

SLOVAK SMES FACING NEW CHALLENGES (WITH AN EMPHASIS ON THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE)

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Abstract

Today's small and medium-sized enterprises (SMEs) face many challenges associated with the implementation of artificial intelligence (AI), which offers a wide range of opportunities to improve efficiency, competitiveness and sustainability. Currently, there are a number of diverse factors affecting the operations of SMEs in Slovakia, and these factors can be divided into general ones, which affect SMEs regardless of the sector in which they operate, and specific ones, which take into account sector specificities. In the context of AI implementation, these factors are determined by the state of knowledge, the sector of AI implementation and the relationships of AI implementation to other environmental factors that determine the consequences. The aim of this paper is to explore the opportunities and challenges of AI implementation in Slovak SMEs, and based on the obtained information, to propose a framework for AI implementation in these enterprises. The conclusion of the article is that proper implementation of AI can help SMEs gain strategic advantage, but as it brings benefits it also brings risks that need to be faced.

Key words:

artificial intelligence, Slovak SMEs, new challenges, benefits, risks

JEL Classification O33, O39

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INTRODUCTION

The Slovak economy shows signs of low GDP growth. The decisive sector is automotive, which, with Volvo's entry into eastern Slovakia, will further emphasize the leading position of the sector. In the past, foreign investments were mainly focused on car production/manufacturing. There is an effort, expressed through investment, to develop scientific research capacities alongside regular production, as is the case with the large company Schäffler in Kysucké Nové Mesto.

The development of Slovak companies and the Slovak economy has been based primarily on foreign investments, which were considered as a source of economic growth. Currently, it is stated that this strategy of foreign investments is being exhausted due to increasing labor costs and rising energy prices. In the automotive sector is assumed an increased robotization (a decrease in demand for labor) and a reduction in the number of executive workers are expected in connection with the transition to electric vehicles. A significant decline in the number of

executive employees is anticipated in this sector in the future.

From a macroeconomic perspective, an important view on the further development of post-socialist economies is presented in an interview where B. Schmögner (former Minister of Finance of the Slovak Republic) states: "The model based on low labor costs, on a low or medium level of innovation development, on an undiversified structure, and on excessive dependence on foreign investments, which the state continues to subsidize with substantial investment incentives even after 30 years, no longer ensures convergence with the 'old' EU member states and doesn't provide guarantees for the observance of adequate social rights" (Šelestiaková, 2023). This strategic view on the macroeconomic development model doesn't explicitly mention automation (AI) as a driving factor, but AI, together with the development of education and the services sector, creates the prerequisites for economic development and the observance of social rights.

The aim of this paper is to explore the opportunities and challenges of AI implementation in Slovak SMEs, and based on

the obtained information, to propose a framework for AI implementation in these enterprises. The first part of the article focuses on a review of the existing literature regarding AI implementation. The second part describes the article's objective and the methods used for data collection and analysis. The third part presents the authors' findings, and the final part is devoted to discussion and conclusions.

LITERATURE OVERVIEW

The rapid development of technologies and the digital revolution have fundamentally transformed the way businesses operate in international trade, which leading to higher efficiency, process optimization, and improved global connectivity. However, these changes also bring new challenges, such as cybersecurity risks, concerns about data protection, and compliance issues. There is a growing need for strategic investments in digital technologies to maximize the potential of global trade and customs operations (Jaloliddin, 2023). While larger companies often incorporate digitalization initiatives into their core business strategies, SMEs frequently face challenges in implementing Industry 4.0 concepts. SMEs encounter limitations in both human and financial resources, making it difficult for them to systematically assess the possibilities of implementing Industry 4.0, which focuses primarily on the digitalization and automation of processes (Havierniková, 2023). The widespread use of artificial intelligence (AI) technologies pushes the boundaries of moral, sociological, and political questions related to human rights in new ways. AI reproduces long-standing structural problems that go beyond the regulation of individual aspects; it integrates into economic structures with cumulative negative effects and presents further challenges that require a reevaluation of the relationship between human rights, science, and technology. Issues associated with AI often stem from technical complexities, which human rights experts should be more sensitive to and engaged with (Bakiner, 2023). AI is fundamentally changing the way we think, act, and learn. It can quickly identify inefficiencies and reveal opportunities for improving productivity and sustainability across

