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AI And ML In Management Accounting And Controlling: Challenges, Opportunities And Threats*

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Abstract

The aim of this article is to present the role of artificial intelligence (AI) in management accounting and controlling systems and to identify the main opportunities and threats resulting from its application. Based on a review of scientific literature and industry reports from 2018–2025, it was indicated that artificial intelligence supports process automation, financial forecasting, risk analysis and anomaly detection, contributing to increased efficiency and quality of management information. At the same time, significant threats were highlighted, such as the lack of transparency of models (the so-called "black box"), regulatory risks, implementation barriers and data quality limitations. The article concludes with recommendations for practice and an indication of research gaps requiring further exploration.

Keywords: Management accounting, controlling, artificial intelligence, machine learning (JEL: M40, G32)

Introduction

The highly dynamic political and economic situation, which results in the emergence of new risks, is one of the most important reasons for implementing and developing tools to help identify, monitor and mitigate the negative effects of risks, especially in the small and medium-sized enterprise sector, which is particularly vulnerable to them. As they are in constant interaction with their environment, they are constantly forced to keep up with changes and search for new information, which they can then use to make decisions. The areas that have long been responsible for collecting, processing and providing information to support decision-making processes are controlling and management accounting (Lucey, 1991). Starting with the first simple cost control tools - already used in the 19th century in the American transport company, Atschison, Topika & Santa Fe Railway System (Berkman, 1988) through the one implemented shortly afterwards - at the beginning of the 20th century at the H. Ford in Detroit – the first decision-making cost accounting system – Standard Cost Accounting, and ending with extremely advanced and specific cost accounting systems, which have developed in theory and practice over more than a hundred years – and which are a response to the information needs of entrepreneurs and managers. The precursors of the idea of implementing, modernizing and developing management accounting and controlling tools included Kaplan (1984) and Johnson and Kaplan (1991).

Management accounting and controlling play a key role in an organization's decision-making processes, providing the information necessary for planning, control and performance evaluation. The dynamic development of information technology, in particular artificial intelligence (AI), opens up new opportunities for the automation of financial processes and the enrichment of decision-making support tools (Kerr, 2025). The literature indicates that the integration of AI with financial systems can significantly change the way controlling departments operate, both by streamlining traditional processes and by implementing innovative data analysis methods (Alruwaili, 2025).

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The popularity and even ubiquity of artificial intelligence in various areas of our lives is currently enormous and its share continues to grow. There is an ongoing debate among academics and practitioners about how deeply AI should interfere in our lives and be present in economic processes. This debate increasingly also covers areas of ethics and the changing role of humans in social and economic life, as well as the risks involved.

The role and contemporary challenges of management accounting and controlling in SMEs

The main source of information for both management accounting and controlling is the financial and accounting system (data on costs and revenues) and a number of organizational units (production, sales, HR and support departments). However, due to the need to adapt to market requirements, it is necessary to conduct an in- depth analysis of the company's environment, including the risks arising from the instability of the global political and economic situation. Therefore, the tools used so far, especially in small and medium-sized enterprises, may often prove insufficient. Many researchers in these fields emphasize the quality and reliability of management information, both that which is the source at the input to the system and that which is already its product (Mytlewski, 2007).

Undoubtedly, in today's turbulent economy, the quantity and quality of events affecting the functioning and survival of small and medium-sized enterprises is extremely significant and requires the use of appropriate tools. Professional risk management systems are unattainable for small and medium-sized enterprises, particularly due to financial barriers, but also due to competence barriers. The owners of the smallest entities often lack knowledge and have problems acquiring it, as they are more focused on day-to-day management for the survival of the company (this was the case during the COVID-19 pandemic and in the case of Polish SMEs after the outbreak of war in Ukraine).

There are many models in the literature that describe the possibilities for identifying and analyzing threats and warning signs (bearing in mind that, of course, not all of them are predictable). It is also worth emphasizing that companies that are able to respond in advance have a better chance of survival, which in turn is possible with proper observation and identification of risks. One of the most interesting threat analysis models is the weak signals model, whose main thesis is that strategic threats are predictable because they are preceded by so-called weak signals (Ansoff and McDonnell, 1990). In their study, Ansoff and McDonell also distinguished three basic types of information that are important in a warning system: those of an alarm nature, those of a corrective nature (when there are deviations from the norm/standard), and those of an unstructured nature (ambiguous and difficult to identify). B. Gilad, on the other hand, stated that in the process of early recognition, the greatest importance should be given to the environment, bearing in mind that early warning systems are elements of an information system designed to enable a company to cope with unexpected situations (Gilad, 2004). Some researchers emphasize that not all signals from the environment indicate changes that have only negative effects on companies. In their work in 2009, P. Kotler and J. Caslione included such stimuli signaling the advent of change as: technical and technological progress, the continuation of the IT revolution, various types of innovative breakthroughs, political changes, hyper competition from aggressive market rivals and the increase in customer power (Kotler and Caslione, 2009). Today, 16 years later, we are facing the effects of all these changes. It should be noted that the development of technology and information communication has completely changed the structure and functioning of the market and companies themselves, as well as the emergence of new business models. The innovative breakthrough in the form of AI, currently used in many areas of our lives, brings as many opportunities as it does threats. Changes related to new competitive conditions, exacerbated by economic and political instability on a regional and global scale, are currently creating new challenges and risks. Therefore, the role of skillful prediction using mathematical models, variant forecasting and decision optimization – these are the tools of management accounting and controlling that will become increasingly important – providing greater opportunities for efficient and effective decision-making (Kaszuba-Perz, 2012). Among the first representatives of science who recognized in their work the need to develop and implement innovative tools to support decision-making processes (including, in particular, controlling and management accounting) were Kaplan (1984) and Johnson and Kaplan (1991). At the end of the last century, in the 1990s, Granlund and Lukka (1998) developed a typology of premises for the development of new innovative management accounting tools. Within four main groups of reasons for innovation, they listed, among others: fluctuations in global markets, market deregulation, increased competition and market globalization, advanced production and information technologies, transnational influence on subsidiaries (especially in the case of global companies), professionalization of management accounting specialists (e.g. networking), and university research. Once again, emphasizing the passage of time, we can note that the premises that were reported over a quarter of a century ago have been addressed through the implementation of appropriate tools in practice. However, observing economic life and the constant dynamism of change, they are still relevant, and the challenges facing

management accounting and controlling are still new.

