PRACE NAUKOWE
Uniwersytetu Ekonomicznego we Wrocławiu
RESEARCH PAPERS
of Wrocław University of Economics and Business

Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu
Research Papers of Wroclaw University of Economics and Business
Year 2026, Vol. 70, No. 2
ISSN 2392-0041
journals.uew.pl/pn

Artificial Intelligence Capabilities and Project Success – Analysis of Research Trends

Katarzyna Marek-Kołodziej

Opole University of Technology

e-mail: k.marek-kolodziej@po.edu.pl

ORCID: 0000-0002-5863-6031

Quote as: Marek-Kołodziej, K. (2026). Artificial Intelligence Capabilities and Project Success – Analysis of Research Trends. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, *70*(2), 59-73.

DOI: 10.15611/pn.2026.2.05

JEL: O33, M15, M54

Abstract

Aim: The objective of this article was to systematically analyse the literature on AI-related competencies of project managers and assess how these competencies were addressed in the context of project management.

Methodology: The study was conducted in accordance with the PRISMA 2020 guidelines, using bibliometric analysis (VOSviewer) and qualitative content analysis. The bibliometric analysis included 38 publications, and the qualitative analysis covered 26 works, coded into four competency categories: technological, cognitive, decision-making, and ethical-organisational.

Results: The literature focuses primarily on the technological dimension of AI, while project managers' competencies are only marginally and inconsistently described. Technological and decision-making competencies dominate, cognitive and ethical-organisational competencies remain underdeveloped, and there is no consistent model of AI competencies for project managers.

Implications and recommendations: Project management competency models should be expanded to include AI-related competencies, such as AI literacy, data work, algorithmic decision-making, and technology ethics. The DigComp 2.2 framework can support their systematisation.

Originality/value: The article identifies the gap between the growing role of AI and current project management competency models and outlines directions for further research.

Keywords: artificial intelligence, project management, project manager competencies, digital competencies

1. Introduction

The rapid development of artificial intelligence (AI) is significantly changing the way organisations operate and projects are implemented. Recent reports indicate that AI is no longer the domain of pilot projects but is becoming an integral part of business processes. According to McKinsey's The State of AI 2025 report, 88% of organisations use AI in at least one function, compared to 78% the year before (Singla et al., 2025a; 2025b). At the same time, only 39% of companies report an increase in EBIT thanks to AI, highlighting the growing gap between rapid technology adoption and the ability to achieve measurable results.

A similar trend can be seen in project management. A study by the Association for Project Management (APM, 2025) showed that the use of AI in projects has "almost doubled," with 62% of project managers predicting a very positive impact of the technology on the sector. As many as 70% of organisations are preparing project managers to work with AI tools and systems, reflecting the growing importance of digital competencies in the project environment. Industry literature and reports emphasise that AI supports not only the automation of routine tasks but also advanced processes such as risk forecasting, deviation analysis, resource optimisation, and big data processing.

The literature reviews point to a wide range of AI applications in the project life cycle: from scheduling and cost estimation, predictive risk modelling, to initiative portfolio management, communication, and knowledge management (Almeida et al., 2025; Bento et al., 2022; Łukasik-Stachowiak, 2025). These changes affect the role of the project manager, who increasingly acts as an integrator of data, technology, and practical knowledge.

The concept of Project Manager 2030 is becoming increasingly prominent in the literature. The role of the project manager is shifting from managing project artefacts to activities that require data interpretation, working with algorithms, and maintaining relationships within teams (Craveiro & Domingues, 2025; Hughes et al., 2025). This was also confirmed by the Project Management Institute (PMI, 2024), which found that AI systems are taking over a significant portion of analytical and administrative tasks.

With the spread of AI tools and systems there is a growing demand for project managers to understand how algorithms work, interpret results, assess data quality, and be aware of the limitations and biases of models. However, previous research focused primarily on tools and processes, and much less frequently on project manager competencies related to AI and their links to project success, both in the classical sense (time, scope, budget) and in the contemporary sense (business value, adaptability, stakeholder satisfaction).