various sectors. Proper use of AI can lead to better performance, streamlined workflows, and the elimination of inefficiencies, what allow employees to focus on critical tasks. AI has the potential to achieve sustainability goals when is implemented correctly and with an emphasis on sustainability (Haleem et al., 2023). Szumil and Wiegelmann (2024) examined the impact of AI and large language models (LLMs), such as GPT-4, on the real estate sector. Their goal was to provide a comprehensive analysis of how these technologies are transforming various aspects of the industry, including the real estate market, valuation, and customer interactions. They concluded that AI and LLMs offer several advantages, including data-driven decision-making, predictive analytics, and enhanced operational efficiency. However, they also highlighted critical challenges, such as potential algorithmic biases and the risk of depersonalizing customer service.

In the study by Chen (2024), was examined, how AI implementation and capability of big data analysis influence the operational performance in technology firms. Employees' intention to adopt AI applications is positively related to integration capabilities and team collaboration, with both integration capability and team collaboration improving operational performance. The authors concluded that employees' intention to adopt AI applications and the ability to analyze big data can effectively contribute to achieving goals associated with high operational performance. Ali Mohamad et al. (2023) explored the influence of AI on competitive advantage in healthcare organizations. In the study, they conducted nine semi-structured interviews with members of the robotic surgery team at CMC Dubai and found that the introduction of AI impacted three key areas: clinical, financial, and technological. Their research provides new insights into the use of AI in healthcare, specifically in robotic surgeries, highlighting how AI can contribute to gaining a competitive edge. Customers' willingness to co-create value is favorably facilitated by the anthropomorphism of service-oriented AI. The anthropomorphism of such AI can enhance customers' perception of the AI's cuteness and capabilities, evoke a sense of novelty, and motivate them to engage more with the AI in value co-creation (Tian et al., 2024).

The authors Liu et al. (2024) analyzed data from six major Chinese construction companies in their study. Their findings showed that current dynamic capabilities play a crucial role in the adoption and adaptation of AI for business model innovations. The authors argue that companies, professionals, and other stakeholders can begin AI implementation by leveraging their existing capabilities. In academia, increasing AI literacy is important to prepare future healthcare professionals for AI-driven environments (Esmailzadeh, 2024). Kovič et al. (2024) examined the adoption of AI software in manufacturing companies in Slovenia, Slovakia, and Croatia across six manufacturing sectors. Their results indicate that company size, role in the supply chain, or technological intensity do not have a statistically significant impact on AI utilization. On the contrary, Industry 4.0 readiness has a significant positive influence on AI adoption, suggesting that companies with advanced digital infrastructure and integrated cyber-physical systems are more likely to adopt AI. The authors concluded that while company characteristics such as size or role in the supply chain are not statistically linked to AI usage, the level of digital readiness is crucial.

Papagiannidis et al. (2023) examined the negative aspects of AI in a Norwegian energy trading company. The authors' study results indicate that the negative consequences of AI can be divided into three main categories: (1) the nature of work, (2) conflicts and their consequences, and (3) responsibility. Watch et al. (2023) also addressed the negative aspects of AI, identifying seven main threats related to generative AI: (1) lack of AI market regulation and the urgent need for regulation, (2) low quality, lack of quality control, misinformation, deepfake content, algorithmic bias, (3) automation-induced job loss, (4) violation of personal data, social surveillance, and privacy infringement, (5) social manipulation, erosion of ethics and goodwill, (6) deepening socio-economic inequalities, and (7) AI technostress. The authors suggest that it is crucial to regulate the AI market to ensure a level playing field and protect rights. They also emphasize the need for continuous education and retraining of workers due to the changing labor market and the importance of AI training. Developers should prioritize ethical aspects when creating AI

systems to protect user privacy and security, and they should implement responsible practices and ethical guidelines to prevent harmful and misleading information. While the negative aspects of AI and its impact on the work environment are becoming more frequently researched, it is equally important to pay attention to information security management, especially in the SMEs segment. In this context, Ključnikov et al. (2019) focused on identifying the success factors of information security management in Slovak SMEs. Based on literary research, they defined four key factors: alignment of information security management with business activities, top management support, implementation of security controls, and raising organizational awareness. The authors found that security controls and top management support are key elements of success and suggest that SMEs should prioritize employee training and awareness along with the implementation of robust security controls.

