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MANAGER IN THE AGE OF ALGORITHMS: THE USE OF AI TOOLS IN DECISION-MAKING PROCESSES

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Purpose: The purpose of the article is to analyze the role of managers in the context of the growing use of artificial intelligence (AI) tools in decision-making processes. The author attempts to answer questions related to the competencies required for effective management in data-driven environments and identifies key challenges and under-researched areas concerning the adaptation of AI technologies within organizations.
Methodology: The study was conducted among 85 managers, business owners, and leaders representing various management levels and economic sectors. A questionnaire method and in-depth interviews were used. The sample was purposefully selected, taking into account the level of AI implementation, company size, and industry. The analysis focused on attitudes toward AI, the scope of tool usage, and the competencies required for their effective application.
Findings: Respondents most frequently used AI for data analysis, process automation, and customer relationship management. The key benefits identified were increased efficiency, more accurate decision-making, and cost reduction. The most important competencies included data analysis skills (86%), adaptability (74%), and critical thinking (73%). Smaller enterprises were less likely to implement AI due to financial constraints and a lack of technological competencies. Most managers recognized the need for further education in analytical tools and AI.
Research limitations: The main limitation is the purposive sampling method, which restricts the generalizability of the results. The article highlights the need for further research on the barriers to AI implementation, particularly in sectors with a low level of digitalization.
Practical implications: The research findings may influence training strategies within organizations and the development of competency programs for managers. The results suggest a need to invest in the development of digital and analytical skills among leaders.
Social implications: The use of AI in management also requires reflection on ethical considerations, algorithmic transparency, and social responsibility, especially in the context of decisions that impact people.
Originality/value: The article fills a research gap by combining theoretical and practical perspectives, providing a comprehensive view of managerial competencies in the age of AI. It is intended for scholars, management practitioners, and technology decision-makers.
Keywords: manager, management, algorithms, competencies, AI.
Category of the paper: research paper.

1. Introduction

The dynamic development of artificial intelligence (AI) is revolutionizing the way organizations operate, introducing new models of management, decision-making, and shaping relationships between humans and technology. This transformation presents managers with numerous challenges whose scale and complexity are unprecedented in the history of management (Krechowicz, 2021, pp. 393-404). Algorithms and tools offered by AI not only automate processes and optimize operational activities but also redefine the concept of leadership, requiring managers to acquire new competencies — from data analysis skills to the ability to lead teams in hybrid human-machine environments (Śledziewska, Włoch, 2020, pp. 45-55). The increasing integration of algorithms into everyday management compels decision-makers to address fundamental questions: which decisions should remain within human domain, and which can be entrusted to algorithms? How can one maintain an ethical approach to management in a data-driven world? What qualities should a future leader possess to effectively lead a company through digital transformation? The article presents both theoretical perspectives on the issue and practical implications for organizational leaders operating in a dynamically evolving technological environment. Despite growing interest in the use of algorithm-based tools in management, previous research has mainly focused on the technological or organizational aspects of their implementation. A research gap thus exists concerning the diversity of managerial attitudes toward AI tools, particularly in relation to industry sectors, levels of technological adoption, and organizational size. Moreover, in-depth analyses of the competencies required to effectively use these tools in decision-making processes — especially in low-digitization environments — are still lacking. This study aims to fill that gap. The purpose of this article is to reflect on the evolving role of managers in the era of artificial intelligence and to analyze the challenges associated with the adoption of algorithm-based tools in decision-making processes. The author attempts to combine both theoretical and practical perspectives, highlighting the key competencies required in AI-supported management. The text also seeks to identify underexplored areas and demonstrate how technological development is reshaping leadership competencies. It serves as an introduction to a broader discussion on the future of management in the context of rapidly advancing technologies and their impact on organizational leadership decision-making.

2. The Evolution of Management in the Context of AI

Management as a scientific discipline has undergone numerous stages of development and transformation, evolving from classical organizational theories to modern approaches based on digitalization and process automation. Artificial intelligence represents the next step in the evolution of management, transforming both decision-making models and the roles of managers within organizations. Initially, management was grounded in a scientific approach dominated by the principles of Taylorism and Fordism. Managers primarily performed a controlling function, and decision-making processes were hierarchical and based on rigid rules (Koźmiński, 2004, pp. 35-53).