Although project success is explicitly invoked in both the title and the research questions, the literature rarely links project managers' AI-related competencies to success in a direct, measurable way. More often, this relationship appears indirectly, through improved forecasting, more reliable risk assessment, better resource allocation, stronger stakeholder communication, and more responsible use of data and algorithms. This gap justified a structured review of how the literature frames such competencies and relates them to project outcomes.

This article aimed to fill this research gap by providing a systematic review of the literature on the AI-related competencies of project managers. The author identified AI-related competencies described in the literature, organising them into categories, and indicating areas requiring further research. The study followed the PRISMA 2020 guidelines: Section 2 presents the methodology, Section 3 the results of the bibliometric and qualitative analyses, and Section 4 provides their interpretation in the context of existing competency models and digital frameworks. The article concludes with a summary of the implications for research and practice.

2. Research Methodology

This study is a systematic review of the literature with elements of bibliometric and qualitative analysis, developed in accordance with the PRISMA 2020 guidelines (Page et al., 2021). The purpose of applying this methodology was to ensure transparency, procedural consistency, and analytical traceability in the identification, selection, and interpretation of publications addressing project managers' AI-related competencies in project management.

2.1. Research Problem and Research Question

Despite the growing number of publications analysing the applications of artificial intelligence in project management, there is still a lack of a systematic approach to the AI competences of project managers and scientific evidence regarding their importance for project success. The results of the preliminary analysis indicate that this issue is marginally present in the literature and does not yet form a coherent research trend.

Thus the following research problem was formulated: how does the scientific literature from 2015 to 2025 describe the project managers' AI-related competencies, and in what way does it present their connection to project success?

In order to address the research problem, the following five research questions were identified:

1. What AI-related competencies are identified in the literature as important for project managers?
2. How do publications define and classify project manager competencies in the field of artificial intelligence?
3. How does the literature describe the relationship between project managers' AI-related competencies and project outcomes?
4. What research trends dominate the literature on the application of AI in project management and project managers' AI-related competencies?
5. What research gaps can be identified in the area of project managers' AI-related competencies?

The research questions served as the basis for constructing the search strategy, selecting keywords, and conducting the subsequent analysis.

In this study, project success is understood in both a traditional sense (time, cost, scope) and a broader contemporary sense, including decision quality, adaptability, stakeholder value, and the responsible use of digital technologies in project environments. This broader understanding is important because the reviewed literature often discusses the effects of AI indirectly through better planning, forecasting, communication, and risk management, rather than using formal success metrics alone.

2.2. Searching for Scientific Publications

The literature search was conducted in two leading scientific databases: Web of Science Core Collection (WoS) and Scopus, covering publications from 2015 to 2025, in English, of the following types: scientific articles, literature reviews, and conference materials. The time frame covers the dynamic development of artificial intelligence solutions and their growing presence in project management practices over the last decade.

In order to obtain the literature relevant to the research problem, a set of keywords was developed relating to three main areas:

- AI competency (AI competency, AI literacy, digital competency),
- the role of the project manager,
- project success (project success, project performance, project effectiveness).

The following query was used in the Web of Science database: TS = (("AI competencies" OR "AI literacy" OR "digital competence" OR ("artificial intelligence" AND "project manager")) AND ("project success" OR "project performance" OR "project effectiveness"))) AND PY = (2015-2025) AND DT = (Article OR Review OR Proceedings Paper)**. A similar query was used in the Scopus database: TITLE-ABS-KEY("AI competence" OR "AI literacy" OR" "digital competence" OR ("artificial intelligence" AND "project manager")) AND TITLE-ABS-KEY("project success" OR "project performance" OR "project effectiveness") AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO(DOCTYPE,"ar") OR LIMIT--TO(DOCTYPE,"re") OR LIMIT-TO(DOCTYPE,"cp"))**.

The search identified 42 publications, including four from the WoS database and 38 from Scopus. These data were compiled and documented in detail.