The utilization of AI will bring changes in many areas, including human resource management (HR). Svatiuk et al. (2022) argue that the use of AI in HR will lead to fundamental changes in performing specific functions within this field. In their study, Varma et al. (2023) indicate that there is significant potential for increasing company profitability through the use of AI in workplaces worldwide. Despite AI has many positive aspects, its application in HR raises several ethical concerns. The authors emphasize that HR managers must be responsible and sensitive to ethical issues. Their role is to closely monitor AI programs to ensure these systems perform their intended functions and protect the dignity of employees by being transparent and respecting privacy regarding the data they collect and use. Gînguță et al. (2023) also address AI has ethical challenges, highlighting that ethical concerns are closely linked to the negative consequences of AI. These include high implementation costs, the risk of job losses, or a lack of human interaction and creativity. The authors further note that AI use in business consulting negatively impacts ethical aspects such as discrimination, privacy infringement, denial of individual autonomy, unjustifiable outcomes, and the breakdown of social bonds. Quinonez and Meij (2024) explored the impact of AI on journalism and editorial processes.

Their work analyzes how AI is changing news practices, focusing on tasks like headline generation, text management, graph summarization, and creating frameworks for data. The authors point out that while AI can significantly influence journalism, it requires careful consideration and ethical approaches.

GOAL AND METHODOLOGY

The aim of this paper is to explore the opportunities and challenges of AI implementation in Slovak SMEs, and based on the obtained information, to propose a framework for AI implementation in these enterprises. To gain an overview and identify key aspects of AI implementation, we analyzed existing literary sources, professional publications, and relevant research studies. For a more detailed understanding, we examined internal documents such as company strategies, reports, and AI-related project plans. This analysis provided valuable insights into the approaches, which enterprises use in implementation of AI technologies and into their organizational practices. To complement our findings, we focused on analyzing online sources, including professional blogs, websites, and articles focused on AI implementation in enterprises. All the collected information was synthesized and interpreted to create a comprehensive view of AI implementation in Slovak SMEs. This synthesis enabled a deeper understanding of the factors influencing the success of AI implementation, its benefits, and risks.

FINDINGS

1. AI and its opportunities and risks

AI represents not only a significant source of increased efficiency but also sustainability and the development of competitiveness for Slovak SMEs. AI involves systems that exhibit intelligent behavior by analyzing their environment and performing tasks— with a certain level of autonomy—to achieve goals.

The benefits of using AI are as follows (with those known to date, and their scope expanding):

- Automation – AI can automate repetitive and rule-based tasks (Hassan, 2024). This frees humans from routine activities and allows them to focus on creative and complex tasks.
- Data analysis – AI is useful for processing and analyzing large volumes of data. It can identify trends and patterns (Skrypka, 2023).
- Personalization – AI can define content, recommendations, and marketing strategies for individual customers based on their preferences, which are derived from the analysis of previous behaviors (Šimová, 2023).
- Predictive analytics – AI can predict future developments, enabling managers to make data-driven decisions while minimizing risks (Hamilton, 2023).
- Natural Language Processing (NLP) – NLP allows chatbots and virtual assistants to communicate with people/customers, enhancing customer support and experiences. NLP-based solutions have a wide range of applications across various companies, including SMEs, and can lead to many changes (Bourdin et al., 2024).
- Image analysis – AI can analyze images to identify objects, faces, and anomalies (api4ai, 2024).
- Process optimization – AI can optimize the supply chain in SMEs, reduce costs, increase efficiency, and improve product quality (Uduma, et al., 2023).
- Theft detection – Small businesses can use AI and machine learning to enhance security. AI can detect anomalies and patterns associated with activities that lead to negative consequences for the business, helping protect against financial losses (Harrisová, 2024).
- Customer understanding – AI can provide insights into customer behavior and preferences, helping businesses create or modify products and services that are in demand (Peekage, 2024).