The development of information technologies and ongoing globalization introduced new concepts, such as process management, while organizations themselves became increasingly focused on learning. Today, with the advancement of algorithms proposed as tools to support both management and decision-making, we can observe a shift toward data- and algorithm-driven organizations, where decisions may be supported or even fully taken over by artificial intelligence systems.

One of the key aspects of modern management relates to the role of algorithms in automating decision-making processes. The development of algorithm-based tools can assist managers in analyzing vast data sets, forecasting market trends, and optimizing business processes (Chen, Liu, Bai, Chen, 2019, p. 2131). Intelligent algorithms can not only recommend optimal strategies but also independently execute tasks that previously required human involvement. An example of this is AI-powered customer relationship management (CRM) systems, which automatically personalize communication with clients and optimize sales strategies.

Decisions based solely on acquired experience may no longer be sufficient in today's business environment. Intuition alone can be too risky, especially given the high volatility and complexity of contemporary markets. Modern approaches rely on data analytics and predictive models to support decision-making processes, which are becoming a natural part of organizational operations. The tools available to managers allow for faster and more accurate decisions, based on the simultaneous analysis of thousands of variables (Davenport, Ronanki, 2018, pp. 108-116). In practice, this means that managers increasingly depend on algorithms that provide recommendations based on historical data analysis and predictions of future outcomes.

As the role of algorithms grows, managers are no longer just decision-makers—they are also strategists and technology integrators. They must understand the potential of AI tools and continuously develop their ability to manage teams in which humans collaborate with intelligent systems. This shift introduces new challenges, such as the ethical implications of

AI usage, emerging legal regulations, managing hybrid teams, and building trust in the solutions provided by AI-based tools.

The development of decision-support tools not only transforms enterprises but also redefines the role of managers and the skills required. Traditional competencies, such as strategic planning, human resource management, or decision-making, must be complemented by the ability to operate in an environment driven by algorithms and data analysis. Today's managers, in order to function and lead effectively in this new reality, must continuously develop new skills that enable them to fully harness the potential of intelligent technologies in management.

One of the key aspects of management in the new reality is the ability to analyze and interpret data. Managers do not need to be experts in programming or statistics, but they should understand the basics of data analytics and market analysis in order to effectively utilize reports generated by available tools and make informed strategic decisions that contribute to maximizing the value of the enterprise (Davenport, 2018, pp. 39-65).

Modern organizations base their strategies on advanced predictive models, which is why the ability to read, interpret, draw conclusions from, and constructively respond to analytical results is becoming an essential element of managerial competencies (Sienkiewicz-Małyjurek, 2018, p. 47).

The tools currently available to managers do not replace people, but they change the way people work. Managers increasingly need to lead hybrid teams, in which intelligent systems support process automation alongside human employees. A key challenge is the effective use of the potential of both people and technology. This requires a new approach to work organization, task coordination, and employee motivation in the face of increasing automation — a task that is complex and demanding (Tegmark, 2019, pp. 111-115).

Tools based on algorithms are increasingly supporting decision-making processes by reducing subjectivity and human error. Managers must learn to interpret recommendations derived from algorithm-generated data and make decisions based on insights provided by these systems. However, a significant challenge lies in understanding the limitations of these tools and in the ability to assess the risks associated with automating decision-making processes.

The use of algorithm-based tools in management is also associated with ethical and social considerations. Managers must be capable not only of managing organizational efficiency but also of ensuring the ethical implementation of technology. This includes maintaining algorithmic transparency, avoiding bias in decision-making, and building trust in systems among employees and customers. These competencies require not only technological knowledge but also soft skills such as empathy and communication abilities (Bostrom, 2016, pp. 17-38).

The use of algorithms in decision-making processes does not eliminate the role of the manager; rather, it redefines it. Business leaders become moderators of analytical processes, capable of interpreting algorithmic recommendations and implementing them within a strategic

context. This means that the core competencies of managers are evolving — in addition to traditional skills like human resource management and business decision-making, they must now develop analytical and technical capabilities that enable them to work effectively with available tools.