The search strategy was intentionally focused on the intersection of three elements central to the study: AI-related competencies, the project manager role, and project success. This narrow logic increased conceptual precision, though it may also have reduced the corpus's representativeness. This limitation is acknowledged and discussed in the final part of the paper.

2.3. Selection of Relevant Publications

The selection of publications was carried out in accordance with the PRISMA 2020 guidelines (Page et al., 2021), including deduplication, preliminary screening, and full-text evaluation. The selection process is illustrated in Figure 1, prepared using the free PRISMA Flow Diagram Shiny App tool (Haddaway et al., 2022).

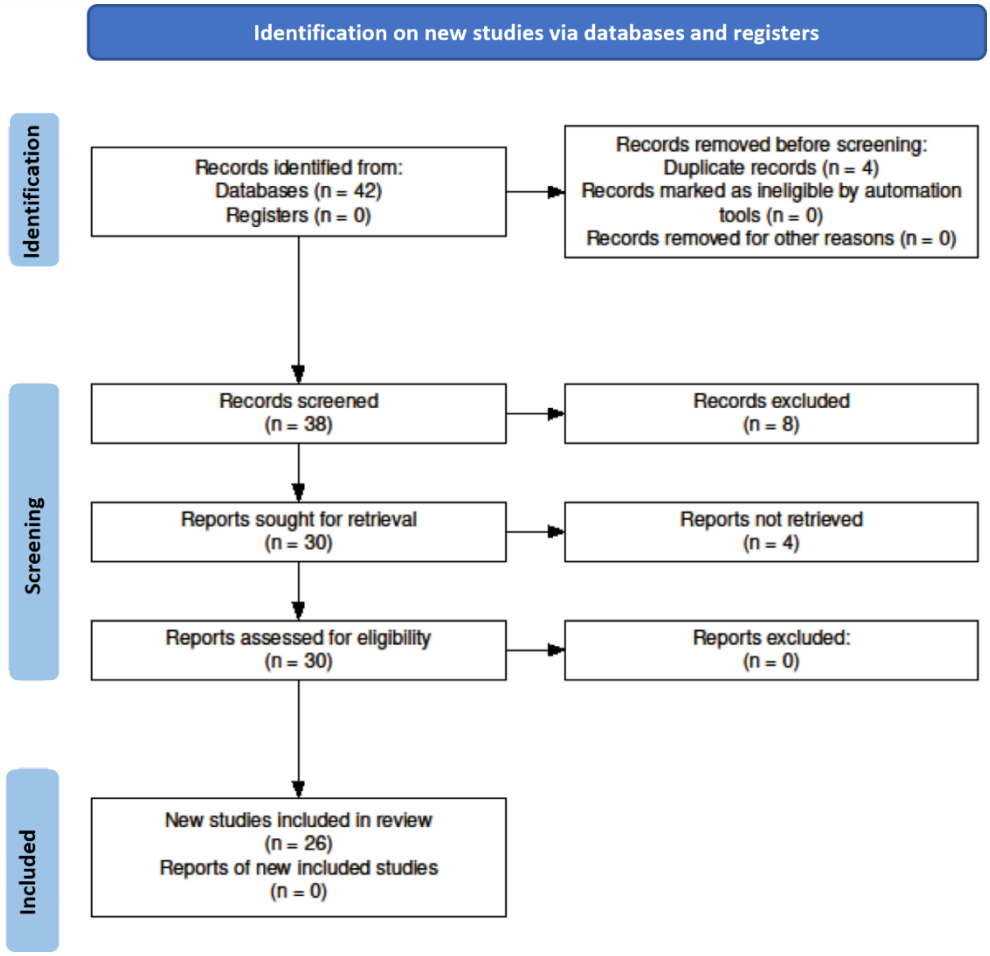

Fig. 1. Systematic literature review in accordance with PRISMA 2020 guidelines

Source: elaboration prepared using the Shiny App.

