzitu dodávateľov, ale aj mieru inklúzie a rovnosti v rámci celého hodnotového reťazca.
- **Humanizácia výskumu a sociálna udržateľnosť:** V nadväznosti na zistenia o potrebe „humanizácie“ práce (Soundararajan et al., 2021) by sa budúce štúdie mali posunúť od čisto technokratického pohľadu na dodávateľský reťazec k hlbšiemu skúmaniu pracovných podmienok. Je potrebné skúmať, ako diverzita ovplyvňuje dôstojnú prácu, ľudské práva a sociálnu spravodlivosť v rozvojových krajinách, ktoré sú často na začiatku globálnych reťazcov.
- **Prienik digitalizácie a diverzity:** Vzhľadom na výskyt tém ako „e-commerce platform products“ a „technology“ je dôležité skúmať vplyv digitálnych platforiem a umelej inteligencie na diverzitu. Výskumná otázka by mohla smerovať k tomu, či algoritmy pri výbere dodávateľov odstraňujú ľudskú zaujatosť, alebo naopak, či nevedomky diskriminujú menšinových dodávateľov.
- **Vplyv spotrebiteľského aktivizmu a geopolitiky:** Niché témy ako „consumer boycotts“ a „economic sanctions“ naznačujú rastúci vplyv externého prostredia. Budúci výskum by mal analyzovať, ako tlak spotrebiteľov a geopolitické napätie nútia podniky prehodnocovať svoje stratégie diverzity nie ako dobrovoľnú aktivitu, ale ako nutnosť pre zachovanie reputácie a trhového podielu.
- **Longitudinálne štúdie dopadu na výkonnosť:** Keďže „performance“ je ústrednou témou, je potrebné prejsť od prierezových štúdií k dlhodobému sledovaniu. Výskum by mal overiť, či je pozitívny vzťah medzi diverzitou a finančnou výkonnosťou udržateľný aj v čase krízy a či podniky s inkluzívnymi reťazcami vykazujú vyššiu odolnosť (resilience) v dlhodobom horizonte.

Táto štúdia podlieha obmedzeniam vyplývajúcim z použitia iba databázy Web of Science, a vybraných 6 vydavateľstiev, čo mohlo viesť k vylúčeniu relevantných prác indexovaných v iných zdrojoch napr. v databáze SCOPUS. Zameranie výlučne na publikácie publikované v období 2021 – 2025 navyše limituje možnosť zachytiť dlhodobý historický vývoj. Bibliometrické analýzy neberú do úvahy širší kontext, v ktorom sa výskum uskutočňuje (napr. spoločensko-politické zmeny, technologický vývoj). Výber metód, kľúčových slov, interpretácia výsledkov a závery môžu byť ovplyvnené subjektívnymi rozhodnutiami autorov článku.

**Poznámka o riešenom projekte**

Táto práca bola podporená z výskumného projektu VEGA 1/0198/25 Vznik, rozvoj a udržateľnosť inovatívnych podnikov.

**Použitá literatúra (References)**

Calabrese, G. G., & Manello, A. (2021). Board diversity and performance in a masculine, aged and glocal supply chain: New empirical evidence. *Corporate Governance: The International Journal of Business in Society*, *21*(7), 1440–1459. https://doi.org/10.1108/CG-09-2020-0417.

Cheah, I., & Shimul, A. S. (2023). Marketing in the metaverse: Moving forward – What's next? *Journal of Global Scholars of Marketing Science*, *33*(1), 1–10. https://doi.org/10.1080/21639159.2022.2163908.

Fernandes, V., Kuzey, C., Uyar, A., & Karaman, A. S. (2023). Board structure policy, board diversity and social sustainability in the logistics and transportation sector. *International Journal of Physical Distribution & Logistics Management*, *53*(1), 62–92. https://doi.org/10.1108/IJPDLM-09-2021-0415.

Govindan, K., Kilic, M., Uyar, A., & Karaman, A. S. (2021a). Drivers and value-relevance of CSR performance in the logistics sector: A cross-country firm-level investigation. *International Journal of Production Economics*, *231*, 107835. https://doi.org/10.1016/j.ijpe.2020.107835.

Johnson, M. P., Dijkstra-Silva, S., Fabusuyi, T., Hesari, E., & Oelrich, S. (2025). Extending Operations Management, Operations Research, and Supply Chain Management Research With Diversity, Equity, and Inclusion: A Literature Review Approach. *Production and Operations Management*, *34*(4), 854–865. https://doi.org/10.1177/10591478241281054.

Kuzey, C., Fritz, M. M. C., Uyar, A., & Karaman, A. S. (2022). Board gender diversity, CSR strategy, and eco-friendly initiatives in the transportation and logistics sector. *International Journal of Production Economics*, *247*, 108436. https://doi.org/10.1016/j.ijpe.2022.108436.

Ruel, S., & Fritz, M. M. C. (2021). Gender diversity in supply chains: Towards more sustainable decisions? evidence from interviews. *Supply Chain Forum: An International Journal*, *22*(3), 205–222. https://doi.org/10.1080/16258312.2021.1948307.

Shalpegin, T., Browning, T. R., & Kumar, A. (2025). OM Forum—Barriers to Implementing Diversity, Equity, and Inclusion (DEI) Programs in Supply Chains: Lessons from Comparing Public and Private Firms. *Manufacturing & Service Operations Management*, *27*(2), 339–353. https://doi.org/10.1287/msom.2023.0621.

Silva, M. E., Ruel, S., & Sousa-Filho, J. M. (2024). Measuring supplier diversity, equity and inclusion (DEI): Scale development and empirical validation. *Supply Chain Management: An International Journal*, *29*(2), 279–296. https://doi.org/10.1108/SCM-06-2023-0306.

Singh, J., Hamid, A. B. A., & Garza-Reyes, J. A. (2023). Supply chain resilience strategies and their impact on sustainability: An investigation from the automobile sector. *Supply Chain Management: An International Journal*, *28*(4), 787–802. https://doi.org/10.1108/SCM-06-2022-0225.

Solaimani, S., & Van Der Veen, J. (2022). Open supply chain innovation: An extended view on supply chain collaboration. *Supply Chain Management: An International Journal*, *27*(5), 597–610. https://doi.org/10.1108/SCM-09-2020-0433.

Soundararajan, V., Wilhelm, M. M., & Crane, A. (2021). Humanizing Research on Working Conditions in Supply Chains: Building a Path to Decent Work. *Journal of Supply Chain Management*, *57*(2), 3–13. https://doi.org/10.1111/jscm.12260.

Vertinsky, I., Kuang, Y., Zhou, D., & Cui, V. (2023). The political economy and dynamics of bifurcated world governance and the decoupling of value chains: An alternative perspective. *Journal of International Business Studies*, *54*(7), 1351–1377. https://doi.org/10.1057/s41267-023-00597-z.

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# DEVELOPMENT OF CORPORATE FINANCIAL PERFORMANCE AND DIGITALISATION IN THE V4 COUNTRIES

*Diana Pallérová – Dávid Rybjanský – Kristián Drugda – Veronika Volfová*

***Abstract***
*This paper examines the development of selected business-sector financial and digitalisation indicators in the Visegrad Group countries, using the EU27 as a comparative benchmark. The financial analysis covers 2022–2024 and includes net turnover, value added, gross operating surplus and an author-calculated gross operating rate. Digitalisation is assessed for 2023–2025 through artificial intelligence, paid cloud computing services, business software and data analytics. The study uses harmonised Eurostat data and descriptive comparative methods, including development indices, percentage changes and standard deviations. Value added and gross operating surplus increased nominally in all V4 countries, while the calculated gross operating rate also increased, most strongly in Slovakia and only marginally in Poland. Czechia recorded increases in all four digital indicators. Artificial intelligence showed the highest relative growth in the published data, although its 2025 questionnaire scope was broader than in 2023. Large enterprises consistently reported higher AI and cloud adoption than SMEs. Cross-country dispersion narrowed for GDP-relative financial indicators and data analytics, widened for the gross operating rate, artificial intelligence and business software, and remained broadly stable for cloud computing.*

***JEL classification**: L25, M21, O33, O52*
***Keywords**: digitalisation, corporate financial performance, artificial intelligence, cloud computing, SMEs, Visegrad Group*

## Introduction

Digitalisation is increasingly reshaping how enterprises organise processes, make decisions, manage information and create value. In business research, digital transformation is understood not merely as the introduction of individual technologies, but as a broader organisational process involving changes in strategy, structures, capabilities and business models (Vial, 2019; Verhoef et al., 2021). Digital technologies may improve efficiency, innovation and competitiveness, but their contribution to corporate performance depends on complementary organisational resources and the ability to integrate them into business processes (Melville et al., 2004).

The assessment of these developments requires a multidimensional understanding of corporate financial performance. Turnover captures the scale of business activity, while value added, operating surplus and operating profitability reflect different aspects of value creation and financial performance. Growth in nominal turnover or operating surplus does not necessarily result in stronger relative profitability. Consequently, several

complementary indicators are needed to distinguish an expansion of corporate activity from an improvement in operating performance (Richard et al., 2009).

Digital technologies also differ in their functions, maturity and organisational requirements. Cloud computing provides scalable access to infrastructure and software, business applications support the integration of information and processes, and data analytics enables enterprises to transform data into managerial knowledge. Artificial intelligence extends these possibilities through automation, prediction and decision support. However, AI generates business value only when enterprises possess the data, skills and organisational capabilities needed to apply it in their operations (Enholm et al., 2022). Research on European SMEs similarly shows that AI adoption is influenced by digital capabilities, innovation capacity and support from the business environment (Arroyabe et al., 2024).

The issue is particularly relevant when comparing SMEs and large enterprises. Large enterprises generally possess greater financial resources, specialised employees and more developed digital infrastructure, which facilitate the adoption and scaling of advanced technologies. SMEs may benefit from more flexible decision-making, but they often face stronger barriers related to costs, skills and implementation capacity. Previous research confirms that large and multinational enterprises experience stronger drivers and fewer barriers to advanced digitalisation than SMEs (Horváth & Szabó, 2019).

Digitalisation is also unevenly distributed across European countries. Earlier studies identified persistent differences in digital infrastructure, technology use and capabilities within the EU (Cruz-Jesus et al., 2012). Comparative research focused on the Visegrad Group likewise found differences in the development of the digital economy across Czechia, Hungary, Poland and Slovakia (Balcerzak & Pietrzak, 2017). Evidence from Central and Eastern European enterprises further suggests that the adoption of digital technologies differs across countries and technologies because firms operate under different organisational, technological and institutional conditions (Szabo et al., 2020).

Despite the growing literature on digital transformation, many studies focus on individual technologies, adoption determinants or firm-level performance effects. To the authors' knowledge, limited attention has been paid to the simultaneous development of several digital technologies and financial indicators across the V4 countries, particularly when the EU27, enterprise size and changes in cross-country dispersion are considered together. Such a comparison is important because growth in digital technology adoption may coexist with different financial trajectories, while narrowing dispersion in one indicator does not necessarily imply the same pattern in another.

This paper therefore examines the development of selected business-sector financial and digitalisation indicators in Czechia, Hungary, Poland and Slovakia, using the EU27 as a comparative benchmark. Financial development is evaluated through net turnover, value added, gross operating surplus and an author-calculated gross operating rate between 2022 and 2024. Digitalisation is assessed through artificial intelligence, paid cloud computing services, business software and data analytics between 2023 and 2025. The analysis also examines whether differences among the V4 countries widened or narrowed and compares selected developments between SMEs and large enterprises.

The study is descriptive and comparative and does not seek to establish a causal relationship between digitalisation and financial performance. The article therefore addresses the following research questions:

- *RQ1: How did selected corporate financial indicators develop in the V4 countries between 2022 and 2024 compared with the EU27?*
- *RQ2: How did the adoption of selected digitalisation tools develop in the V4 countries between 2023 and 2025 compared with the EU27?*
- *RQ3: Did differences among the V4 countries widen or narrow over the analysed periods, and how did the developments differ between large enterprises and SMEs?*

## 1 Current state of the solved problem at home and abroad

### 1.1 Corporate financial performance and digitalisation

Corporate financial performance is a multidimensional concept that should be assessed through indicators of business scale, value creation and profitability. Growth in turnover, value added or operating surplus does not necessarily lead to higher relative profitability. The use of several complementary indicators is therefore necessary to distinguish the expansion of corporate activity from improvements in operating performance (Venkatraman & Ramanujam, 1986; Richard et al., 2009).

This distinction is also important when evaluating digitalisation. Research on information technology business value shows that technological investment alone does not automatically improve financial performance. Its benefits depend on complementary resources, employee skills, managerial capabilities and changes in business processes (Melville et al., 2004). Digital transformation should therefore be understood as a broader organisational process involving changes in technologies, strategy, structures and business models rather than the isolated adoption of individual digital tools (Vial, 2019; Verhoef et al., 2021).

The financial effects of digitalisation may also appear with a delay because implementation initially generates costs related to technology acquisition, integration, training and process redesign. Evidence from SMEs indicates that initial increases in digital orientation may coincide with performance setbacks before benefits emerge at higher levels of digital orientation (Escoz Barragan & Becker, 2025). Consequently, higher adoption of digital technologies does not necessarily produce immediate improvements in turnover or operating profitability.

### 1.2 Selected digital technologies and business value

Artificial intelligence can support automation, prediction, decision-making and innovation. However, AI creates business value only when firms possess the technological, human and organisational capabilities required to integrate it into business processes (Enholm et al., 2022; Mikalef & Gupta, 2021). Research on European SMEs confirms that AI adoption depends particularly on digital capabilities, innovation

capacity and conditions in the external environment (Arroyabe et al., 2024). Rapid growth in AI use should therefore not automatically be interpreted as evidence of advanced organisational implementation, especially when initial adoption levels are low.

Cloud computing provides scalable access to computing infrastructure, software and data storage. Its adoption is influenced by technological readiness, compatibility, management support, competitive pressure and security concerns (Oliveira et al., 2014). International evidence shows that cloud computing is more widely diffused than data-dependent technologies such as artificial intelligence, which remain concentrated among larger firms and selected sectors (OECD, 2024).