AI is limited as follows (its scope is also shifting, and definitive conclusions are based on the current state):

- Common sense and creativity – AI lacks the ability to think creatively. Its operations are based on patterns and data rather than intuition or imagination. The use of AI allows people time and space to focus on creativity (Business Insider, 2024).

- Ethical Decision-Making – AI lacks an ethical dimension in decision-making. It doesn't perform complex moral judgments, evaluate the social implications of proposed actions, or prioritize ethical considerations. For small and medium-sized enterprises (SMEs) entering the field of AI, understanding the ethical aspects of this technology is essential. AI ethics are based on moral principles that govern its development and use, with an emphasis on protecting personal data, addressing bias, ensuring transparency, and accountability. A key challenge is aligning AI systems with human values and societal norms (Agrawal, 2024).
- Empathy – AI doesn't understand or handle human emotions (Adib-Moghaddam, 2021).
- Contextual Understanding – AI doesn't differentiate or understand language nuances (HINZ consulting, 2023).
- Learning Beyond Data – AI builds its learning from data; the models it creates are trained on data; anything not present in the data cannot be incorporated into its models.
- Complete Autonomy – AI systems cannot yet operate without human intervention (in situations where the system or subject cannot

be specifically identified) in changing, unpredictable real-world conditions. Ünver (n.d.) emphasizes the ethical implications of high autonomy in AI and points to the need for human oversight to ensure moral responsibility and prevent the dehumanization of decision-making processes, which is particularly important for SMEs.

- Originality – AI generates recommendations based on existing data and patterns; it doesn't create entirely original ideas or innovations like a human.
- Manipulation of unstructured data: AI can effectively process structured data; unstructured data (such as unformatted text or handwritten text) can be problematic.

Currently, Chat GPT and similar technologies are used for generating artistic images, e-books, or short stories, and for selling them online. These examples demonstrate the rapid development of AI and its application in areas that were not previously anticipated. Another specific application is the use of AI in retail food sales. The involvement of AI in retail means that such a store can operate 24/7, with no need for sales staff or personnel during nighttime hours.

Fig. 1 Classification of products into defined areas

Area	Content
Communication and Learning	Q&A, sentence correction to standard English, translation between English and other languages (Spanish, Japanese), creating tables from long texts, classifying items into categories, extracting keywords from text, creating tables from various data, chatbot, extracting airport codes from text, extracting contact information from text, friendly communication, creating analogies, summarizing meeting notes, essay writing, question creation - interviews, providing basic information for a given area/problem, media broadcasting; Interactive teaching, teaching considering individual prerequisites and preferences
IT	Converting text to program commands, converting language to SQL commands, converting Python language to another, converting from one programming language to another, explaining complex parts of a program, creating SQL commands
Marketing	product description, creating a product name from a verbal description, commenting on services/food based on a restaurant description
Healthcare	disease diagnosis, radiology – image recognition
Finance	processing materials for financial decision - making
Art	creating images based on a brief, generating music compositions, writing short stories, poetry
Services	self driving cars, waste sorting services, delivery of goods
Trade	selling goods and payment
Human Resources	selecting employees for a given position based on submitted CV

Source: own processing

2. Roadmap for AI implementation in SMEs

The above examples document the current state of AI application in various spheres, part of which is/can be implemented in enterprises. If we assume that the implementation of AI in SMEs can increase their efficiency and competitiveness, then it is logical to ask about the implementation process and the different steps to be taken in the enterprise.

The issue of implementation includes the following key areas:

1. Understanding the AI issue and defining the area that will be addressed by AI tools
2. Preparing a pilot AI project, processing data, and training the model
3. Education of employees in the field of AI and the use of the outputs of the pilot project in the enterprise's activities
4. Evaluating results, measuring progress and the learning process.