In the first stage, records from the Web of Science and Scopus databases were combined and deduplicated in Mendeley, removing four duplicates and leaving 38 unique publications. This was followed by a preliminary assessment of titles and abstracts, during which eight publications that did not meet the thematic criteria were excluded, including those focusing exclusively on the technical aspects of AI or on fields unrelated to project management.

Table 1. List of inclusion and exclusion criteria for the literature review

Category	Criteria
Inclusion criteria	• publications on project manager competencies, digital competencies, or AI (AI-related competencies, AI literacy) • works relating to the application of artificial intelligence in project management • publications analysing project success, project effectiveness, or AI-assisted decision-making processes • scientific articles, literature reviews, and conference materials • publications in English • years of publication: 2015-2025 • full text availability
Exclusion criteria	• articles of a purely technical nature (e.g. ML algorithms, autonomous systems), without reference to PM or competencies • works on other fields (medicine, education, robotics) unrelated to project management • publications that do not take into account the human factor (PM, team, stakeholders) • no access to the full text • duplicates or publications that do not meet the search criteria

Source: own elaboration.

Thirty publications were selected for full-text analysis, of which four articles were excluded due to a lack of access to the full text. Ultimately, 26 publications that met both thematic and formal criteria were included in the review. Table 1 presents the inclusion and exclusion criteria for the literature review.

3. Results of the Literature Review

The results of the systematic literature review comprised two levels of analysis: a bibliometric analysis of 38 publications, selected after deduplication and thematic selection, and a qualitative analysis of 26 publications included in the full-text review in accordance with the PRISMA guidelines.

The two analyses complemented each other, enabling the identification of dominant research trends, key topics, and gaps in project manager competencies in the context of artificial intelligence.

3.1. Bibliometric Analysis

To identify the dominant research areas on project manager competencies in the use of artificial intelligence in project management and their impact on project success, a bibliometric analysis of keyword co-occurrence was conducted across 38 publications selected for thematic analysis and deduplication. The analysis was performed in VOSviewer, using two thresholds for the minimum number of occurrences of a keyword (5 and 4), enabling capture of both the main and extended thematic scope of the literature. Figure 2 shows the map of keyword co-occurrence for threshold 5, and Figure 3 shows the map for threshold 4.