Business software, including ERP, CRM and other enterprise applications, supports the integration of information and coordination of business processes. Evidence suggests that these systems can improve selected performance dimensions, although their effects depend on implementation quality, organisational adaptation and the type of system used (Hendricks et al., 2007).

Data analytics creates value when firms can transform data into actionable knowledge and integrate analytical results into decision-making. Data analytics capability therefore combines technological resources, data quality, human expertise and managerial skills (Gupta & George, 2016).

The technologies analysed in this article consequently represent different dimensions of enterprise digitalisation. Cloud computing provides digital infrastructure, business software integrates processes and information, data analytics supports evidence-based decisions, and AI enables the automation or augmentation of more complex tasks. Their adoption rates and development patterns should therefore not be expected to be identical.

### 1.3 Enterprise size, regional disparities and research gap

Enterprise size is an important determinant of digital technology adoption. Large enterprises generally possess more financial resources, specialised employees, formalised processes and developed digital infrastructure. SMEs may have more flexible decision-making structures, but they often face stronger limitations in financing, skills, data availability and implementation capacity. Research on Industry 4.0 confirms that large and multinational enterprises usually experience fewer barriers to advanced digitalisation than SMEs (Horváth & Szabó, 2019).

Digitalisation also remains uneven across European countries. Differences in digital infrastructure, human capital, innovation capacity and institutional conditions contribute to a persistent digital divide within the EU (Cruz-Jesus et al., 2012). Research focused on Central and Eastern Europe similarly shows that V4 countries entered digital transformation with different technological and organisational capabilities (Szabo et al., 2020). These differences may initially widen because advanced technologies are first adopted by countries and enterprises with stronger digital capabilities.

Existing studies usually examine individual technologies, adoption determinants or firm-level performance effects. To the authors' knowledge, limited attention has been paid to

comparisons that simultaneously consider several digital technologies, multiple financial indicators, enterprise-size categories and national developments within the V4. The present article addresses this gap by comparing the development of business-sector financial indicators and the adoption of AI, cloud computing, business software and data analytics in the V4 countries against the EU27.

The purpose is not to establish a causal relationship between digitalisation and financial performance. Instead, the article identifies development trajectories, enterprise-size differences and changes in cross-country dispersion. This approach enables an assessment of whether the V4 countries are becoming more similar or more different in selected dimensions of corporate performance and digitalisation.

## 2 Research design and methodology

### 2.1 Research design and data source

The main objective of this study was to assess and compare the development of selected business-sector financial and digitalisation indicators across the V4 countries, Czechia, Hungary, Poland and Slovakia, and to evaluate their position relative to the EU27. The study focused on changes in indicator levels, growth dynamics, cross-country dispersion and differences between SMEs and large enterprises. The analysis was descriptive and comparative; therefore, it did not examine correlation, causality or the statistical effect of digitalisation on financial performance.

Secondary data were obtained from the Eurostat database. Structural business statistics were used for the financial analysis, as they provide harmonised information on the structure and performance of enterprises. Digitalisation data were obtained from the Eurostat survey on ICT usage and e-commerce in enterprises, which is conducted annually and covers the adoption of technologies such as artificial intelligence, cloud computing, business software and data analytics (Eurostat, 2026).

The most recent observations available for the selected variables were used. The main financial comparison covered 2022–2024, while the digitalisation analysis covered 2023–2025. The different reference periods reflect the publication schedules and availability of the Eurostat datasets. Additional figures used 2021–2024 for net turnover by enterprise size and 2021, 2023 and 2025 for artificial intelligence and cloud computing by enterprise size.

### 2.2 Research sample and variables

The research sample consisted of the four V4 countries: Czechia, Hungary, Poland and Slovakia. The EU27 aggregate was included as a contextual benchmark but was excluded from all calculations of dispersion among the V4 countries.

The coverage and enterprise-size definitions differ between the two Eurostat sources. Financial indicators refer to the sector of non-financial corporations (S11), while ICT indicators cover enterprises with at least 10 persons employed in non-financial business activities, specifically NACE sections C–N excluding K and division S95.1. In the ICT

analysis, SMEs employ 10–249 persons and large enterprises 250 or more. Therefore, the financial and digitalisation indicators are based on related but not fully identical statistical populations.

The financial analysis used the following Eurostat structural business statistics variables (Eurostat, 2026):

- Net turnover represents revenue generated from the sale of goods and services after deductions associated with sales. It was used as an indicator of the overall scale of business activity.
- Value added measures the value generated by enterprises after deducting intermediate inputs and therefore reflects their contribution to economic output.
- Gross operating surplus represents value added remaining after employee benefits expense has been deducted. It reflects the operating surplus generated by the covered enterprises before financing and taxation items.
- Gross operating rate measures operating profitability relative to turnover. To ensure internal consistency, it was calculated by the authors from the same table cells as 100 × gross operating surplus / net turnover, rather than imported as a separately filtered series.

Absolute financial indicators were reported in current millions of euros. To reduce the effect of differences in economic size, net turnover, value added and gross operating surplus were also presented as percentages of nominal GDP. The GDP-adjusted value was calculated as:

$$X_{GDP,it} = \frac{X_{it}}{GDP_{it}} \times 100,$$

where $X_{it}$ denotes the financial indicator for country i in year t.

The digitalisation analysis included four indicators from the Eurostat ICT usage and e-commerce survey (Eurostat, 2026):

- Artificial intelligence – the percentage of enterprises using at least one of the AI technologies covered by the relevant annual questionnaire;
- Cloud computing – the percentage of enterprises using paid cloud computing services over the internet;
- Business software – the percentage of enterprises using at least one of ERP, CRM or business intelligence software;
- Data analytics – the percentage of enterprises for which data analytics is performed by the enterprise's own employees or by an external provider.

### 2.3 Data processing and procedure

The data-processing procedure consisted of several stages. First, observations were selected for CZ, HU, PL, SK and EU27_2020 by reference year, Eurostat variable, unit, NACE aggregate and enterprise-size class. Financial monetary variables used EUR million, GDP used current-price EUR million, and ICT indicators used percentages of enterprises.

The main SBS tables used non-financial corporation classes, while the ICT aggregate tables used enterprises with at least 10 persons employed. All displayed values, development indices, percentage changes and dispersion measures were subsequently cross-checked for internal consistency.

Second, the financial and digital indicators were organised and interpreted separately because their periods, activity coverage and enterprise populations are not identical. Their joint assessment was therefore limited to a descriptive comparison of country positions and development patterns, without treating the observations as matched firm-level data.

Third, a development index was calculated for each country and indicator:

$$DI_i = \frac{X_{i,t_1}}{X_{i,t_0}},$$

where $X_{i,t0}$ is the value in the initial year and $X_{i,t1}$ is the value in the final year.

The index was interpreted as follows:

- DI>1: an increase in the indicator.
- DI=1: no change.
- DI<1: a decrease in the indicator.

Finally, differences among the V4 countries were assessed using the population standard deviation, calculated separately for the initial and final year of each indicator. The EU27 was excluded. Since the analysis included all four V4 countries rather than a sample of countries, the population standard deviation was calculated using the STDEV.P function in MS Excel.

## 3 Research results

### 3.1 Development of selected corporate financial indicators in the V4 countries

This subsection analyses the development of selected financial indicators in the V4 countries, with the EU27 used as a benchmark. The assessment focuses on net turnover, value added, gross operating surplus and the author-calculated gross operating rate over 2022–2024. Particular attention is paid to indicator levels, growth dynamics and cross-country dispersion.

Table 1 presents selected indicators of corporate activity and operating performance in the V4 countries and the EU27 in 2022 and 2024. Poland recorded the highest absolute values of net turnover, value added and gross operating surplus among the V4 countries in both years, largely reflecting the size of its economy. Czechia reported the highest net turnover relative to GDP, although this ratio declined from 241% to 200%. Between 2022 and 2024, nominal value added and gross operating surplus increased in all V4 countries. Slovakia recorded the strongest growth in both indicators, while Poland achieved the highest increase in net turnover. By contrast, net turnover declined in Czechia and

remained broadly stable in Hungary. Net turnover as a share of GDP decreased in every V4 country and in the EU27.

**Table 1**
Selected corporate financial indicators in the V4 countries and the EU27 in 2022 and 2024

| Indicator | | Net turnover | | Value added | | Gross operating surplus | Gross operating rate | |
|---|---|---|---|---|---|---|---|---|
| | | EUR mil. | % of GDP | EUR mil. | % of GDP | EUR mil. | % of GDP | % |
| **Czechia** | 2022 | 692 731 | 241% | 155 288 | 54% | 70 538 | 25% | 10% |
| | 2024 | 643 112 | 200% | 175 861 | 55% | 78 004 | 24% | 12% |
| **Hungary** | 2022 | 392 458 | 233% | 82 606 | 49% | 36 072 | 21% | 9% |
| | 2024 | 390 767 | 190% | 102 562 | 50% | 41 620 | 20% | 11% |
| **Poland** | 2022 | 1 372 088 | 207% | 324 263 | 49% | 157 994 | 24% | 12% |
| | 2024 | 1 530 640 | 180% | 398 505 | 47% | 177 750 | 21% | 12% |
| **Slovakia** | 2022 | 229 152 | 208% | 51 123 | 46% | 23 179 | 21% | 10% |
| | 2024 | 236 512 | 182% | 64 620 | 50% | 31 596 | 24% | 13% |
| **EU** | 2022 | 32 834 947 | 190% | 8 783 712 | 51% | 3 684 047 | 21% | 11% |
| | 2024 | 32 320 755 | 172% | 9 741 471 | 52% | 3 907 705 | 21% | 12% |

*Source: Own processing based on Eurostat (2026)*

The calculated gross operating rate increased across all V4 countries. The strongest improvement was recorded in Slovakia, from 10.12% to 13.36%, followed by Czechia, from 10.18% to 12.13%, and Hungary, from 9.19% to 10.65%. Poland recorded only a marginal increase, from 11.51% to 11.61%. Overall, Slovakia demonstrated the most favourable improvement in relative operating performance, whereas Poland's strong nominal expansion was accompanied by almost unchanged operating profitability.

**Table 2**
Development indices of selected financial indicators in the V4 countries and the EU27

| Indicator | Czechia | Hungary | Poland | Slovakia | EU |
|---|---|---|---|---|---|
| | 2024/2022 | 2024/2022 | 2024/2022 | 2024/2022 | 2024/2022 |
| **Net turnover** | 0,928 | 0,996 | 1,116 | 1,032 | 0,984 |
| | 0,829 | 0,814 | 0,866 | 0,872 | 0,902 |
| **Value added** | 1,132 | 1,242 | 1,229 | 1,264 | 1,109 |
| | 1,012 | 1,015 | 0,954 | 1,067 | 1,017 |
| **Gross operating surplus** | 1,106 | 1,154 | 1,125 | 1,363 | 1,061 |
| | 0,988 | 0,943 | 0,874 | 1,151 | 0,972 |
| **Gross operating rate** | 1,191 | 1,159 | 1,009 | 1,321 | 1,078 |

*Source: Own processing based on Eurostat (2026)*

Table 2 presents the development indices of selected financial indicators between 2022 and 2024. Poland recorded the strongest increase in nominal net turnover, at 11.6%, followed by Slovakia at 3.2%. Turnover declined marginally in Hungary by 0.4% and more substantially in Czechia by 7.2%, compared with a 1.6% decrease in the EU27. Relative to GDP, however, net turnover declined in all V4 countries, with the largest decrease in Hungary at 18.6% and the smallest in Slovakia at 12.8%. All V4 countries recorded a stronger decline than the EU27, where the decrease reached 9.8%.

Nominal value added increased in every V4 economy and grew faster than the EU27 rate of 10.9%. Slovakia recorded the highest growth at 26.4%, followed by Hungary at 24.2%, Poland at 22.9% and Czechia at 13.2%. Relative to GDP, value added increased in Slovakia, Hungary and Czechia, whereas Poland recorded a decline of 4.6%. Gross operating surplus also increased nominally in all V4 countries, with Slovakia achieving the strongest growth of 36.3%, substantially exceeding the EU27 increase of 6.1%. Slovakia was also the only V4 country to record a significant increase in operating surplus relative to GDP, at 15.1%.

The calculated gross operating rate improved in all V4 countries. The strongest increase was recorded in Slovakia at 32.1%, followed by Czechia at 19.1% and Hungary at 15.9%, all exceeding the EU27 growth rate of 7.8%. Poland recorded only a marginal improvement of 0.9%. Overall, Slovakia demonstrated the most favourable financial development, while Poland combined strong nominal growth with weaker development in GDP-relative indicators and operating profitability.