Despite the numerous benefits, implementing AI tools in management also brings new, still unknown challenges. One of the most significant is trust in algorithms — managers are often reluctant to rely on AI-generated recommendations due to the lack of full transparency in decision-making models. Furthermore, algorithms may fail to account for the cultural and social context of decisions, potentially leading to unintended consequences (Brynjolfsson, Rock, Severson, 2017, pp. 33-35).

3. Methodology and Sample Selection

The aim of this study is to analyze managers' perceptions regarding the role of algorithm-based tools that support decision-making processes in their daily work. The research seeks to verify how management personnel use these tools, what benefits they perceive, and what challenges and risks they identify. A key aspect of the study is also the assessment of the competencies required by managers and their readiness to adapt new technologies in managerial practice. The study was conducted in September and October 2024. This period was chosen due to the availability of respondents and the stability of external conditions, which allowed for the collection of reliable and comparable data. The research was carried out among business owners, managers, and leaders from various industries, sectors, and management levels. This approach provided a broad perspective on the impact of artificial intelligence on management practices and the competencies required in the era of digital transformation. The sample was selected purposefully, taking into account sectoral diversity, organizational size, and the degree of use of decision-support tools within companies. Participants included business owners, managers, and mid- to senior-level leaders holding executive, managerial, or board positions. This group was selected because they are the primary decision-makers responsible for the strategic implementation of new technologies, including AI-based systems.

The respondents represented various sectors of the economy, which enabled the analysis of differences in approaches to AI tools depending on the specific characteristics of the enterprise. The study included individuals working in sectors such as IT and new technologies, finance and banking, industry, trade and e-commerce, services (e.g., HR, business consulting), healthcare, and public administration.

In terms of organizational size, the study involved managers, leaders, and business owners managing micro, small, medium, and large enterprises. This approach allowed for the examination of how attitudes toward AI tools vary based on company size. An additional

segmentation criterion was the level of AI tool implementation in decision-making processes within the organizations. Three groups were identified:

- Enterprises actively using AI in decision-making processes.
- Enterprises planning to implement AI tools in the future.
- Enterprises not using AI at all.

The total number of respondents was 85, including leaders, managers, directors, and business owners. The survey questionnaire was made available online and distributed through professional social networks such as LinkedIn, as well as via direct email outreach to businesses.

Additionally, to deepen the analysis, interviews were conducted with selected respondents, which made it possible to obtain more detailed information about their experiences with the implementation and use of AI tools in day-to-day management and decision-making processes. Although the sample was selected purposefully, its representativeness was ensured by taking into account key criteria such as industry sector, organization size, and the level of AI implementation in decision-making processes. Furthermore, elements of randomness were introduced within respondent subgroups to reduce selection bias and enhance the credibility of the results. This approach enabled a diversified analysis of managers' perceptions, representing various levels of management and different experiences with algorithm-based technologies, thus strengthening the validity of the findings. A limitation of the study is the purposive sampling, which, although representative in terms of selected criteria, does not allow for full generalization of the results to the entire population of managers in Poland. Given the dynamic development of AI-based technologies, it is necessary to conduct ongoing research that can capture changing attitudes and the level of AI adoption across different economic sectors. Future studies should further explore the barriers to AI implementation, particularly in low-digitization sectors, and incorporate the perspectives of operational staff and specialists who support decision-making processes.

Table 1.
Sample selection based on the management level criterion

Position level	**N – Sample size**
Lower management level	N = 17
Middle management level	N = 31
Senior management level	N = 18
Business owner	N = 19
Total	N = 85

Source: own elaboration.

Table 2.
Sample selection based on the industry sector criterion

Industry sector	**N – Sample size**
IT and new technologies	N = 15
Finance and banking	N = 12
Manufacturing and industry	N = 10

Cont. table 2.

Trade and e-commerce	N = 14
Services (HR, business consulting)	N = 13
Healthcare	N = 11
Public administration	N = 10
Total	N = 85

Source: own elaboration.