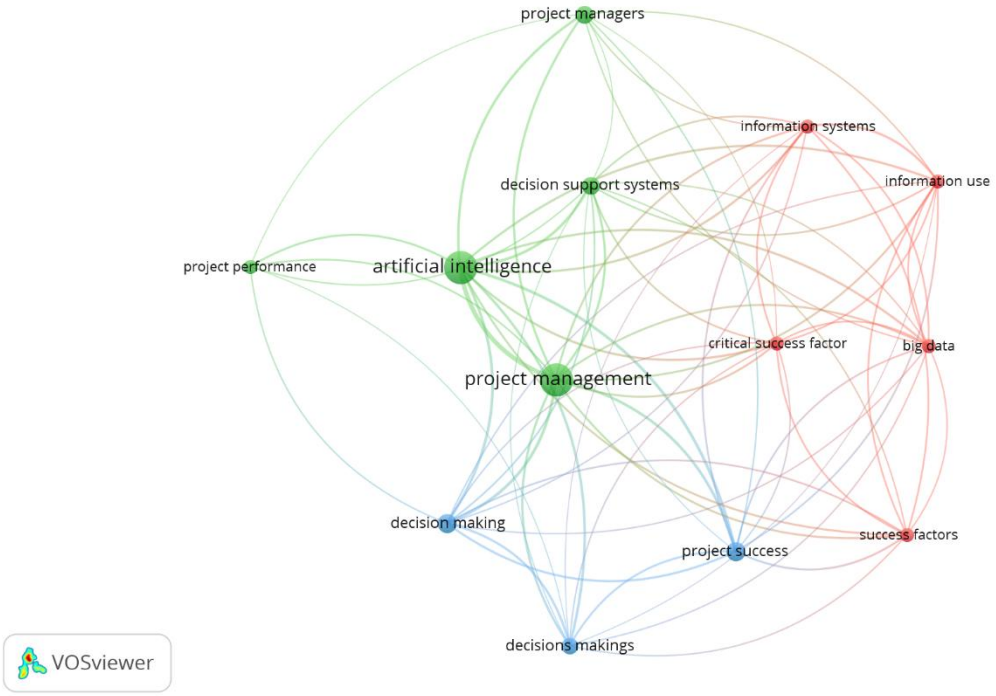

Fig. 2. Map of keyword co-occurrence for threshold 5

Source: own elaboration prepared using the VOSviewer tool.

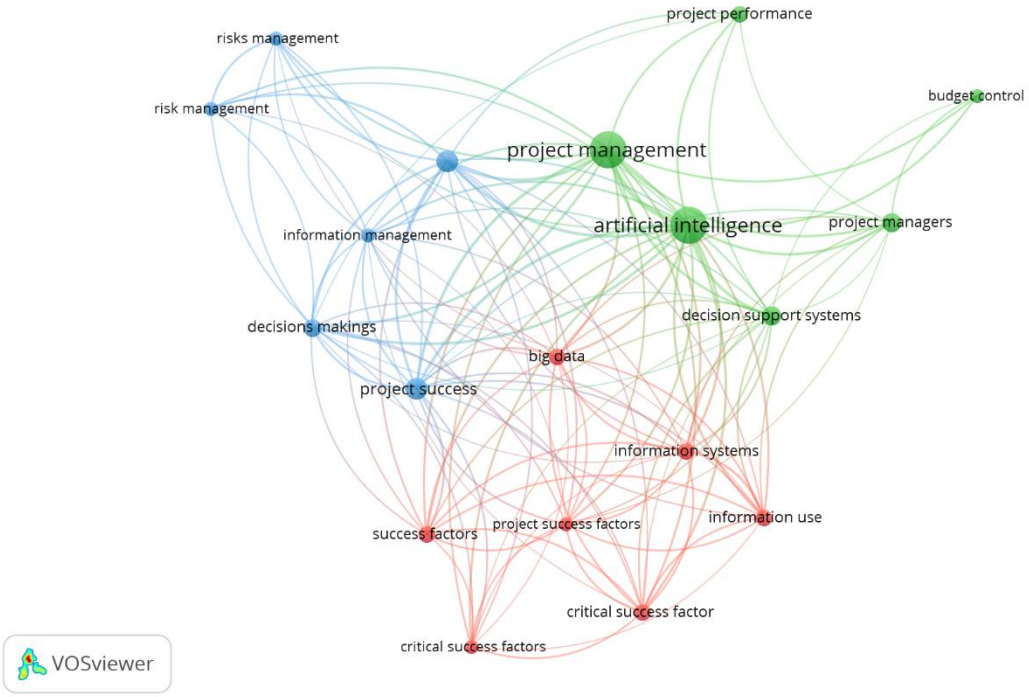

Fig. 3. Map of keyword co-occurrence for threshold 4

Source: own elaboration prepared using the VOSviewer tool.

The minimum threshold of five occurrences allowed us to identify the most established concepts in the research (13 terms), while lowering the threshold to four occurrences expanded the set of analysed keywords to 19 terms, revealing additional, less prominent themes. In both analyses, three stable thematic clusters were obtained, reflecting the main directions of AI research in the design context.

The first cluster – information technologies and project success factors – includes concepts such as big data, information systems, information use, success factors, and critical success factors. Its subject matter indicates a strong emphasis on technological and informational determinants of project success. Research in this area emphasises the role of data and information systems as an analytical foundation supporting project management processes. However, this cluster does not include direct references to the project managers' competencies, suggesting that researchers' attention is mainly on technological tools rather than their users.