**Table 3**
Standard deviation of selected financial indicators across the V4 countries in 2022 and 2024

| Indicator | Unit | 2022 | 2024 |
|---|---|---|---|
| **Net turnover** | EUR mil. | 437 267 | 500 910 |
| | pp | 14.9 | 8,1 |
| **Value added** | EUR mil. | 105 676 | 129 378 |
| | pp | 2,8 | 2,9 |
| **Gross operating surplus** | EUR mil. | 52 610 | 57 782 |
| | pp | 1,5 | 1,9 |
| **Gross operating rate** | pp | 0,8 | 1,0 |

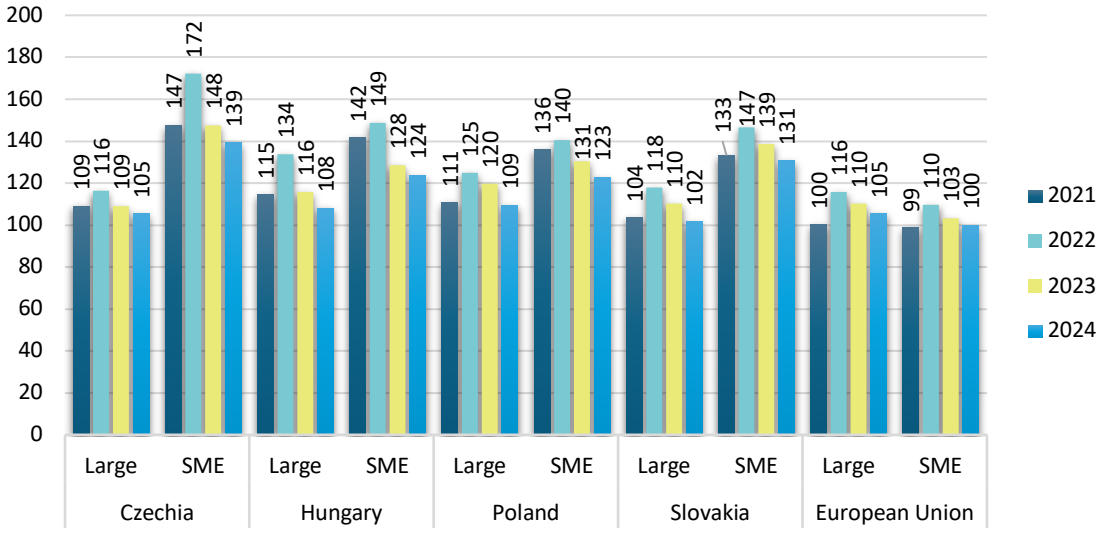
*Source: Own processing based on Eurostat (2026)*

Table 3 presents the population standard deviation of selected financial indicators across the V4 countries in 2022 and 2024. In nominal terms, cross-country differences increased. The standard deviation of net turnover rose by 14.6%, from EUR 437,267 million to EUR 500,910 million. Dispersion also increased for value added by 22.4% and for gross operating surplus by 9.8%. These results indicate widening differences in the absolute scale of corporate activity among the V4 economies. By contrast, the dispersion of indicators expressed relative to GDP declined. The standard deviation of net turnover as a share of GDP decreased by 45.6%, while the corresponding declines reached 75.0%

for value added and 36.0% for gross operating surplus. However, the standard deviation of the gross operating rate increased by 25.0%, from 0.8 to 1.0 percentage points. Thus, GDP-relative volume indicators became more similar across the V4 countries, whereas differences in operating profitability widened moderately.

To provide a clearer comparison of net turnover across enterprise-size categories and countries, Figure 1 presents net turnover as a percentage of GDP for large enterprises and SMEs in the V4 countries and the EU27 over the period 2021–2024.

**Figure 1**
Net turnover in large enterprises and SMEs over 2021–2024 (% of GDP)




*Source: Own processing based on Eurostat (2026)*

Czechia reported the highest SME values, peaking at 172% of GDP in 2022, followed by Hungary, Slovakia and Poland. Among large enterprises, Hungary generally recorded the highest values, although Poland slightly exceeded it in 2024. In most countries, net turnover reached its maximum in 2022 and subsequently declined in 2023 and 2024. Despite this decrease, turnover relative to GDP for SBS-defined SMEs, including micro-enterprises, remained above the corresponding EU27 in all V4 countries in 2024. Czechia recorded the highest SME value at 139% of GDP, while Slovakia recorded the lowest V4 value at 131%, compared with 100% for the EU27. These SBS-defined SMEs are not identical to the 10–249 employee category used in the ICT figures.

## 3.2 Development of selected digitalisation indicators in the V4 countries

This subsection examines the development of selected digitalisation indicators in the V4 countries, with the EU27 serving as a comparative benchmark. The analysis focuses on the adoption of artificial intelligence, cloud computing, business software and data analytics between 2023 and 2025. Attention is given to changes in indicator levels, differences in growth dynamics and the dispersion of results across the V4 countries. A

more detailed comparison by enterprise size is subsequently provided for artificial intelligence and cloud computing, distinguishing between large enterprises and SMEs.

**Table 4**
Selected digitalisation indicators in the V4 countries and EU27 in 2023 and 2025 (%)

| Indicator | Czechia | | Hungary | | Poland | | Slovakia | | EU | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2023 | 2025 | 2023 | 2025 | 2023 | 2025 | 2023 | 2025 | 2023 | 2025 |
| **Artificial intelligence** | 5.90 | 17.60 | 3.68 | 10.37 | 3.67 | 8.36 | 7.04 | 18.00 | 8.06 | 19.95 |
| **Cloud computing** | 47.15 | 54.90 | 44.94 | 47.96 | 55.67 | 54.71 | 34.42 | 36.44 | 45.32 | 52.74 |
| **Business software** | 34.22 | 54.25 | 39.88 | 36.12 | 38.88 | 41.80 | 32.09 | 33.57 | 50.00 | 53.47 |
| **Data analytics** | 19.49 | 44.60 | 53.21 | 40.56 | 19.31 | 24.50 | 30.17 | 38.75 | 33.25 | 39.85 |

*Source: Own processing based on Eurostat (2026)*

Table 4 presents the development of selected digitalisation indicators in the V4 countries and the EU27 between 2023 and 2025. The published share of enterprises using at least one AI technology increased in all analysed economies. In 2025, Slovakia recorded the highest share among the V4 countries at 18.00%, closely followed by Czechia at 17.60%; both remained below the EU27 of 19.95%. Because the 2025 AI questionnaire covered an additional generative AI category and a broader language-generation category, the change from 2023 should not be interpreted as a fully definition-constant time comparison.

Cloud computing increased in Czechia, Hungary and Slovakia, while Poland recorded a slight decline. Czechia and Poland achieved the highest levels in 2025, both exceeding the EU27. The most substantial improvement in business software use was observed in Czechia, where the share increased from 34.22% to 54.25%, slightly surpassing the EU27. By contrast, Hungary recorded a decline.

Data analytics showed the largest initial differences across the V4 countries. Czechia recorded the strongest increase, from 19.49% to 44.60%, and reached the highest level in 2025. Slovakia and Poland also improved, whereas Hungary declined from 53.21% to 40.56%. Overall, Czechia recorded increases in all four digital indicators, while developments in Hungary and Poland were more uneven.

**Table 5**
Development indices of selected digitalisation indicators in the V4 countries and the EU27

| Indicator | Czechia | Hungary | Poland | Slovakia | EU |
|---|---|---|---|---|---|
| | 2025/2023 | 2025/2023 | 2025/2023 | 2025/2023 | 2025/2023 |
| **Artificial intelligence** | 2.983 | 2.818 | 2.278 | 2.557 | 2.475 |
| **Cloud computing** | 1.164 | 1.067 | 0.983 | 1.059 | 1.164 |
| **Business software** | 1.585 | 0.906 | 1.075 | 1.046 | 1.069 |
| **Data analytics** | 2.288 | 0.762 | 1.269 | 1.284 | 1.198 |

*Source: Own processing based on Eurostat (2026)*

Table 5 presents development indices between 2023 and 2025, where values above 1 indicate growth and values below 1 indicate decline. Artificial intelligence recorded the highest relative growth in the published data. Czechia achieved an increase of 198.3%, followed by Hungary at 181.8%, Slovakia at 155.7% and Poland at 127.8%. These AI indices combine genuine diffusion with the broader scope of the 2025 questionnaire and should therefore be interpreted cautiously. Czechia, Hungary and Slovakia exceeded the published EU27 growth rate of 147.5%, whereas Poland remained below it.

Cloud computing developed more moderately. Czechia recorded the highest increase among the V4 countries, at 16.4%, equal to the EU27 rate. Hungary and Slovakia grew by 6.7% and 5.9%, respectively, while Poland was the only country to record a decline, of 1.7%. The strongest growth in business software was also observed in Czechia, at 58.5%, substantially above the EU27 increase of 6.9%. Poland and Slovakia recorded moderate growth, whereas Hungary declined by 9.4%. Data analytics showed the most uneven development. Czechia achieved an increase of 128.8%, followed by Slovakia at 28.4% and Poland at 26.9%, all exceeding the EU27 growth rate of 19.8%. By contrast, Hungary recorded a decline of 23.8%. Czechia recorded increases in all four analysed digital indicators.

**Table 6**
Standard deviation of selected digitalisation indicators across the V4 countries in 2023 and 2025

| Indicator | 2023 | 2025 |
|---|---|---|
| **Artificial intelligence** | 1,454 | 4,279 |
| **Cloud computing** | 7,570 | 7,504 |
| **Business software** | 3,222 | 7,976 |
| **Data analytics** | 13,805 | 7,578 |

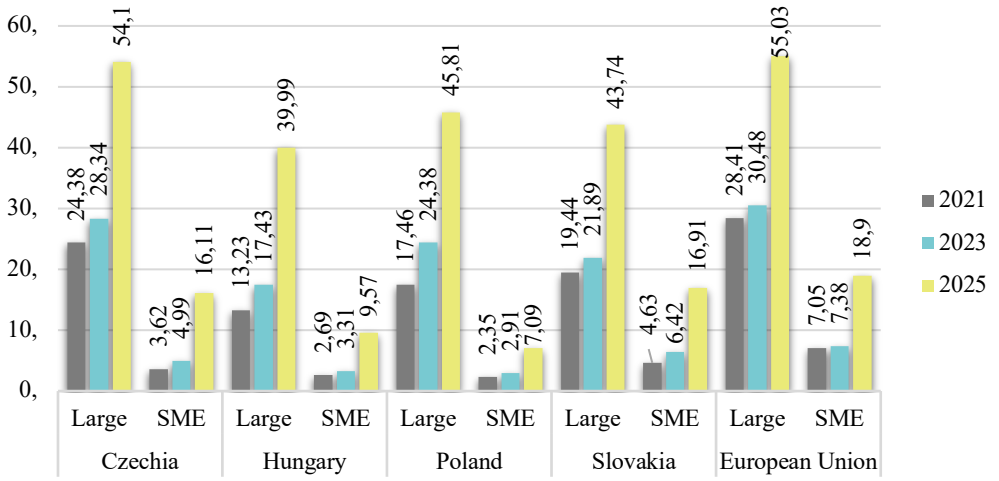
*Source: Own processing based on Eurostat (2026)*

Table 3 presents the population standard deviation of selected financial indicators across the V4 countries in 2022 and 2024. In nominal terms, cross-country differences increased for all indicators. The standard deviation of net turnover rose by 14.6%, from EUR 437,267 million to EUR 500,910 million. Dispersion increased by 22.4% for value added and by 9.8% for gross operating surplus. These results indicate widening differences in the absolute scale of corporate activity among the V4 economies. The development of GDP-relative indicators was mixed. The standard deviation of net turnover as a share of GDP decreased by 45.6%, indicating a substantial narrowing of cross-country differences. By contrast, dispersion increased by approximately 3.6% for value added relative to GDP and by 26.7% for gross operating surplus relative to GDP. The standard deviation of the gross operating rate also increased by 25.0%, from 0.008 to 0.010. Overall, the V4 countries became more similar in turnover relative to GDP, while differences in value creation, operating surplus and operating profitability widened.

To complement the aggregate results presented in Tables 4–6, Figures 2 and 3 compare the adoption of artificial intelligence and cloud computing by enterprise size. In accordance with the Eurostat ICT survey classification, SMEs comprise enterprises with 10-249 persons employed, while large enterprises comprise those with 250 or more

persons employed. The figures cover the V4 countries and the EU27 in 2021, 2023 and 2025.

**Figure 2**
AI use in large enterprises and SMEs in 2021, 2023 and 2025 (%)

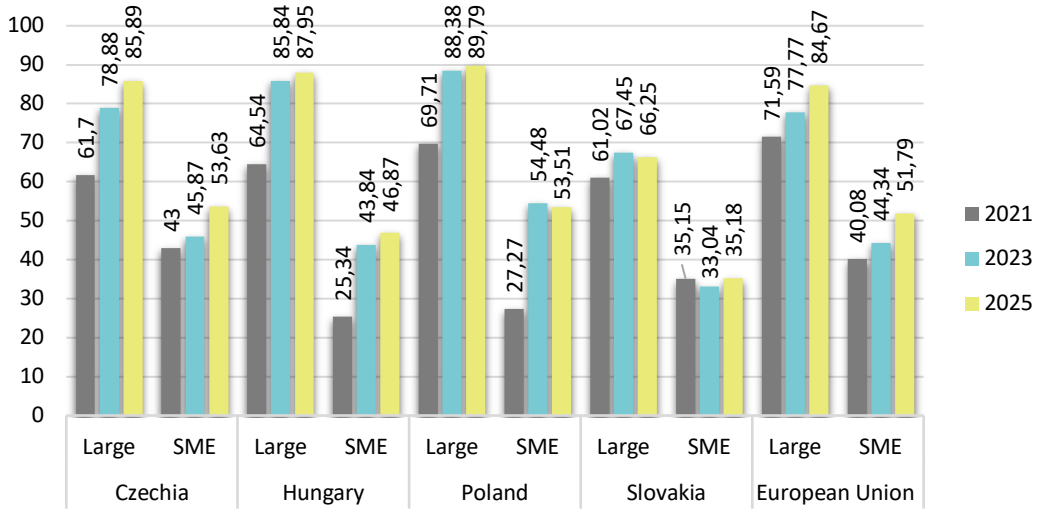



*Source: Own processing based on Eurostat (2026)*

Figure 2 shows a substantial increase in the published AI indicator in both large enterprises and SMEs. Large enterprises consistently reported considerably higher shares than SMEs in all V4 countries and the EU27. In 2025, Czechia recorded the highest share among large V4 enterprises, at 54.10%, approaching the EU27 of 55.03%. Poland followed at 45.81%, while Slovakia and Hungary reached 43.74% and 39.99%, respectively. The 2025 values reflect the broader AI questionnaire scope described in the methodology. Among SMEs, Slovakia achieved the highest AI adoption rate within the V4 in 2025, at 16.91%, closely followed by Czechia at 16.11%. Hungary and Poland remained at lower levels, reaching 9.57% and 7.09%, respectively. All V4 countries remained below the EU27 for SMEs of 18.90%. Overall, the figure confirms rapid growth in AI adoption but also highlights a persistent digital gap between large enterprises and SMEs, particularly in Hungary and Poland.