Table 3.
Sample selection based on the enterprise size criterion

Position level	**N – Sample size**
Micro enterprise (up to 9 employees)	N = 18
Small enterprise (10 to 49 employees)	N = 23
Medium enterprise (50 to 249 employees)	N = 27
Large enterprise (250 or more employees)	N = 17
Total	N = 85

Source: own elaboration.

Table 4.
Sample selection based on the level of implementation of algorithm-based AI tools supporting decision-making

Position level	**N – Sample size**
Enterprises actively using AI	N = 44
Enterprises planning to implement AI tools in decision-making	N = 23
Enterprises not using AI tools in decision-making	N = 18
Total	N = 85

Source: own elaboration.

Among the respondents who participated in the study, there were 18 managers, leaders, directors, and business owners representing enterprises that have not implemented AI tools in their decision-making processes and do not plan to do so in the near future. This group provides valuable insights into the barriers, limitations, and reasons for refraining from adopting artificial intelligence in management.

Respondents working in companies that do not use AI tools in decision-making processes represent various sectors of the economy, with a predominance of organizations operating in industries with lower levels of automation and more traditional business models. The sectoral breakdown is as follows: Manufacturing and industry – 4 enterprises, Trade and e-commerce – 3 enterprises, Services (HR, business consulting) – 3 enterprises, Public administration – 3 institutions, Finance and banking – 2 enterprises, IT and new technologies – 2 enterprises, Healthcare – 1 enterprise.

4. Managerial Competencies in the Age of AI: Findings from Empirical Research

AI tools are increasingly becoming an integral part of management, supporting managers in decision-making, business process optimization, and data analysis. Their application can significantly impact organizational efficiency; however, the level of adoption of this technology varies across industries and economic sectors. Questions still arise regarding the actual role of AI tools in management, the extent of their use, and the challenges and concerns associated with their implementation.

Considering the size of the enterprises managed by the respondents, those not using AI are mainly small and medium-sized businesses. This suggests that limitations in implementing new technologies may stem from financial and organizational barriers, as well as a lack of appropriate technological competencies. The size structure of these enterprises is as follows: micro-enterprises (up to 9 employees) – 6 enterprises, small enterprises (10 to 49 employees) – 5 enterprises, medium enterprises (50 to 249 employees) – 5 enterprises, large enterprises (over 250 employees) – 2 enterprises.

Figure 1 presents the main reasons for the lack of AI tool implementation in this group of enterprises.

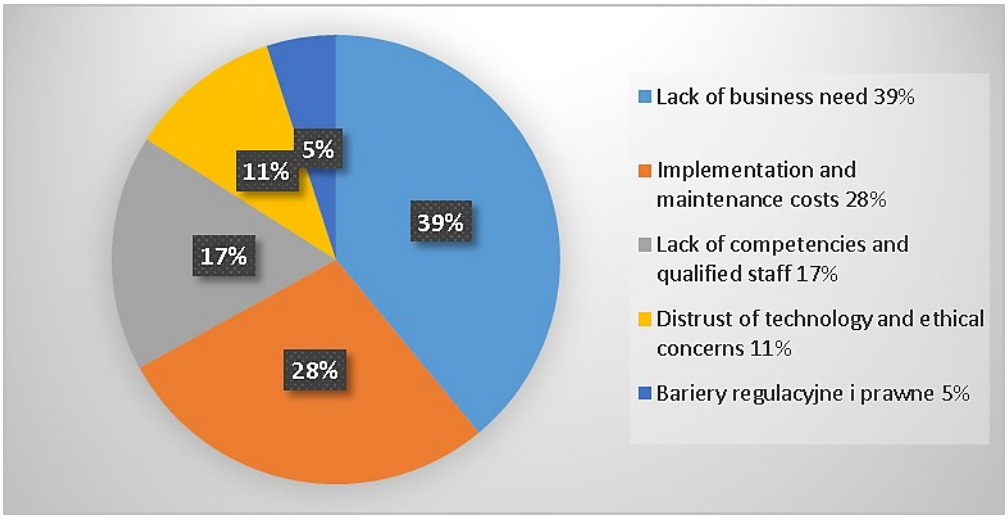

Figure 1. Reasons for the lack of AI tool implementation in decision-making processes among the surveyed sample.