The second cluster, which covers the integration of artificial intelligence with project management, includes artificial intelligence, decision support systems, project management, project managers, and project performance, and represents the mainstream of scientific literature. It focuses on integrating AI tools and systems into project management processes and analysing their impact on project effectiveness and outcomes. The emergence of the concept of project managers indicates that some research considers the role of people in the AI implementation process, yet in the analysed literature these references do not develop into a definition of AI competencies for project managers.

The third cluster, namely decision-making, risk management, and project success, covers concepts related to the decision-making process and project effectiveness, including decision-making, project success, and, in threshold 4, risk management and information management. This shows that the literature primarily viewed artificial intelligence as a tool that supports decision-making and increases the predictability of project outcomes, particularly through information and risk analysis.

A comparison of thresholds 5 and 4 indicates that the thematic structure of the literature on project manager competence in the use of artificial intelligence in project management is stable regardless of the analytical threshold adopted, as in both cases three similar clusters emerge: technological--information, integration of artificial intelligence in project management, and decision-making and risk. Threshold 5 allows to capture the core of scientific discourse, focusing on big data, information systems, project decisions, and the fundamental relationships between artificial intelligence and project management. However, lowering the threshold to 4 occurrences broadens the scope of the observed relationships, revealing additional elements, such as risk management, information management, and budget control, indicating the expanding area of AI applications in management and operational processes. Despite this expansion, neither threshold includes concepts directly related to AI competences for project managers, confirming that this area remains poorly established in the literature and requires further systematic research.

The conclusions from the bibliometric analysis indicate that research on project manager competencies in the use of artificial intelligence in project management primarily focuses on the technological and decision-making aspects of these applications, including information system integration, big data analysis, decision support tools, and their impact on project outcomes. The thematic structure of the literature consists of three stable clusters: technological and informational, integration of artificial intelligence in project management, and decision-making and risk, which appear regardless of the analytical threshold adopted. These results showed that artificial intelligence is primarily seen as a tool that supports management processes and enhances a project's predictability and effectiveness, whilst the analysis did not reveal a separate cluster related to project manager competence, and terms such as AI competency or AI literacy did not appear among the keywords. This means that the AI competence of project managers remains a marginal topic in existing research, confirming a significant research gap in understanding, measuring, and assessing the importance of AI competence for project success. It is still poorly established in the literature and requires further systematic research.

3.2. Qualitative Analysis

The qualitative analysis procedure used thematic coding. The coding framework was developed through repeated reading of selected publications and then refined with reference to concepts present in the literature on digital and professional competencies, particularly the DigComp 2.2 framework. The final analytical categories were: technological (T), cognitive (C), decision-making (D), and ethical--organisational (E) competences. Each publication was coded for the presence of one or more of these categories (Table 2). To increase coding transparency, category definitions and decision rules were applied consistently throughout the analysis. As a single researcher conducted the coding, interrater reliability was not calculated. This is recognised as a methodological limitation and a direction for future studies.

Table 2. Results of the literature analysis

Author, Year	**T** – technological competences	**C** – cognitive competences	**D** – decision-making competences	**E** – ethical--organisational competences
Costantino et al. (2015)	1	1	1	1
Hazır (2015)	1	0	1	1
Feylizadeh et al. (2018)	1	0	1	0
Miller (2018)	1	0	1	0
Dam et al. (2019)	1	1	1	1
Miller (2019)	1	0	1	0
Rakade (2020)	0	0	1	0
Kumar et al. (2021)	1	1	1	1
Miller (2021)	1	1	1	1
Müller et al. (2021)	1	1	1	1
Hanafi et al. (2022)	1	1	1	0
Maher & Alneamy (2022)	1	1	1	0
Miller (2022)	1	1	1	1
Siripurapu et al. (2022)	1	1	1	1
Zarghami & Zwikael (2022)	1	1	1	1
Bragadin et al. (2023)	1	1	1	1
Sravanthi et al. (2023)	1	1	1	1
Kozhakhmetova et al. (2024)	1	1	1	1
Rehan et al. (2024a)	1	1	1	1
Rehan et al. (2024b)	1	1	1	0
Titu et al. (2025)	1	0	1	0
Bulkrock et al. (2025)	1	0	1	0
Goyal & Gupta (2025)	1	1	1	0
Isah & Kim (2025)	1	1	1	0
Jing et al. (2025)	1	0	1	0
Okika et al. (2025)	1	1	1	1

Source: own elaboration.