Figure 3 shows that large enterprises consistently reported higher cloud computing adoption than SMEs. In 2025, Poland recorded the highest share among large enterprises in the V4, at 89.79%, followed by Hungary at 87.95% and Czechia at 85.89%. All three countries exceeded the EU27 of 84.67%, while Slovakia remained substantially below it at 66.25%.

**Figure 3**
Paid cloud computing use in large enterprises and SMEs in 2021, 2023 and 2025 (%)




*Source: Own processing based on Eurostat (2026)*

Among SMEs, Czechia achieved the highest adoption rate in 2025, at 53.63%, followed by Poland at 53.51%, Hungary at 46.87% and Slovakia at 35.18%. Czechia and Poland slightly exceeded the EU27 for SMEs of 51.79%, whereas Hungary and Slovakia remained below it. Overall, cloud computing use increased between 2021 and 2025 in nearly all enterprise categories, although a considerable gap between large enterprises and SMEs persisted.

## 4 Discussion

The results indicate that the V4 countries followed different financial and digital development paths. Nominal increases in value added and gross operating surplus were accompanied by uneven improvements in the calculated gross operating rate, while digital adoption differed across countries, technologies and enterprise-size categories. The findings therefore do not support a simple correspondence between higher digitalisation and stronger short-term financial performance.

In terms of RQ1, value added and gross operating surplus increased nominally in all V4 countries between 2022 and 2024, with growth rates exceeding those of the EU27 aggregate. Slovakia recorded the strongest growth in both indicators and the highest increase in the gross operating rate. Poland retained the highest absolute financial values and achieved the strongest turnover growth, but its operating profitability improved only marginally. Czechia experienced a decline in nominal turnover but a clear improvement in the gross operating rate, while Hungary combined strong value-added growth with higher operating surplus and profitability. These findings confirm that growth in turnover and value added should not be interpreted as equivalent to improved profitability. Although nominal value added and gross operating surplus increased, net turnover relative to GDP declined in all V4 countries. Value added relative to GDP increased in Czechia, Hungary and Slovakia but declined in Poland, while gross operating surplus

relative to GDP increased only in Slovakia. Nominal growth may partly reflect inflation, economic expansion and exchange-rate movements rather than an equivalent improvement in real corporate performance.

Regarding RQ2, digitalisation generally increased between 2023 and 2025, although developments varied by technology. Artificial intelligence recorded the highest relative growth in all V4 countries, but the magnitude of the indices was affected by low initial adoption levels and the broader scope of the 2025 questionnaire. All V4 countries remained below the EU27 aggregate in the published 2025 AI indicator. This is consistent with evidence that AI adoption remains concentrated among larger and technologically advanced enterprises and depends on existing digital and innovation capabilities (Arroyabe et al., 2024; OECD, 2024).

Cloud computing developed more moderately. Czechia, Hungary and Slovakia recorded growth, whereas Poland experienced a slight decline. Czechia achieved the broadest digital progress, with increases in AI, cloud computing, business software and data analytics. However, the present analysis does not identify the organisational or institutional factors underlying these developments.

Considering RQ3, cross-country dispersion developed unevenly. Differences in absolute financial indicators increased, partly reflecting the different size of the V4 economies. Among GDP-relative indicators, dispersion narrowed for net turnover but increased for value added, gross operating surplus and the calculated gross operating rate. In digitalisation, differences widened in AI and business software, remained broadly stable in cloud computing and narrowed in data analytics. These findings support the view that digital technologies diffuse at different speeds across heterogeneous national contexts (Szabo et al., 2020).

The enterprise-size comparison confirms a persistent digital divide, as large enterprises reported substantially higher AI and cloud adoption than SMEs in every country. Overall, country positions in financial performance and digitalisation did not fully correspond. Czechia recorded the broadest digital progress, Slovakia achieved the strongest financial improvement, and Poland combined turnover growth with only a marginal increase in operating profitability. These differences do not establish a causal relationship between digitalisation and financial performance but are consistent with research suggesting that financial benefits may emerge only after firms reach sufficient digital maturity and absorb the initial costs of implementation and organisational adaptation (Escoz Barragan & Becker, 2025).

**Conclusion**

This paper examined the development of selected financial and digitalisation indicators in the V4 countries, using the EU27 aggregate as a benchmark. Between 2022 and 2024, value added and gross operating surplus increased nominally in all V4 countries. The gross operating rate also improved in every country, with the strongest increase recorded in Slovakia and only a marginal improvement in Poland. Poland maintained the highest absolute financial values, while Slovakia achieved the most favourable overall

financial development. Czechia, despite a decline in nominal turnover, recorded a clear improvement in operating profitability.

The digitalisation analysis showed substantial progress between 2023 and 2025, although developments differed by technology and country. Czechia recorded increases in all four digital indicators and therefore demonstrated the broadest digital progress. Artificial intelligence achieved the highest relative growth, but all V4 countries remained below the EU27 aggregate in AI adoption, particularly among SMEs. These results must be interpreted cautiously because the 2025 AI questionnaire covered a broader set of technologies than in 2023. Cloud computing developed more moderately and remained more widely adopted than AI.

Cross-country dispersion changed unevenly. Differences in absolute financial indicators widened, reflecting the different size of the V4 economies. Among GDP-relative indicators, dispersion narrowed only for net turnover, while differences increased for value added, gross operating surplus and the calculated gross operating rate. In digitalisation, disparities widened in artificial intelligence and business software, remained broadly stable in cloud computing and narrowed in data analytics. Large enterprises consistently reported higher AI and cloud adoption than SMEs, confirming a persistent enterprise-size digital divide.

Overall, the country rankings in financial performance and digitalisation did not fully correspond. Slovakia recorded the strongest financial improvement, while Czechia achieved the broadest digital progress. The findings therefore do not support a direct conclusion that higher digitalisation is automatically associated with stronger short-term financial performance. The study is limited by different reference periods for financial and digital indicators, aggregated country-level data, the changed scope of the AI questionnaire and the use of current-price financial values affected by inflation and exchange-rate movements.

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**References**

Arroyabe, M. F., Arranz, C. F. A., Fernandez de Arroyabe, I., & Fernandez de Arroyabe, J. C. (2024). Analyzing AI adoption in European SMEs: A study of digital capabilities, innovation, and external environment. *Technology in Society, 79*, Article 102733. https://doi.org/10.1016/j.techsoc.2024.102733

Balcerzak, A. P., & Pietrzak, M. B. (2017). Digital economy in Visegrad countries: Multiple-criteria decision analysis at regional level in the years 2012 and 2015. *Journal of Competitiveness, 9*(2), 5–18. https://doi.org/10.7441/joc.2017.02.01

Cruz-Jesus, F., Oliveira, T., & Bacao, F. (2012). Digital divide across the European Union. *Information & Management, 49*(6), 278–291. https://doi.org/10.1016/j.im.2012.09.003

Enholm, I. M., Papagiannidis, E., Mikalef, P., & Krogstie, J. (2022). Artificial intelligence and business value: A literature review. *Information Systems Frontiers, 24*, 1709–1734. https://doi.org/10.1007/s10796-021-10186-w

Escoz Barragan, K., & Becker, F. S. R. (2025). Keeping pace with the digital transformation—exploring the digital orientation of SMEs. *Small Business Economics, 64*(3), 1361–1385. https://doi.org/10.1007/s11187-024-00947-7

Eurostat. (2026). Eurostat database: Enterprise statistics by size class and NACE Rev. 2 activity (sbs_sc_ovw); Gross domestic product and main components (nama_10_gdp); Artificial intelligence by size class of enterprise (isoc_eb_ai); Cloud computing services by size class of enterprise (isoc_cicce_use); Integration of internal processes by size class of enterprise (isoc_eb_iip); Data analytics by size class of enterprise (isoc_eb_das) [Data sets]. https://ec.europa.eu/eurostat/data/database

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information & Management, 53*(8), 1049–1064. https://doi.org/10.1016/j.im.2016.07.004

Hendricks, K. B., Singhal, V. R., & Stratman, J. K. (2007). The impact of enterprise systems on corporate performance: A study of ERP, SCM, and CRM system implementations. *Journal of Operations Management, 25*(1), 65–82. https://doi.org/10.1016/j.jom.2006.02.002

Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change, 146*, 119–132. https://doi.org/10.1016/j.techfore.2019.05.021

Melville, N., Kraemer, K. L., & Gurbaxani, V. (2004). Review: Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly, 28*(2), 283–322. https://doi.org/10.2307/25148636

Mikalef, P., & Gupta, M. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. *Information & Management, 58*(3), Article 103434. https://doi.org/10.1016/j.im.2021.103434

OECD. (2024). *OECD Digital Economy Outlook 2024 (Volume 1): Embracing the Technology Frontier*. OECD Publishing. https://doi.org/10.1787/a1689dc5-en

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management, 51*(5), 497–510. https://doi.org/10.1016/j.im.2014.03.006

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of Management, 35*(3), 718–804. https://doi.org/10.1177/0149206308330560

Szabo, R. Z., Vuksanović Herceg, I., Hanák, R., Hortovanyi, L., Romanová, A., Mocan, M., & Djuričin, D. (2020). Industry 4.0 implementation in B2B companies: Cross-country empirical evidence on digital transformation in the CEE region. *Sustainability, 12*(22), Article 9538. https://doi.org/10.3390/su12229538

Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review, 11*(4), 801–814. https://doi.org/10.5465/amr.1986.4283976

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research, 122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

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# ECONOMIC ASPECTS OF CROSS BORDER ELECTRONIC COMMERCE

*Katarina Vavrová – Alexander Šarlina*

***Abstract***
Electronic commerce represents a significant phenomenon of the contemporary digital economy, substantially influencing the functioning of the internal market, consumer behavior, and business strategies of sellers. The aim of study is to analyze the main economic aspects of electronic commerce and to identify their impacts on market participants, particularly buyers and sellers. The analysis focuses on factors such as price competition, logistics costs, tax and customs burdens, exchange rate risks, and differences in regulatory environments across countries. The article highlights the benefits of cross-border electronic commerce, including a wider range of products, lower prices, and increased competition, while also identifying risks and barriers that may negatively affect market efficiency. The findings contribute to a better understanding of the economic implications of cross-border electronic commerce and may serve as a basis for the development of economic and regulatory policies.

***JEL classification:*** *H25*
***Keywords:*** *cross-border e-commerce, digital economy, consumer, seller, market*

## Introduction

The global spread of digital technologies and the increasing integration of global markets have fundamentally changed the nature of international trade. E-commerce has significantly penetrated traditional international trade. E-commerce has become a key vehicle through which goods and services are exchanged across national borders. Their exchange has significantly reduced traditional barriers related to distance, information asymmetry and market access (Laudon and Traver, 2022). In this context, cross-border e-commerce has become an important part of the global economy, allowing businesses of all sizes to participate in international markets and offering consumers unprecedented access to foreign products. It can be stated that the historical relationship between warfare and taxation and the evolution of fiscal systems in response to political and military pressures are analyzed (Bank and Thordnike, 2008).

From an economic perspective, cross-border e-commerce affects market structures, pricing mechanisms and competitive dynamics. By increasing price transparency and reducing search and transaction costs, online platforms intensify competition between domestic and foreign sellers, often leading to downward pressure on prices and improving product variety and quality (OECD, 2019). At the same time, these developments challenge traditional business models and require firms to adapt their strategies to a more complex and highly competitive digital environment (UNCTAD, 2021). A comprehensive introduction to financial theory and monetary systems with a focus on public finance principles is provided (Borzová and MedveĐ et al., 1999).

Despite its potential benefits, cross-border e-commerce is not without economic challenges. In particular, differences in tax systems, customs duties, logistics costs and regulatory frameworks across countries create additional costs and uncertainties for both sellers and consumers (Gomez-Herrera et al., 2014). These factors can reduce the price benefits associated with international online shopping and affect consumer confidence and purchasing decisions. In addition, exchange rate fluctuations and compliance with multiple legal regimes further increase the operational complexity of cross-border e-commerce activities (European Commission, 2020). Digital business models and e-commerce management, with emphasis on strategic, technological, and managerial aspects of online commerce, are examined (Chaffey, Hemphill and Edmundson-Bird, 2019). Understanding the economic aspects of cross-border e-commerce is therefore essential to assess its impact on market participants and overall economic efficiency. As governments seek to balance market openness with fiscal and regulatory objectives, and businesses seek to optimize cross-border strategies, comprehensive economic analysis is becoming increasingly important. This article focuses on the key economic dimensions of cross-border e-commerce and examines their implications for buyers, sellers, and market competition in an international context. E-commerce allows businesses to generate revenue without a physical presence, which makes it difficult for tax authorities to accurately collect taxes (Basu, 2008). Of e-commerce, covering its business, technological, and societal dimensions, is offered (Laudon and Traver, 2013).

## 1 Current state of the solved Problem at home and abroad

To begin with, the rapid development of digital technologies and the widespread adoption of the Internet have significantly changed traditional forms of trade, and consequently the behavior of their participants. E-commerce has become an integral part of the global economy, allowing businesses to reach customers across borders and consumers to access a wider range of goods and services (Laudon and Traver, 2022). Public finance theory and practice, addressing taxation, public expenditures, and fiscal policy mechanisms, are analyzed (Medveď et al., 2011). In this context, cross-border e-commerce has become a key driver of market integration and the growth of international trade (OECD, 2019). Cross border electro-commerce offers a number of economic benefits, including increased competition, price transparency and increased efficiency for both buyers and sellers (UNCTAD, 2021). Value-added tax issues related to electronic commerce, with particular emphasis on cross-border online sales, are analyzed (Sádovský, 2020). The consumer clearly benefits from wider availability of products and potentially lower prices for these products. On the other hand, sellers gain access to new markets with relatively low entry costs (Cui et al., 2020). At the same time, cross-border online sales pose specific challenges related to logistics, taxation, customs procedures, currency exchange and differences in legal and regulatory frameworks between countries (Gomez-Herrera et al., 2014). Despite its growing importance, cross-border e-commerce is still affected by various economic and institutional barriers that can limit its full potential. Differences in consumer protection rules, value added tax regimes, delivery costs and return policies can significantly influence purchasing decisions and

shape business strategies (European Commission, 2020). Understanding these economic aspects is therefore essential for market participants as well as policymakers seeking to foster the development of a competitive and integrated digital market. The aim of this article is to analyze the key economic aspects of cross-border electronic commerce and assess their impact on market participants, with a particular focus on buyers and sellers. By examining both the benefits and barriers associated with cross-border online transactions, this study contributes to a deeper understanding of the economic consequences of digital trade in an international context. Physical presence in the market or dependence on traditional customer services (Benicewicz and Miazda, 2002). Broadband is considered a basic infrastructure in today's knowledge economy. Therefore, it should be given considerable attention by all countries that want to compete effectively in the global market (Teluk, 2002). The historical development of taxation and public expenditure in Western economies is presented (Webber and Wildavsky, 1986).