Source: own elaboration.

Despite the current lack of AI tool implementation in decision-making processes, more than half (56%) of respondents in this group indicated that they may consider adopting artificial intelligence tools within the next 3-5 years.

After excluding the group of enterprises that have not implemented AI tools in decision-making, the further analysis focuses on 67 managers, business owners, directors, and leaders who actively use AI solutions in decision-making processes.

The analyzed group consists of representatives from various management levels. The position structure is as follows: business owners – 21%, directors (senior management) – 27%, and managers/leaders (lower and middle management) – 52%. This distribution indicates that the largest group consists of lower and middle-level managers who are responsible for day-to-day operational and strategic decisions, supported by algorithm-based tools.

The enterprises where managers have implemented AI tools in decision-making operate across various industries/sectors. The sectoral distribution is presented in Figure 2.

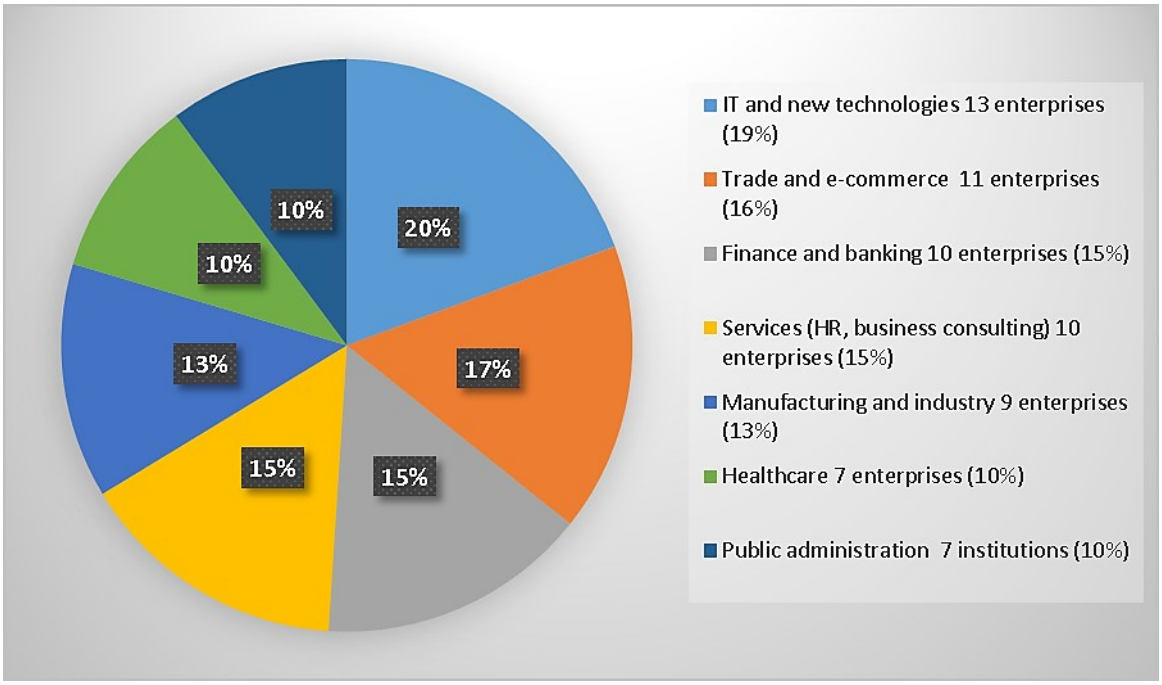

Figure 2. Distribution of the research sample using AI tools in the decision-making process (in %).
Source: own elaboration.

The largest share in the group is held by enterprises from the IT and new technologies, trade, and finance sectors, indicating that AI tools supporting decision-making are particularly popular in industries that require the processing of large volumes of data and the automation of decision-making processes.

Taking into account the size of enterprises that actively implement AI tools in decision-making processes, the data shows that among the respondents working in micro-enterprises, only 12 (18%) use AI in decision-making; in small enterprises, 16 respondents (24%); in medium-sized enterprises, 23 respondents (34%); and in large enterprises, 16 respondents (24%).