Understanding the AI issue and defining the area that will be addressed by AI tools

The content of this phase is the generation of proposals that are consistent with AI capabilities and with the company's strategy. The output from AI should support business goals and be aligned with the company's strategy.

Preparing a pilot AI project, processing data, and training the model

The solution for the pilot project can involve either internal or external resources. Qualified external resources provide greater assurance of achieving business goals (assuming limited internal resources). It is essential to address the need for sufficient relevant data when working on the pilot project. The created model, which is trained on the data, should generate outputs that are subject to analysis in terms of their relevance to the expected results or decision-making processes within the business.

Education of employees in the field of AI and the use of the outputs of the pilot project in the enterprise's activities

A significant component of the entire process is education on AI issue as well as the project outputs and their significance for the enterprise.

This education begins at the start of the AI implementation project in the company. External trainers may also be involved in the education process and will later work on the model and its implementation within the enterprise. The education aims to enhance employees' know-how and simultaneously minimize distrust and concerns about the project. The outputs of the pilot project should be aligned with the enterprise's strategy and increase the efficiency of identified activities/processes.

Evaluating results, measuring progress and the learning process

Evaluating results is crucial and should be aligned with the desired KPIs when formulating the project. The results should confirm the achievement of the project's performance goals. Records are created from the evaluation of the entire process and the identification of issues related to the development and implementation of AI, which will be considered for further development in the area of AI implementation within the business. At this stage, it is recommended to establish communities that exchange national and international knowledge on AI implementation in businesses. This phase involves connecting the academic environment with the business sector. Meetings generate opportunities for further development in sectors and processes from both AI and managerial perspectives.

3. Benefits and risks of AI implemented in SMEs

AI implemented in SMEs is linked with the following benefits and risks:

- complexity and diversity of AI models,
- AI applications don't only present benefits – some professions and sectors feel threatened (e.g., the beginnings of legal disputes),
- AI applications are not limited only to simple repetitive problems/tasks; their applications extend to specific solutions, that integrate data and knowledge in the given field (corresponding with the concept of machine learning),
- AI applications are based on data and applied methods, so it is important to confront provided solutions with reality,

- AI applications represent a significant element in enhancing the competitiveness of enterprise and country; AI is becoming part of enterprise development strategies, also in connection with security; there is a widespread view of expected positive effects of AI implementation, which will show in the economy: through increased productivity, market power and employment; on the contrary, it is expected that the AI implementation in routine/repetitive fields and activities (such as industry or agriculture), where it is relatively easy to collect data and derive products from it, will lead to increased unemployment,
- although there are conclusions about the assumptions of the impact of AI on the workforce; it is noted that, in the long term, it is problematic to claim that the implementation of AI in a company will lead to a reduction in the number of employees. It is also suggested that AI will create additional jobs and professions. Overall, however, there is a consensus that the impact of AI will primarily affect repetitive, routine, and monotonous activities (Manyika and Sneider, 2018).

advantages are positively linked to the intention of SMEs to implement AI-based chatbots (Sharma, et al., 2024). Nevertheless, the adoption of AI technologies in SMEs faces significant obstacles, particularly in terms of costs, lack of technical skills, and employee willingness to embrace these technologies (Hussain and Rizwan, 2024). Agrawal, et al. (2024) also argue that the process of AI utilization and adoption in SMEs is influenced by numerous factors, including technological, organizational, and environmental aspects. AI in enterprise is a new phenomenon, which in the context of business strategy, brings both benefits and risks during its implementation. The technologies and implementation of AI are rapidly evolving, in areas such as global trade, healthcare, real estate, and other sectors; however, this also presents new challenges in cybersecurity, data protection, and ethics. AI has the potential to fundamentally change the functioning of SMEs and improve the efficiency of their operations, but this always involves the need for careful management, regulation, and education to minimize the risk of negative consequences.

DISCUSSION AND CONCLUSION

AI technologies are currently advancing and gaining greater recognition. SMEs now have access to technologies that were once available only to large corporations (Borah, et al., 2022). Perceived factors such as employee capabilities, availability of financial support, top management support, costs, complexity, and relative challenges.

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