Cross-border electronic commerce differs from domestic e-commerce primarily in terms of transaction complexity and cost structure. While digital platforms reduce information and search costs, cross-border transactions often involve higher logistics costs, longer delivery times, and additional administrative requirements. Price competition is one of the most significant economic features of cross-border electronic commerce. Consumers can compare prices across countries, which increases market transparency and exerts downward pressure on prices. At the same time, sellers may benefit from economies of scale and broader demand, enabling them to optimize production and distribution costs. However, these advantages are partly offset by additional costs related to international shipping, customs duties, and compliance with different regulatory regimes. These factors influence both pricing strategies and consumer purchasing decisions.

## 2 Research design and methodology

### 2.1 Economic Impacts on Consumers, on Sellers

From a consumer perspective, cross-border e-commerce can be characterized as access to a wider range of goods and services, including products that may not be available in domestic markets. In this regard, it can be stated that increased competition between sellers often leads to lower prices and improved quality of goods. However, consumers face several economic risks. Additional costs, such as transport charges, value added tax and customs duties, can reduce the expected price advantage of cross-border purchases. In addition, longer delivery times and higher costs associated with returning products can negatively affect consumer satisfaction. Information asymmetry also plays a role, as consumers may have limited knowledge of foreign sellers, legal protection and complaint mechanisms. These factors increase the perceived risk and can discourage cross-border online shopping.

From the sellers' perspective, it is clear that cross-border e-commerce provides sellers with opportunities to access new customer segments and diversify revenue streams. Digital platforms significantly lower the barriers to entry compared to traditional

international trade channels. However, sellers also have to cope with higher operational complexity. Complying with different tax systems, consumer protection laws and data protection regulations increases administrative costs. Managing logistics and customer service across borders requires additional investment and organizational capabilities. Small and medium-sized enterprises in particular may face difficulties in absorbing these costs, which can limit their ability to compete with larger multinational platforms.

### 2.2 Barriers and Risks in Cross-Border Electronic Commerce

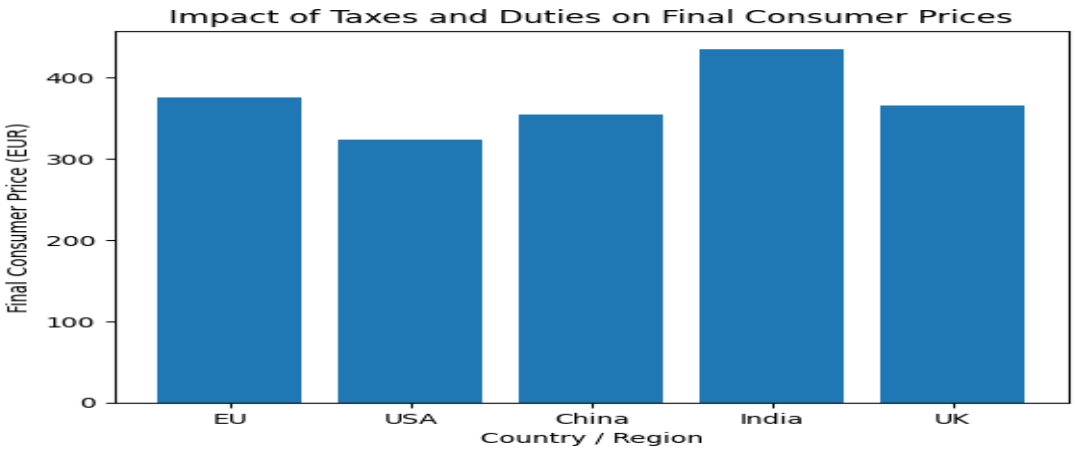
To summarize the cross-border e-commerce landscape, several barriers continue to hinder the growth of cross-border e-commerce. The most significant barriers include logistical issues, including high delivery costs and inefficient cross-border transport. Regulatory fragmentation, particularly in the areas of taxation and consumer protection, further complicates cross-border transactions. Fluctuating exchange rates add uncertainty for both consumers and sellers, while differing payment preferences and levels of digital infrastructure across countries can affect the efficiency of transactions. Addressing these barriers requires coordinated efforts at national and international level to harmonise regulations and improve cross-border infrastructure.

## 3 Result of the Paper

We have included a representation of the impact of taxes and duties on the final consumer price for several reasons. We use a standardized product with a base price of EUR 300 in our selected markets as an example. The survey results show significant differences in final prices across countries. Final prices vary and their differences are due to differences in VAT/GST rates, customs duties and tax structures. The highest final price is observed in India, where high import duties combined with GST significantly increase the total cost to consumers. In contrast, the United States shows the lowest final price due to the absence of a federal VAT system. The European Union and the United Kingdom show slightly higher prices, mainly due to VAT applied at the destination, while China occupies a middle position, reflecting its import VAT regime and customs regime. These findings confirm that tax and customs policies play a key role in shaping the price competitiveness of cross-border e-commerce offers.

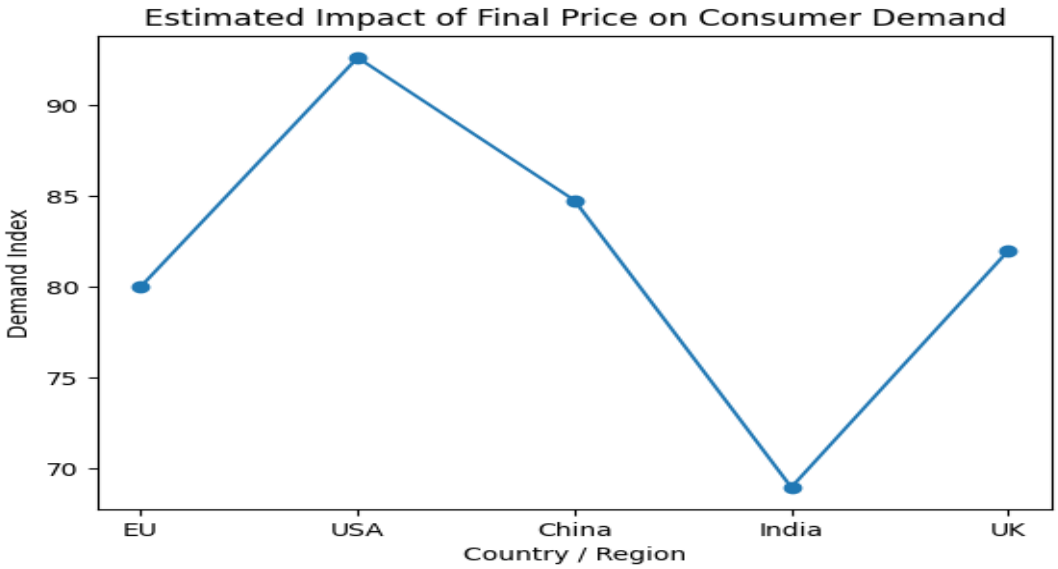
The graph shown represents the estimated demand index. We have included the demand index for several reasons. First, it is calculated assuming an inverse relationship between price and demand. Second, the index highlights how higher final prices can negatively affect consumer demand for products they acquire through cross-border trade. Markets with lower final prices, such as the United States, show higher estimated levels of demand, while India, which is characterized by the highest consumer prices, shows the lowest demand index. The European Union and the United Kingdom show moderate levels of demand, reflecting a trade-off between regulatory compliance and price competitiveness. Our graphical analysis supports the theoretical assumption that increased tax and customs burdens reduce the price advantage of cross-border e-commerce, leading to lower consumer demand.

**Table 1**
Impact of Taxes and Duties on Final Consumer Prices




*Source: Authors' own processing of secondary data*

**Figure 1**
Impact on Consumer Demand




*Source: Authors' own processing of secondary data*

Based on the previous graphs, it can be concluded that from an economic perspective, the results suggest the following. Sellers operating in an environment with high taxes and duties must either absorb some of the additional costs or pass them on to consumers, which can lead to reduced demand. Consumers, on the other hand, are more likely to engage in cross-border purchases in markets with lower regulatory and fiscal barriers. Overall, the graphical analysis highlights the importance of tax harmonization and simplified customs procedures in supporting cross-border e-commerce and increasing market efficiency.

Recently, a number of serious facts regarding cross-border trade have become clear. These factors continue to hinder the growth of cross-border electronic commerce. The most significant obstacles include problems related to logistics, including high delivery costs and inefficient cross-border transport. Regulations, especially in the areas of taxation and consumer protection, further complicate cross-border transactions. Fluctuations in exchange rates bring additional uncertainty for both consumers and sellers, while different payment preferences and levels of digital infrastructure in individual countries can affect the efficiency of transactions. Addressing these obstacles requires coordinated efforts at national and international level to harmonize regulations and improve cross-border infrastructure. It can also be stated that cross-border trade is very problematic, e.g. for smaller family businesses.

## 4 Discussion

In the discussion, we would like to highlight the important role that taxation, customs and regulatory frameworks play in shaping the economic outcomes of cross-border e-commerce. The graphical analysis in the article shows that differences in tax and customs regimes between the countries we have mentioned lead to substantial differences in final consumer prices. Consequently, the regimes significantly influence consumer demand and purchasing behavior.

In line with previous research (Gomez-Herrera et al., 2014; OECD, 2019), the findings confirm that higher regulatory and fiscal burdens reduce the price competitiveness of cross-border online offers. Countries that are characterized by markets with high import duties and complex tax structures, such as India, clearly show higher final prices and lower estimated demand. In contrast, markets with relatively liberal regimes, such as the United States, benefit from lower transaction costs and higher consumer demand, supported by the absence of a federal value-added tax.

The European Union and the United Kingdom represent cases where VAT is systematically applied to cross-border e-commerce transactions. This approach ensures fiscal compliance and fair competition between domestic and foreign sellers. But it reduces the price advantage traditionally associated with cross-border online shopping. The planned tightening of customs rules in the European Union further indicates a policy shift towards greater regulatory control, which may have long-term implications for consumer welfare and seller strategies.

From the seller perspective, the results suggest that businesses engaged in cross-border e-commerce must carefully balance pricing strategies with regulatory compliance. Higher taxes and duties can either be passed on to consumers, reducing demand, or absorbed by sellers, which in turn negatively affects profit margins. Larger companies with integrated logistics and compliance functions are better positioned to meet these challenges, while SMEs and family businesses may face significant barriers to international expansion.

The article would particularly highlight the importance of regulatory harmonisation and simplified customs procedures in supporting the sustainable growth of cross-border e-

commerce. Reducing administrative complexity and increasing transparency could increase market efficiency, stimulate consumer demand and improve competitiveness without compromising fiscal objectives.

## Conclusion

In conclusion, we could note that when it comes to cross-border trade, businesses should focus mainly on the website, the domain on which they sell their products. It is important that the website is visually attractive to consumers and at the same time correctly set up in relation to prices and VAT. Therefore, it is recommended to contact companies specializing in Internet marketing, which will also provide you with professional advice regarding VAT on the website. The genesis and development of electronic business are explained in the context of technological and organizational change (Krakówska, 2012).

One of the providers of internet domains and related advice on setting up VAT on the website is the company Smartweb s. r. o. The company's portfolio includes a number of e-shops, the aim of which is to sell not only in Slovakia, but also in the Czech Republic and other surrounding countries. In order for the e-shop to function as effectively as possible, customers are advised to set up a separate domain for each country – for example: ".cz, .hu, .de", where the e-shop will be operated. E-commerce creates both new market opportunities and regulatory challenges for businesses and governments (Kommerskollegium, 2012). Electronic commerce is described as an integral part of modern business activities, emphasizing its impact on companies and consumers (Paweloszek-Korek, 2014). Consumer intentions toward cross-border mobile commerce are influenced primarily by perceived trust and risk, which jointly shape users' willingness to engage in international m-commerce transactions (Cui, Mou, Cohen and Liu, 2020).

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## References

CUI, L., MOU, J., COHEN, J. a LIU, Y. (2020). Understanding consumer intentions toward cross-border m-commerce: An integrated model of trust and risk. *Journal of International Consumer Marketing*, 32(2), 89–104. DOI: 10.1080/08961530.2019.1653249.

GOMEZ – HERRERA, E., MARTENS, B. a TURLEA, G. (2014). The drivers and impediments for cross-border e-commerce in the EU. *Information Economics and Policy*, 28, 83–96. DOI: 10.1016/j.infoecopol.2014.05.002.

BASU, S. (2008). International taxation of e-commerce: Persistent problems and possible developments. *Journal of Information, Law & Technology*. University of Leeds. Dostupné na: https://hdl.handle.net/10419/99172 [cit. 15. 2. 2023].

*Citation of a book*

BANK, S. A. – THORDNIKE, J. J. (2008). *War and taxes*. Washington, DC: Urban Institute. ISBN 978-1-4548-0996-8.

BENICEWICZ – MIAZDA, A. (2003). *E-business on the Internet and in multimedia*. Warsawa: Mikom. ISBN 83-7279-339-5.

BORZOVÁ, A. – MEDVEĎ, J. a kol. (1999). *Úvod do teórie financií a meny*. Banská Bystrica: Fakulta financií UMB. ISBN 80-8055-091-03.

CHAFEY, D., HEMPHILL, T. and EDMUNDSON – BIRD, D. (2019). *Digital business and e-commerce management*. Harlow: Pearson Education. ISBN 978-1-292-19333-5.