Contemporary knowledge-based decision support systems allow for a much deeper diagnosis of a company's situation. In the practice of some industries and companies, models are also being developed that enable the identification of knowledge structures, inference and the application of multi-stage prediction algorithms using traditional accounting, as well as systems that simultaneously generate so-called explanations in financial systems (Daniels and Caron, 2009).

The use of artificial intelligence in management accounting and controlling.

In the field of accounting, finance, management accounting and controlling, artificial intelligence has been present for some time now, covering, among other things, the automation of certain processes (e.g. accounting and analytical) (Mediaty, 2024). The automation of operations (using, among other things, OCR and NLP technologies) has so far covered document processing, automatic accounting and reporting, as well as automatic analysis of documents and their compliance with regulations (Czyżewski, 2025). Machine learning (ML) models, on the other hand, support forecasting and prediction in terms of sales, costs, results and liquidity, and, thanks to the automation of routine tasks, increase operational efficiency (Kerr, 2025).Advanced technologies supporting financial management, controlling and management accounting assisted by AI enable real-time analysis for the detection of irregularities (Alruwaili, 2025), which is an excellent basis for creating advanced risk management tools. These systems also require scenario simulations, budget planning and, consequently, cost optimization (Kerr, 2025). In addition to sophisticated forecasting tools, those that participate in active financial liquidity management and even fraud detection are also noteworthy (Broby, 2022).The result is models based on existing and constantly evolving controlling and management accounting instruments that support operational and strategic planning, enriched with modern technologies.

A review of the literature indicates that although the potential of AI in controlling and management accounting is significant, business practice is still in the experimental phase. The identified risks (particularly those related to data quality and the inability to effectively audit models) require the development of a supervisory framework and the use of explainable AI (XAI) methods (Zhang et al., 2022).

AI and ML technologies, as well as LLM (large language model), imply new forms of controlling and, consequently, a change in decision-making practices and the role of the controller (Sundström et al., 2024). This results in new educational and organizational challenges. The need to undertake work and develop recommendations for policy and professional education is discussed by Alruwaili and Mgammal (2025) and Vysotskaya (2024), who emphasizes the need to integrate data analytics (including ML) into management accounting education and to prepare curricula and case studies that prepare financial employees to work with AI. Greenman et al. (2024) point to the need for discussion and the search for solutions regarding the impact of AI on various areas of broadly understood financial and accounting systems (including auditing, taxation and controlling), especially in the context of ethics and competence. Other authors also emphasize the fact that the implementation of decision-making algorithms in the financial sector, auditing and management accounting raises issues of transparency, accountability, privacy and social justice (Arrieta-Barredo et al., 2020; Černevičienė and Kabašinskas, 2024). The social and ethical problems of using AI in the fields of management and finance are also manifested in a radical change in the role of humans, as the "manual" processing of information by controlling employees is being replaced by advanced ML and AI models. On the other hand, these specialists will increasingly be required to have competences in model validation, interpretation of XAI (Explainable AI) results, their critical evaluation (Bahoo et al., 2024) and final decision-making ("human-in-the-loop"). The problem of using ML in management accounting in the process of obtaining alternative sources of information, but above all in the context of the problem of validation and interpretability of final results and analyses carried out by such complex systems, is addressed by Ranta (2023) in his work.

Thus, the automation of financial and management processes changes the role of humans from executors to supervisors and interpreters of the results generated by AI systems (Kerr, 2025). Furthermore, the challenge of investing in the retraining of employees and helping them acquire completely new skills in order to reduce the risk of professional marginalization is becoming crucial (Kerr, 2025).

The use of AI in management accounting and controlling systems may involve a number of risks. Among them, those related to the lack of transparency of AI models seem to be significant, as this significantly hinders interpretation and auditing. The quality of processes and data is also a problem. Regulatory and ethical risks also remain unresolved. In turn, the existing competence and cost barriers in implementation processes affect the smallest enterprises in particular.

Conclusions and recommendations

In summary, it is important to emphasize the importance of continuously developing tools that support decision-making processes in companies, especially those that are particularly exposed to risks associated with current changes. It is also worth noting the need for skillful and wise use of information technology achievements, including ML and AI, which enrich controlling and management accounting systems. At the same time, it is important to remember to invest in data quality and develop mechanisms for supervising AI tools. The integration of financial and technological competences in controlling teams is also required, and the competence changes of controllers themselves give rise to new educational and ethical challenges. Therefore, an important postulate is the need to conduct scientific research on the impact of AI on the quality and effectiveness of decisions. Considering the risks associated with the development of AI through self-learning and independent model shaping, which may completely exclude human decision-making, it is necessary to create a legal and ethical framework not only for systemic AI modelling/programming, but also for its use in social and economic life. An important research problem requiring diagnosis, in-depth analysis and the formulation of recommendations and courses of action in the near future is to determine the impact of AI on the quality of management decisions in various types of entities, including small and medium-sized enterprises.

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