The analysed literature most often describes decision-making competencies (D), which appear in all publications (26/26). AI is consistently presented as a tool supporting forecasting, scenario analysis, and risk assessment (Bulkrock et al., 2025; Costantino et al., 2015; Dam et al., 2019; Sravanthi et al., 2023). Machine learning-based systems enable the creation of more accurate predictive models (Bragadin et al., 2023; Costantino et al., 2015), which requires project managers to be able to interpret algorithmic limitations, evaluate action options, and combine AI recommendations with expert

knowledge and intuition (Kumar et al., 2021; Rakade, 2020). Across the reviewed studies, decision-making competencies were also the competence group most clearly linked to project success, mainly through more accurate forecasting, scenario evaluation, prioritisation, and risk-informed action.

Twenty-four out of 26 publications (92%) mention technological competencies (T), which include understanding machine learning and artificial intelligence tools, integrating them into project processes, and being able to oversee the quality of data used by algorithms (Hazir, 2015; Maher & Alneamy, 2022; Siripurapu et al., 2022). The research emphasises that a project manager does not need to be an algorithm developer, but must be aware of the possibilities, limitations, and technical requirements associated with implementing AI systems (Okika et al., 2025; Titu et al., 2025). In many publications, technological competencies are linked to the practical use of AI to optimise time, costs, resources, and risk identification (Kozhakhmetova et al., 2024; Sravanthi et al., 2023). In the reviewed literature, these competencies are associated with project success mainly through implementation quality, process efficiency, and the operational usability of AI tools in planning and control activities.

Cognitive competencies (C) appear in 16 publications (over 60%). They include understanding the mechanisms of algorithms, their limitations, predictive errors, and uncertainties (Miller, 2021; Siripurapu et al., 2022; Sravanthi et al., 2023). In some studies, cognitive competencies also refer to integrating AI with the emotional intelligence of the project manager or to understanding the impact of technology on human behaviour (Hanafi et al., 2022; Jing et al., 2025). Their contribution to project success is notable above all in reducing misinterpretation, strengthening critical judgement, and improving the quality of decisions made under uncertainty.

Ethical-organisational competencies (E) are mentioned in fewer publications (54%), but are an important area related to responsibility for AI implementation, data protection, model transparency, and change management (Bulkrock et al., 2025; Miller, 2021; 2022). Research highlighted the need to assess the consequences of algorithmic decisions, including potential biases, predictive errors, and the impact of automation on project teams' work (Rehan et al., 2024a). These competencies also relate to leaders' ability to adapt organisations to operate in a human-AI environment, as evidenced in research on leadership in the context of digital transformation (Rehan et al., 2024b). Although less frequently discussed, these competencies are linked to long-term project success through trust, accountability, compliance, and the social legitimacy of AI-supported project practices.

To capture the evolution of the approach to PM competencies, an analysis was conducted across three periods: 2015-2019, 2020-2022, and 2023-2025. This division allowed to determine how the representation of individual competence categories has changed and which areas have developed the fastest. A summary of the number of publications by period is presented in Figure 4, covering competences T, C, D, and E.