LAUDON, K. C. – TRAVER, C. G. (2013). *E-commerce: Business, technology, society*. 9. vyd. Pearson Education. ISBN 978-0-13-460156-4.

MEDVEĎ, J. a kol. (2011). *Verejné financie*. Bratislava: Sprint. ISBN 978-80-89393-46-6.

SÁDOVSKÝ, M. (2020). *DPH u prodeje zboží přes elektronické obchody*. Praha: Grada. ISBN 978-80-27116-904.

TELUK, T. (2002). *E-biznes. Nowa gospodarka*. Gliwice: Helion. ISBN 83-7197-844-8.

WEBBER, C. – WILDAVSKY, A. B. (1986). *A history of taxation and expenditure in the Western world*. New York: Simon and Schuster. ISBN 978-0-671-54617-5.

*Electronic resources*

EUROPEAN COMMISSION. (2020). *Retail barriers: Hindering the single market for consumers and businesses*. Luxembourg: Publications Office of the European Union.

OECD. (2019). *Unpacking e-commerce: Business models, trends and policies*. Paris: OECD Publishing. DOI: 10.1787/23561431.

OECD. (2023). *Consumption tax trends 2023: VAT/GST and excise, core design features and trends* [online]. Paris: OECD Publishing. Dostupné na: https://www.oecd-ilibrary.org [cit. 15. 2. 2025].

UNCTAD. (2021). *Digital economy report 2021: Cross-border data flows and development*. New York: United Nations Publications.

ENACHE, C. (2003). *VAT rates in Europe* [online]. Dostupné na: https://taxfoundation.org/data/all/eu/value-added-tax-2024-vat-rates-in-europe/ [cit. 7. 1. 2026].

FINANČNÉ RIADITEĽSTVO SR. (2023). *Elektronické formuláre* [online]. Dostupné na: https://www.financnasprava.sk/sk/elektronicke-sluzby/verejne-sluzby/katalog-danovych-a-colnych/katalog-formularov [cit. 15. 1. 2026].

GYMBEAM s. r. o. (2023). *Najčastejšie otázky* [online]. Dostupné na: https://gymbeam.sk/najcastejsie-otazky [cit. 1. 6. 2025].

KOMMERSKOLLEGIUM. (2012). *E-commerce – New opportunities, new barriers* [online]. Dostupné na: https://lnk.sk/rkx6 [cit. 11. 4. 2024].

KRAKÓWSKA, M. (2012). *E-business – genesis of electronic business* [online]. Dostupné na: http://www.heuristic.pl/blog/e-biznes/159.html [cit. 1. 5. 2025].

PAWELOSZEK – KOREK, I. (2014). *Electronic commerce and business* [online]. Dostupné na: http://www.paweloszek.republika.pl/ecommerce.html [cit. 15. 2. 2025].

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# NORMATÍVNE TEÓRIE ROZHODOVANIA A HODNOTOVO ORIENTOVANÝ PRÍSTUP K CENOTVORBE

*Roman Žlebek – Katarína Remeňová*

***Abstract***
Aj keď sa na prvý pohľad môže zdať že hodnotovo orientované rozhodovanie z pohľadu zákazníka je motivované a ovplyvňované vnútornými myšlienkovými procesmi jednotlivca, určitej skupiny spotrebiteľov či trhového segmentu, čo dokazujú iracionality v nákupnom správaní spotrebiteľov, a teda je takmer nemožné ho popísať normatívnym spôsobom, vykonané štúdie v tejto oblasti naznačujú prekvapivý opak. Podľa výskumov prevedených v uplynulých rokoch sa ukazuje, že existuje prienik v pohľade na rozhodovanie podľa behaviorálnej ekonómie, ktorej súčasťou je aj hodnotovo orientovaný prístup, a normatívnymi teóriami rozhodovania. Preto sme sa rozhodli v tomto príspevku stručne popísať identifikované normatívne teórie a vyhodnotiť ich aplikáciu špecificky pri hodnotovo orientovanom pohľade. Následne sme identifikovali ďalšie možné oblasti pokračovania výskumu v tejto oblasti.

***JEL classification:*** *D91, G41, M21*
***Keywords:*** *normatívne teórie rozhodovania, behaviorálna ekonómia, hodnotovo orientovaná cenotvorba*

## Úvod

Mnohí autori sa zhodujú na rozdelení prístupov k cenotvorbe na nákladovo-orientované, konkurenčne-orientované a hodnotovo-orientované. (Calabese & Francesco, 2014; Raju & Zhang, 2010) Normatívne pravidlá nasvedčujú, že z pomedzi týchto troch prístupov je najvhodnejším prístup orientovaný na hodnotu vnímanú zákazníkom, pretože tento jediný berie do úvahy perspektívu zákazníka pri stanovení ceny. (Guierreiro & Amaral, 2018) Taktiež napriek tomu, že existuje široký konsenzus vo vedeckej aj profesionálnej obci že rozhodovanie na základe hodnoty vnímanej zákazníkom a jeho ochoty platiť je prístupom ktorý dokáže najviac ovplyvniť ako výkonnosť podnikov tak aj spokojnosť zákazníkov, iba 17-20% podnikov tvrdí, že zaviedli hodnotovo-orientovanú cenotvorbu. (Lizou, 2017)

Štúdie vykonané výskumníkmi v oblasti rozhodovania pri cenotvorbe preukázali rozdiely pri aplikácii v teórii a praxi. (Guierreiro & Amaral, 2018) Podniky stále aj napriek zjavným benefitom preferujú cenotvorbu na základe nákladov alebo cien konkurencie. (Ingelbleek, 2007) Vychádza to z existencie náročných prekážok pri implementácii cenotvorby orientovanej na hodnotu vnímanú zákazníkom ako chýbajúce potrebné zdroje, schopnosti a nástroje, komunikácia hodnoty zákazníkovi a spôsob stanovenia samotnej ceny využitím tohto prístupu. (Töytäri – Keränen – Rajala, 2017)

Nákladovo a konkurenčne orientované prístupy využívajú matematické modely na stanovenie cien, čím naznačujú že ide o normatívne teórie. Na druhej strane hodnotovo orientovaný prístup vyžaduje inklúziu správania spotrebiteľov do modelu, vrátane iracionalít, čím naznačuje prevažne aplikáciu deskriptívne orientovaných teórií. Chai a Hgai ale zvýrazňujú, že deskriptívne a normatívne teórie by sa nemali odlišovať podľa interpretácie modelov, ale podľa matematických foriem a modelov ktoré využívajú. (2020).

Z tohto dôvodu, keďže hodnotovo orientované prístupy nasvedčujú že by mali viac využívať deskriptívne pohľady a teórie na rozhodovanie, sme sa rozhodli skúmať v tomto článku práve opačnú stranu, a to prienik normatívnych prístupov a hodnotovo orientovanom prístupe k rozhodovaniu spotrebiteľov.

## 1 Súčasný stav riešenej problematiky

Po dlhé roky bol proces rozhodovania zákazníkov skúmaný z normatívneho pohľadu využívajúc silné predpoklady a axiomatizované systémy. Ak tieto boli naplnené, preferencie zákazníkov mohli byť popísané kvantitatívne a merané ako hodnoty funkcií užitočnosti, ktoré racionálne viedli zákazníkov pri rozhodovaní (Chai a kol., 2021)

Výskumníci z dátovej vedy, počítačovej vedy a informačných systémov často rozumeli pod zatrieďovaním a klasifikáciou správanie sa systému a strojov, čím podčiarkovali normatívne klasické teórie užitočnosti a preferencií. Avšak tieto, ako ukazujú výskumy z praxe, neodpovedajú skutočnému správaniu sa zákazníkov. (Chai a kol., 2021)

Podľa množstva empirických dôkazov a štúdií nie je vhodným prístupom fixovať sa na maximalizáciu užitočnosti pre zákazníka ako základ ekonomickej teórie racionality, keďže správanie spotrebiteľov je výrazne odlišné od tejto teórie (De Clippel-Rozen, 2021). Je nutné sledovať ako zákazníci reagujú na zmeny v makroprostredí, ako sa bežne správajú v realite, a do akej miery ich voľba spätne ovplyvňuje makroprostredie. Do úvahy pri tomto rozhodovaní mali byť brané psychológia, sociológia a behaviorálna ekonómia. (Shaikh, 2012).

Behaviorálna ekonómia vzišla z kombinácie vedy v oblasti rozhodovania, manažmentu, ekonómie, financií, aplikovanej psychológie a počítačovej vedy ako oblasť s cieľom viať do úvahy aj behaviorálne aspekty pri rozhodovaní, a tak presnejšie opísať dianie v skutočnej praxi. (Chai & Nhai, 2020).

## 2 Výskumný dizajn a metodológia

Cieľom tohto článku je preskúmať prepojenie a využiteľnosť normatívnych teórií rozhodovania a hodnotovo orientovaného prístupu podľa dostupnej literatúry a výskumu, a následná identifikácia konkrétnych oblastí ďalšieho možného výskumu v rámci tohto prepojenia.

Výskumnými otázkami boli:

1. Aké sú najčastejšie využívané normatívne prístupy v rozhodovacom procese podľa dostupnej literatúry a výskumu?
2. Existuje prepojenie a využitie normatívnych prístupov a hodnotovo orientovaného prístupu podľa súčasného výskumu?

Objektom skúmania teda boli vedecké články a state v databáze Web of Science.

Na identifikáciu výskumných zdrojov k prieniku normatívnych teórií a hodnotovo orientovaného sme využili vyhľadávanie výraz „normative and descriptive decision-making“, ku ktorým bolo v databáze nájdených 519 príspevkov. Následne sme pridali kritérium, že má ísť o príspevky nie staršie ako z roku 2010, a má ísť iba o vedecké články a prehľadové vedecké články. Takto získaný počet výsledkov bol 308. Ďalším krokom bol výber aplikovateľnej oblasti článkov – zvolili sme Business, Business Finance, Behavioral Sciences, Psychology a Applied Psychology. Z tohto výberu bol výsledný počet článkov 49. Keďže cieľom tohto článku je posúdenie prepojenie hodnotovo orientovaného prístupu a normatívnych teórií, vyselektovali sme iba články, ktoré boli relevantné k danej téme, pričom týchto článkov bolo 8.

Následne sme pomocou logickej syntézy sme zhrnuli zistený stav literatúry, vyhodnotili prepojenie najčastejšie využívaných normatívnych teórií rozhodovania a hodnotovo orientovaného prístupu, a identifikovali možné oblasti ďalšieho výskumu prieniku skúmaných oblastí.

## 3 Výsledky skúmania a diskusia

Z preskúmanej literatúry sme zistili, že autori uvádzajú ako najčastejšie využívané normatívne teórie klasickú teóriu užitočnosti a preferencií, subjektívnu očakávanú užitočnosť a teórie využívajúce tieto ako základ, pričom k nim pridávajú postuláty, ktorých úlohou je odstrániť nedostatky základných teórií očakávanej užitočnosti.

Klasická teória užitočnosti usudzuje objektívnu racionalitu spotrebiteľov, a teda že pravdepodobnosti a užitočnosť možných alternatív je rovnaká pre všetkých spotrebiteľov, a že tieto pravdepodobnosti sú známe – ide o rozhodnutia pod vplyvom rizika. (Hay a kol., 2010) Savage neskôr rozšíril túto teóriu a sformuloval Teóriu Subjektívnej očakávanej užitočnosti ktorá nahrádza objektívnu známu pravdepodobnosť subjektívnymi pravdepodobnosťami spotrebiteľov, ktoré ani nemusia byť v čase rozhodovania známe – prechod z rozhodovania pod vplyvom rizika na rozhodovanie v stave neurčitosti. (Chai a kol., 2021)

Teóriami doplňujúcimi postuláty sú nasledovné:

1. MaxMin – rozhodovateľ vždy usudzuje že, nastane najhoršia možná situácia, a teda volí kombináciu, ktorá mu prinesie najvyššiu možnú užitočnosť pri najhoršom možnom výstupe. Teda usudzuje, že prirodzený stav rozhodovacej situácie je proti nemu,
2. MaxMax – opak MaxMin - rozhodovateľ vždy usudzuje, že nastane najlepšia možná situácia, a teda volí kombináciu, ktorá mu prinesie najvyššiu možnú

užitočnosť pri najlepšom možnom výstupe. Teda usudzuje, že prirodzený stav rozhodovacej situácie je v jeho prospech,

3. MinMax Regret – rozhodovateľ sa sústredí na minimalizáciu straty pri voľbe zlého rozhodnutia, teda volí takú kombináciu, pri ktorej dochádza k minimalizácii maximálnej straty,
4. Alpha Model – aj keď rozhodovateľ nepozná presné pravdepodobnosti pre jednotlivé kombinácie, verí že ležia na nejakom kompaktnom konvexnom sete, a tak robí rozhodnutia na báze váženého priemeru minimálnej a maximálnej očakávanej užitočnosti na tomto sete.

Chai a kol. sa vo svojom výskume venovali prepojeniu normatívnych a deskriptívnych teórií, a tak vzniku skupiny tzv. "preskriptívnych" teórií, ktoré by poskytli racionálne a praktické odporúčania pre rozhodovateľov. Obsahujú normatívne princípy, ako aj správanie spotrebiteľov, a tak vytvárajú most medzi dvoma skupinami prístupov, čím podporujú teoretický rozvoj behaviorálneho rozhodovania. Autori prepojili ako normatívne tak aj deskriptívne teórie s behaviorálnym rozhodovaním, čím potvrdili, keďže hodnotovo orientovaný prístup je vysoko závislý na často iracionálnom (resp. obmedzene racionálnom) správaní spotrebiteľa a teda je súčasťou behaviorálneho rozhodovania, že existuje prepojenie medzi normatívnymi teóriami a hodnotovo orientovaným rozhodovaním spotrebiteľa. (2021)

Pre kategorizáciu a vizualizáciu výstupov analýzy sme využili aj kritérium pozitivity prístupu ktoré posudzuje, či rozhodovateľ usudzuje že prirodzený stav rozhodovacej situácie je v jeho prospech alebo neprospech, a teda či sa sústredí na pozitívne výstupy alebo negatívne, resp. maximalizáciu negatívnych výstupov. Optimistický prístup sa teda sústredí na pozitívne výstupy, a analogicky pesimistický na negatívne výstupy.