This data demonstrates that the use of AI tools in decision-making is not limited to large corporations—smaller enterprises also invest in algorithm-based artificial intelligence solutions, although the scale of implementation may vary depending on the organization's resources and capabilities.

Managers also indicated the decision-making areas in which AI tools play a key role. These are presented in Table 5.

Table 5.
Areas of AI Application in the Decision-Making Process

1	Data analysis and market trend forecasting	78% respondents
2	Automation of operational and production processes	65% respondents
3	Customer relationship management (CRM, chatbots, offer personalization)	59% respondents
4	Cost optimization and resource allocation	55% respondents
5	Recruitment	42% respondents
6	Support for strategic business decisions	39% respondents

Source: own elaboration.

Respondents also identified the key benefits of using AI tools in decision-making processes. These are presented in Table 6.

Table 6.
Key Benefits of Using AI Tools in the Decision-Making Process

1	Increased operational efficiency	82% respondents
2	Faster and more accurate decisions	76% respondents
3	Reduction of operational costs	61% respondents
4	Improved customer experience	58% respondents
5	Enhanced business competitiveness	52% respondents

Source: own elaboration.

Respondents were also asked about the competencies they consider essential for the effective use of AI tools in the decision-making process. The results are presented in Table 7.

Table 7.
Key Competencies for the Effective Use of AI Tools in the Decision-Making Process

Ability to analyze and interpret data	86% respondents
Flexibility and adaptability in a changing environment	74% respondents
Critical thinking	73% respondents
Understanding of automation processes and decision-making algorithms	59% respondents
Digital and technological competencies	52% respondents

Source: own elaboration.

The study indicates that among managers who actively use AI tools in decision-making processes, the ability to analyze data, adapt to new technologies, and think critically are of key importance. These tools are most frequently used for data analysis, which influences decision-making, process automation, and cost optimization. Managers, leaders, directors, and business owners clearly recognize the benefits of AI, such as increased efficiency and improved competitiveness.

At the same time, there are still significant barriers to the implementation of AI tools that support decision-making—particularly in terms of integration with existing systems, implementation costs, and the need to develop technological competencies among managers. In the face of these challenges, training and the development of analytical and digital skills are crucial to effectively harness the potential of available tools in management.

5. Summary

The research findings indicate that managerial competencies in the age of AI differ significantly from traditional leadership skills. While classical management relied on intuition, experience, and control of operational processes, today's managers need to develop analytical and digital competencies, as well as the ability to manage teams in which AI plays a key role.

The analysis shows that 85% of respondents identified the ability to analyze and interpret data as a crucial competency when using AI tools to support decision-making. This means that managers must not only understand reports and analyses generated by algorithms but also make decisions based on facts rather than intuition.

The importance of this skill is particularly evident in sectors where AI is used for market trend forecasting, customer behavior analysis, and operational process optimization. Managers in IT, finance, and e-commerce more frequently emphasized the need for analytical skills (with over 90% of responses), while in healthcare and public administration this figure was around 40%.

To manage effectively in a dynamic technological environment, managers must demonstrate a high degree of adaptability to tools. As many as 74% of respondents highlighted the ability to quickly adjust to a changing business environment as one of the most important success factors for managers using AI in decision-making. This means that AI cannot be treated as a static tool—technology is constantly evolving, and its effective use requires continuous skills development and openness to change. Furthermore, 59% of respondents stated that managers should have at least a basic understanding of automation processes and decision-making algorithms to use AI effectively in management.

This does not imply that leaders must possess programming skills—but it is essential to understand how AI works, its limitations, and the risks associated with implementing algorithms into decision-making processes.

The study shows that managerial competencies in the age of AI must include both hard skills—such as data analysis and technological know-how—and soft skills, such as adaptability, leadership, and an ethical approach to management. The findings suggest that the future of managerial competencies in the AI era will depend on the ability to integrate analytical expertise with human-centered leadership skills. Managers who succeed in combining these two dimensions will be better equipped to leverage AI in building their organization's competitive advantage.

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