V prípade klasickej teórie užitočnosti narážame na problém, a tým je nutnosť znalosti objektívnych pravdepodobností kombinácií všetkých možných volieb užitočnosti, ktorú nie je možné dosiahnuť vzhľadom na prirodzenosť hodnotovo orientovaného prístupu, a to teda že hodnota jednotlivých možností je pre každého spotrebiteľa, skupinu spotrebiteľov, či segment, subjektívna, a teda rozdielna. Z pohľadu pozitivity teórie ide o optimistický prístup.

Teória subjektívnej očakávanej užitočnosti tento nedostatok klasickej teórie odstraňuje nahradením objektívnych známych pravdepodobností realizácie kombinácií subjektívnymi pravdepodobnosťami spotrebiteľov. Následne je potrebné nahradiť užitočnosť hodnotou vnímanou zákazníkmi alebo určitou skupinou zákazníkov, a tak dosiahnuť kardinálne (konkrétne hodnoty) alebo ordinálne (zoradené preferencie) vyjadrenie rozhodnutia spotrebiteľa. Týmto spôsobom dosiahnuť prepojenie teórie subjektívnej očakávanej užitočnosti a hodnotovo orientovaného prístupu z pohľadu zákazníka. Keďže táto teória sa sústredí na maximalizáciu výstupov, ide o optimisticky orientovaný pohľad.

Doplnením postulátu MaxMin k subjektívnej teórii užitočnosti pozorujeme, že v jej priamej forme nie je priamo využiteľná pri hodnotovo orientovanom prístupe k rozhodovaniu, a to teda ak by sme za užitočnosť považovali ekonomické benefity pre

spotrebiteľa, avšak v prípade že by sme šli hlbšie, a teda prihliadali na to, že hlavne behaviorálne a iracionálne rozhodnutia spôsobujú prekážky v stanovení hodnotovo orientovanej ceny z pohľadu zákazníka, tak nahradením ekonomických benefitov všetkými benefitmi, ktoré spotrebiteľ získava, a to ako hmotnými tak aj nehmotnými, dosiahneme jednoznačné prepojenie teórie rozšírenej o tento postulát a hodnotovo orientovaného rozhodovania spotrebiteľov. Pozornosť zameraná na maximalizáciu užitočnosti pri najhoršom možnom výstupe naznačuje pesimistický prístup.

Predpoklad MaxMax nasleduje rovnakú logiku ako MaxMin, pričom jediný rozdiel je, že sa sústredí na pozitívny prístup – dosiahnutie čo najvyššej možnej užitočnosti pri najlepšom možnom výstupe, a teda je možné uplatniť rovnakú argumentáciu prepojenia teórie s hodnotovo orientovaným zameraním ako pri dodatočnej podmienke MaxMin. Z dôvodu špecifického rozdielu tohto predpokladu oproti MaxMin predpokladu vieme jednoznačne usúdiť, že sa jedná o optimisticky orientovaný predpoklad.

Ak dôjde korekciou subjektívnej teórie užitočnosti pridaním postulátu MinMax Regret k zameraniu sa na minimalizáciu maximálnej straty z nesprávnej voľby, je možné usúdiť, že existujú subjektívne pravdepodobnosti z pohľadu rozhodovateľa, a že rozhodovateľ pozná buďto pravdepodobnosti jednotlivých možností a hodnotu ktorú získa z jednotlivých kombinácií možností, alebo ich vie ordinálne zoradiť. Z toho vyplýva, že pridaním tejto podmienky nenastáva konflikt k hodnotovo orientovaným prístupom, je iba potrebné upraviť definíciu užitočnosti tak, aby brala do úvahy hodnotu vnímanú zákazníkom.

Model Alpha, pri ktorom rozhodovateľ prikladá váhy minimálnej a maximálnej očakávanej užitočnosti, ktorú vieme nahradiť hodnotou vnímanou zákazníkom, je vo svojej podstate kombináciou MaxMin a MaxMax prístupov, a to tak, že ak je pridelená váha minimálnej užitočnosti 1 a teda maximálne užitočnosti 0, dochádza k redukcii modelu Alpha na model MaxMin, a ak je pridelená váza minimálnej užitočnosti 0 a maximálnej 1, stáva sa tento model modelom MaxMax. Indukciou teda vieme vyhodnotiť, že ak prístupy MaxMin a MaxMax sú v súlade s hodnotovo orientovaným prístupom, tak aj model Alpha musí byť. Z pohľadu pozitivity tohto modelu, keďže sa sústredí ako na pozitívne tak aj na negatívne výstupy a nedá sa jednoznačne povedať, že prirodzený stav rozhodovacej situácie je v prospech alebo neprospech rozhodovateľa, kategorizovali sme tento prístup ako neutrálny.

Dané zistenia sú zhrnuté v nasledujúcej tabuľke.

**Tabuľka 1**
Kategorizácia skúmaných modelov na využitie umelej inteligencie pri cenotvorbe

| Normatívna teória | Pozitivita prístupu | Súlad s hodnotovo orientovaným prístupom |
|---|---|---|
| Klasická teória užitočnosti | Optimistický | Nie, kvôli potrebe objektívnych pravdepodobností |
| Subjektívna očakávaná užitočnosť | Optimistický | Čiastočne, a teda ak dôjde k úprave definícii užitočnosti |
| MaxMin | Pesimistický | Čiastočne, a teda ak dôjde k úprave definícii užitočnosti |
| MaxMax | Optimistický | Čiastočne, a teda ak dôjde k úprave definícii užitočnosti |
| MinMax Regret | Pesimistický | Čiastočne, a teda ak dôjde k úprave definícii užitočnosti |
| Alpha Model | Neutrálny | Čiastočne, a teda ak dôjde k úprave definícii užitočnosti |

*Zdroj: Vlastné spracovanie*

## Záver

Hoci striktnosť normatívnych teórií rozhodovania sa môže javiť že je v priamom rozpore s hodnotovo orientovaným prístupom, ktorý je založený na princípoch behaviorálnej ekonómie, preskúmaním literatúry a súčasného výskumu sa nám podarilo zistiť, že to tak nie je.

Bežne využívané normatívne metódy, a to klasická teóriu užitočnosti a preferencií, subjektívna očakávaná užitočnosť a teórie využívajúce tieto ako základ, pričom k nim pridávajú postuláty, ktorých úlohou je odstrániť nedostatky základných teórií očakávanej užitočnosti, je možné len mierne upraviť, s výnimkou klasickej teórie užitočnosti, a prijať novú definíciu užitočnosti, a prepojenie bude dosiahnuté.

Ako vhodnú novú definíciu užitočnosti navrhujeme: „Užitočnosť predstavuje súhrn všetkých vnímaných jednoznačných ako aj skrytých benefitov, ktoré môže spotrebiteľ získať alebo očakávať že ich získa, a má maximalizovanú hodnotu stanovenú na základe dostupných informácií v čase rozhodovania.“

Tento výskum má svoje limitácie, keďže vzhľadom na charakter skúmania bola zvolená forma selekcie relevantných zdrojov, ktorá nezahrňovala všetku dostupnú literatúru v sledovanej oblasti, a teda nešlo o kompletnú systematickú literárnu rešerš, čo mohlo spôsobiť, že neboli preskúmané všetky teórie, pri ktorých môže existovať prienik s hodnotovo orientovaným prístupom.

Možnou oblasťou ďalšieho výskumu sa javí preskúmanie komplexného prieniku normatívnych, deskriptívnych a preskriptívnych metód a teórií rozhodovania s hodnotovo orientovaným pohľadom na rozhodovanie spotrebiteľa, a tak identifikácie možných metód a nástrojov na zjednodušenie implementácie hodnotovo orientovaného rozhodovania.

**Poznámka o riešenom projekte**

Tento príspevok je súčasťou výskumu pod projektom VEGA č. 1/0110/24 Výskum akcelerovanej digitalizácie v malých podnikoch s dôrazom na udržateľný rozvoj vzťahov so zákazníkmi.

**Použitá literatúra (References)**

Calabrese, A., & De Francesco, F. (2014). A pricing approach for service companies: service blueprint as a tool of demand-based pricing. *Business Process Management Journal*, *20*(6), 906-921.

De Clippel, G., & Rozen, K. (2021). Bounded rationality and limited data sets. *Theoretical Economics*, *16*(2), 359-380.

Elqayam, S., & Evans, J. S. B. (2011). Subtracting "ought" from "is": Descriptivism versus normativism in the study of human thinking. *Behavioral and Brain Sciences*, *34*(5), 233-248.

Guerreiro, R., & Amaral, J. V. (2018). Cost-based price and value-based price: are they conflicting approaches?. Journal of Business & Industrial Marketing, 33(3), 390-404.

Hey, J. D., Lotito, G., & Maffioletti, A. (2010). The descriptive and predictive adequacy of theories of decision making under uncertainty/ambiguity. *Journal of risk and uncertainty*, *41*(2), 81-111.

Chai, J., & Ngai, E. W. (2020). Decision-making techniques in supplier selection: Recent accomplishments and what lies ahead. *Expert Systems with Applications*, *140*, 112903.

Chai, J., Weng, Z., & Liu, W. (2021). Behavioral decision making in normative and descriptive views: A critical review of literature. *Journal of Risk and Financial Management*, *14*(10), 490.

Ingenbleek, P. (2007). Value-informed pricing in its organizational context: literature review, conceptual framework, and directions for future research. *Journal of Product & Brand Management*, *16*(7), 441-458.

Liozu, S. M. (2017). State of value-based-pricing survey: Perceptions, challenges, and impact. *Journal of Revenue and Pricing Management*, *16*(1), 18-29.

Raju, J., & Zhang, Z. (2010). *Smart pricing: How Google, Priceline, and leading businesses use pricing innovation for profitability*. Pearson Prentice Hall.

Shaikh, A. (2012). Rethinking microeconomics: A proposed reconstruction. *The New School Economics Department Working Paper*, *6*, 2012.

Töytäri, P., Keränen, J., & Rajala, R. (2017). Barriers to implementing value-based pricing in industrial markets: A micro-foundations perspective. Journal of Business Research, 76, 237-246.

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# Project overview

## Futurepreneurs and SMEs for a sustainable Central Europe | Certification Scheme

Futurepreneurs are professionals that are driven by purpose and impact. They take on societal challenges and climate change with an entrepreneurial mindset and want to improve our lives. The GREENPACT project sets up partnerships between companies and futurepreneurs. The aim is to develop a certification scheme for a new generation of impact-driven top executives. To this end, the project develops joint action plans, pilot actions and a self-assessment tool.

**1,78** m € Project Budget

80% of the Budget is funded by ERDF

**5** Countries

**6** Regions

**9** Partners

**1** Pilots

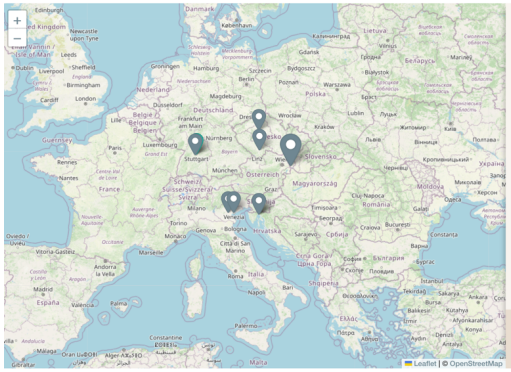
## Duration

| | |
|---|---|
| Start date | 04.2023 |
| End date | 03.2026 |

**Project progress**

20%

## Project partnership




Project partner

**University of Economics in Bratislava**

Faculty of Business management

Address
Dolnozemská cesta 1
85235 Bratislava

Country
Slovakia (SK)

Web
www.euba.sk

Total partner budget
207 200 €

## Project partners

Lead partner

**Stuttgart Media University**

Startup Center

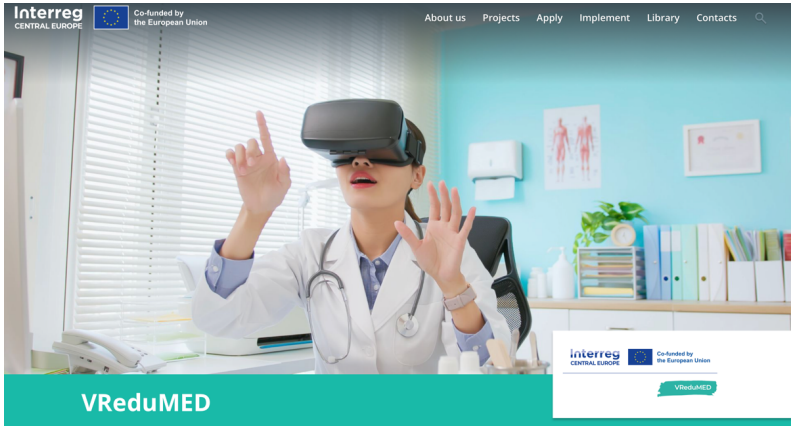
Address
Nobelstr. 10
740569 Stuttgart

Country
Germany (DE)

Web
https://www.hdm-stuttgart.de/en

Project partner

- Stuttgart Region Economic Development Corporation
- ENAIP Veneto Social Enterprise
- Region of Veneto - Department of Labour
- STEP RI Science and Technology Park of the University of Rijeka Ltd
- City of Rijeka
- Czech Chamber of Commerce
- Institute of Technology and Business in České Budějovice
- University of Economics in Bratislava




## Project partners

Lead partner

**South Bohemian Science and Technology Park, corp.**

---

Address
Lipová 1789/9
37005 České Budějovice

Country
Czechia (CZ)

Web
www.jvtp.cz

Project partner

- **University of South Bohemia in České Budějovice**
- **Business Upper Austria**
- **Education Group**
- **University of Economics in Bratislava**
- **National Institute of Children's Diseases**
- **Strategic Partnership for Sensor Technologies**
- **Ostbayerische Technische Hochschule Regensburg**
- **Innoskart Business Development Nonprofit Ltd.**
- **Széchenyi István University**

## Project overview

### Virtual Reality Education and Training Solutions for Medicine Sector

Medical interventions are increasingly digitalised but training of health care staff is still lagging behind. The VReduMED project helps to untap the potential of virtual and augmented reality for their education. The partnership develops a roadmap for virtual reality training products and services and will publish a handbook on the integratoon of virtual reality into health care education. They also set up three regional virtual reality labs to test different virtual reality use cases.

**2,20** m €
Project Budget

**80%**
of the Budget is funded by ERDF

**5**
Countries

**6**
Regions

**10**
Partners

**3**
Pilots

## Duration

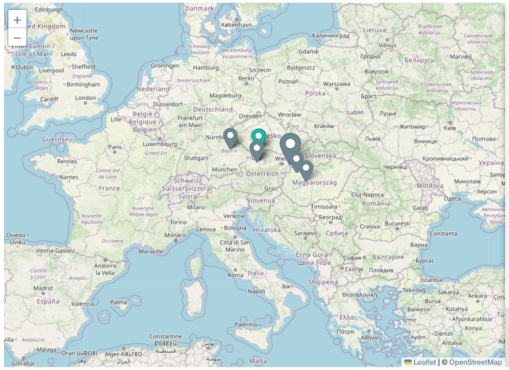
Start date **04.2023**

End date **03.2026**

**Project progress**

20%

## Project partnership




Project partner

**University of Economics in Bratislava**

**Faculty of Business Management**

Address
Dolnozemská cesta 1/A
852 35 Bratislava

Country
Slovakia (SK)

Web
www.euba.sk

Total partner budget
**220 900 €**

Interreg Danube Region

Co-funded by the European Union

SReST

## Project overview

**Start date:** 01 January 2024

**Status: ongoing**

**End date:** 30 June 2026

**€1,540,470** budget

**80.00 %** funded by Interreg Funds

**7** countries

**10** partners

SOCIALLY RESPONSIBLE SLOW FOOD TOURISM IN THE DANUBE REGION

**The main objective of the SReST project is to promote "slow food" tourism in the Danube region and enhance the employability of vulnerable groups by providing solutions that enable the valorisation of agrobiodiversity and gastronomic heritage and a fair distribution of generated benefits, including the well-being of the host communities.**

By focusing on agro-biodiversity, food heritage and local identity, the goal is to broaden the socially responsible sustainable tourism offer and promote "slow food" tourism based on the exploration of gastronomic traditions and the local communities that preserve them. The project will help enhance local agricultural high-value chains while appreciating natural and cultural diversity of partner regions.

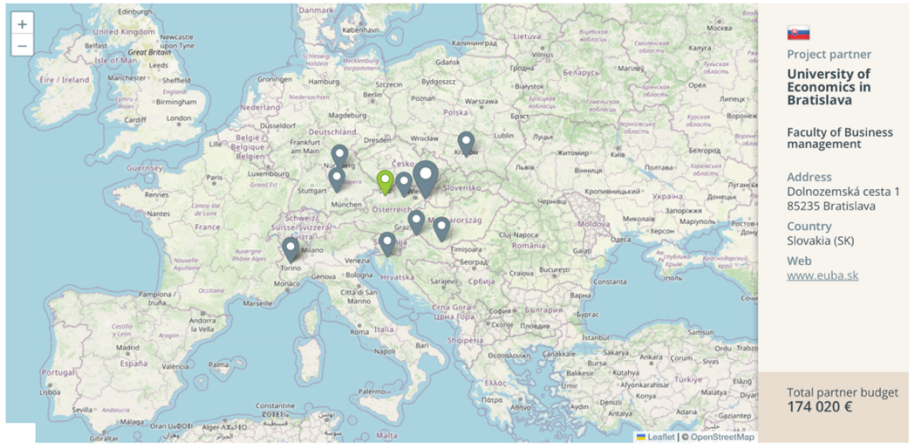
SReST will develop joint solutions to enhance socio-economic development and promote alternative models and competitive new tourism products of "slow food" itineraries grounded in agrobiodiversity and food heritage, tested in different territorial contexts of pilot regions. These solutions will not be limited to the local level, but will have a wider impact in the Danube area. Therefore, the success of the project will be based on close cooperation between partners from different countries and regions. You can learn more about the project partners here.


## Duration

Start date **06.2024**

End date **11.2026**

## Project partnership




Project partner

**University of Economics in Bratislava**

**Faculty of Business management**

Address
Dolnozemská cesta 1
85235 Bratislava

Country
Slovakia (SK)

Web
www.euba.sk

Total partner budget
174 020 €

## Project partners

Lead partner

**Business Upper Austria**

Mechatronics Cluster + Circular Economy Team @ Plastics Cluster

Address
Hafenstraße 47-51
4020 Linz

Country
Austria (AT)

Web
https://www.biz-up.at

Project partner

- **ConPlusUltra Ltd**
- **University of Economics in Bratislava**
- **Chamber of Commerce and Industry of Pécs- Baranya**
- **South Poland Cleantech Cluster Ltd.**
- **STEP RI science and technology park of the University of Rijeka Ltd.**
- **Development and Training Centre for the Metal Industry – Metal Centre Čakovec**
- **MESAP Innovation Cluster**
- **Science and Technology Park - Envipark**
- **Bayern Innovativ**
- **Cluster of Environmental Technologies Bavaria**

## **Project** overview

### Circular design and development of Sustainable products in 4 key sectors in Central Europe

The ongoing transition to a circular economy is not only a tedious obligation for the manufacturing industry. It also offers an opportunity to develop innovative sustainable products. The CURIOST project helps small- and medium-sized companies in sectors like mechanics, packaging, plastics, and construction to harvest the potential benefits. They help selected companies to co-develop tailor-made, innovative, sustainable and circular product prototypes. The learnings are then aggregated into a universal strategy and action plans to accelerate the green transition in the manufacturing industry.

**1,90** m €
Project Budget

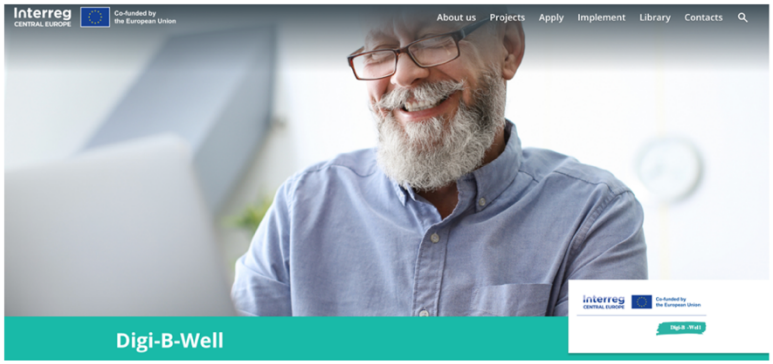
**80%**
of the Budget is funded by ERDF

**7**
Countries

**10**
Regions

**11**
Partners

**1**
Pilots

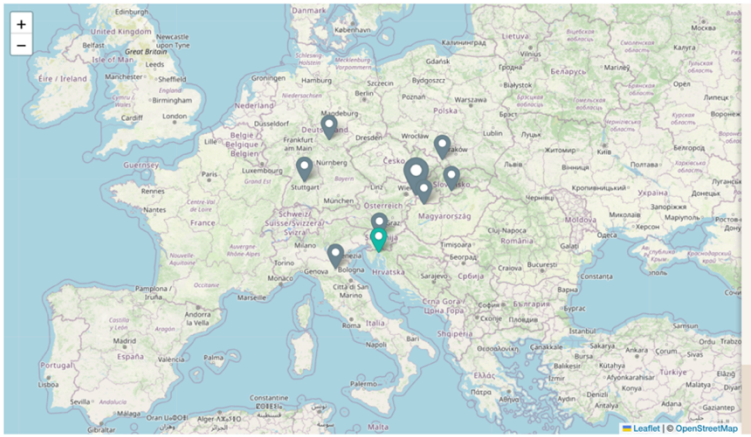



## Duration

Start date **06.2024**

End date **05.2027**

## Project partnership




Project partner

**University of Economics in Bratislava**

Faculty of Business Management

Address
Dolnozemská cesta 1/B
85235 Bratislava

Country
Slovakia (SK)

Web
fpm.euba.sk

Total partner budget
**286 428,83 €**

## Project partners

Lead partner

**Primorje-Gorski Kotar County**

Administrative Department for Regional Development, Infrastructure and Project Management

Address
Adamićeva 10
51000 Rijeka

Country
Croatia (HR)

Web
www.pgz.hr

| Project partner |
|---|
| **Alma Mater Studiorum - University of Bologna** |
| **Technical University Ilmenau** |
| **bwcon** |
| **Chamber of Commerce and Industry of Slovenia** |
| **Pannon Business Network Association** |
| **University of Economics in Bratislava** |
| **Regional Development Agency in Bielsko-Biała** |
| **City Lucenec** |

## **Project** overview

**Enhancement of capacities of SMEs, public authorities and academia for digitalisation, digital era-fit management and achievement of digital well-being.**

The digital transformation offers new opportunities for companies but also increases complexity. Especially employees over 55 can suffer from digital stress or burnout at the workplace. The Digi-B-Well project helps companies to transform and make employees fit for the digital age. The partners upskill competences of managers, public authorities, and academia to better prevent digital stress and burnout. They develop and test new tools to self-assess digital maturity and digital transformation models in companies. In addition, a digitalisation strategy and action plans ensure the uptake of their innovative solutions into broader policy and business practices.

**2,19** m €
Project Budget

**80%**
of the Budget is funded by ERDF

**7** Countries

**9** Regions

**9** Partners

**1** Pilots


Interreg Danube Region

Co-funded by the European Union

PATHS

# Our Solution

PATHS introduces the **Life Path Support Service (LPSS)** model – a new approach to career guidance that is local, inclusive, and tailored to the individual.

Instead of one-size-fits-all programs, LPSS offers:

- Free, accessible services in small municipalities
- Career workshops, camps, and internships rooted in **self-awareness**
- Trained local **mentors** who provide personal guidance and support
- A long-term strategy for sustainable regional development

This model is being piloted in communities across Hungary, Slovakia, Czech Republic, Romania, Croatia, and Bosnia & Herzegovina – with expert support from Austria and Slovenia.

## Project overview

**Start date:** 01 April 2025

**Status: ongoing**

**End date:** 31 March 2028

**€2,516,726** budget

**80.00 %** funded by Interreg Funds

**9** countries

**13** partners

Interreg Europe

Co-funded by the European Union

PERSIST

## What did this project achieve?

This project will:

- **Strengthen regions' ability** to deliver smart specialisation in a sustainable way.
- **Develop and test new methods** to move from the Entrepreneurial Discovery Process to the Ongoing Discovery Process.
- **Improve cooperation** between authorities, businesses and researchers.
- **Enable inclusive decisions** and make better use of regional resources.
- **Boost innovation capacity** and strengthen regional competitiveness.
- **Create stronger ecosystems** and new opportunities that benefit both the economy and society.

### A few numbers

1,793,584 € budget

01 May 2025-31 Jul 2029

12 partners

# Project summary

Across Europe, regions face similar challenges. How can we build **innovation systems that endure** – systems that meet today's needs while paving the way for a **sustainable future**, **economically**, **socially**, and **environmentally**?

This project helps **regional authorities and agencies** strengthen **long-term cooperation** around smart specialisation.

Through **practical frameworks and tools**, it supports regions in creating **strong, inclusive networks** with **lasting commitment** from key actors.

The project builds on engagement through the **Entrepreneurial Discovery Process** and other **participatory methods**. This ensures that collaboration is rooted in **real regional needs and ambitions**.

## Who we are

Persist brings together nine partners from across Europe – regions, universities, and development agencies working together for smarter, more sustainable regional growth.

- **Region Jönköping County** (Sweden)
- **Podkarpackie Region** (Poland)
- **Regional Development Agency of Khmelnytskyi oblast** (Ukraine)
- **University of Economics in Bratislava** (Slovakia)
- **Ústí Region** (Czech Republic)
- **Regional Management Northern Hessen** (Germany)
- **University of Groningen** (Netherlands)
- **Business Innovation Center of Cartagena** (Spain)
- **Udhëtim i Lirë** (Albania)

Together, we share knowledge, test new ideas, and build long-term cooperation to strengthen smart specialisation across Europe.

Interreg Europe

Co-funded by the European Union

ForYouth

## A few numbers

1,617,350 € budget

01 May 2025-31 Jul 2029

9 partners

# Project summary

**Youth involvement** is essential in all policy areas that affect their lives, as highlighted in the **EU Youth Strategy 2019–2027**. The project aims to develop **mechanisms and instruments** tailored to young people's needs, supporting the strengthening of their **voice in decision-making**, promoting effective use of resources, and fostering **cross-sector collaboration**.

The project's **innovative character** stems both from its **topic** and the **partnership structure**. The topic is highly relevant, as the gap between **urban strategies** and **youth interests** remains visible in the targeted regions. The partnership unites territories with contrasting demographic realities: some face **low birth rates** and an **ageing population**, while others stand out for having a **large youth population**, which is uncommon in many European areas.

The **overall objective** is to improve policies that enable **active youth participation** in community life and decision-making processes. The project seeks to create an environment where young people feel **valued, empowered, and motivated** to contribute to **societal progress and development**.

This objective will be achieved by:

- **Removing barriers and administrative blockages** that prevent young people from feeling appreciated;
- Encouraging them to **remain in or return to their birthplaces** and engage actively in their communities;
- **Engaging key stakeholders** (public institutions, NGOs, education, and private sector);
- **Transferring knowledge and good practices** from advanced regions to those with fewer youth-oriented solutions;
- Developing **tools and mechanisms** based on the gathered experiences;
- Promoting **social inclusion**, with a focus on **young emigrants** and the **youth diaspora**.

The project will be implemented within the framework of **territorial cooperation** among partner regions, through the **exchange of good practices and experiences** on youth participation.