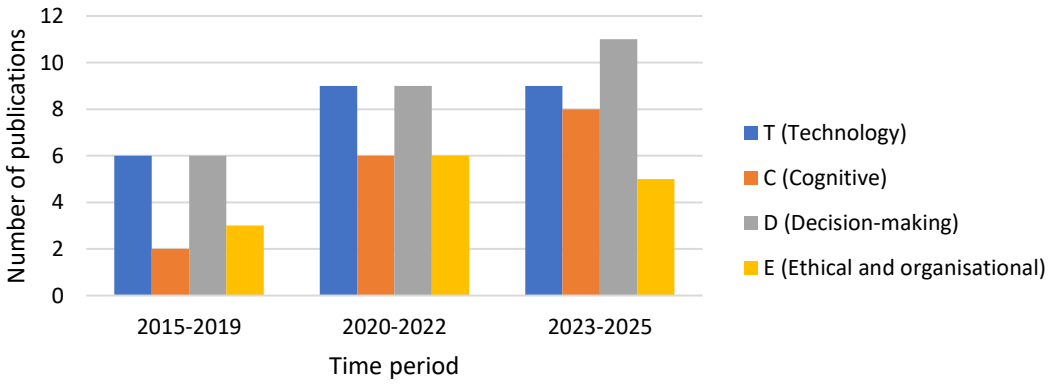

Fig. 4. Number of publications on project manager competencies in the context of AI in three time periods: 2015-2019, 2020-2022, and 2023-2025

Source: own elaboration.

The technological and decision-making aspects of AI characterised the years 2015–2019. Some studies (Costantino et al., 2015; Dam et al., 2019; Hazır, 2015) treated artificial intelligence mainly as an analytical tool supporting scheduling, risk modelling, and project selection. Cognitive and ethical--organisational competencies were marginal during this period. Themes such as responsibility for algorithmic decisions or the impact of automation on the organisation appeared only sporadically in publications (Miller, 2018; 2019). The efficiency paradigm prevailed, assuming that a project manager's competencies are reduced to interpreting model results.

In contrast, the period 2020-2022 brought an apparent increase in the maturity of AI applications and a broadening of the research perspective. The literature was shifting from a technological to an integrated approach that encompasses technical, cognitive, and organisational competencies. Miller (2021) highlighted the critical evaluation of AI results and the project manager's role in algorithmic systems, while Siripurapu et al. (2022) emphasised the need to evaluate data quality and algorithm parameters. During this period the importance of ethical-organisational competencies also increase, especially in the context of transparency, AI oversight, and the impact of automation on work culture (Hanafi et al., 2022). The concept of human-AI collaboration was also emerging, in which the project manager becomes an active partner of technology, rather than just a user.

In contrast, the period 2023-2025 represented the phase of mature AI implementations. Research focused on integration with design systems and on the analysis of the impact of algorithms on scheduling, resource allocation, and risk analysis (Bragadin et al., 2023; Goyal & Gupta, 2025; Isah & Kim, 2025; Okika et al., 2025). Decision-making skills dominate, especially those related to interpreting predictions and assessing the effects of AI-assisted decision-making (Goyal & Gupta, 2025). Cognitive competencies were strongly emphasised: critical interpretation of results, assessment of data reliability, and understanding of model limitations. Ethical-organisational competencies were less commonly mentioned, mainly appearing in publications on infrastructure and construction projects (Rehan et al., 2024a; 2024b).

To sum up, the period 2023-2025 was characterised by a pragmatic approach to AI and an increased emphasis on cognitive competencies. Technological and decision-making competencies remain central, however the project manager's role increasingly includes critical thinking, interpreting algorithms, and managing human-AI collaboration.

3.3. Summary of Results

The bibliometric and qualitative analyses yield several consistent observations regarding research on the use of artificial intelligence in project management and the role of project manager competencies. The results showed that the existing body of work focused primarily on the technological and decision--making aspects of AI applications, whereas the issue of project manager competencies, especially in the cognitive and ethical-organisational dimensions, remained less developed.

The bibliometric analysis identified three stable thematic clusters: (1) information technologies and project success factors, (2) integration of AI systems with project management processes, and (3) decision-making processes and risk management. No separate cluster referring directly to project managers' AI-related competencies was identified. The central concepts were artificial intelligence and project management, confirming the strong focus of the analysed literature on the relationship between technology and project practice. Keywords directly related to project managers' AI competencies, such as AI competency or digital competence, were not present.

The qualitative analysis of 26 publications identified four main categories of project manager competencies in the context of AI applications: technological (T), cognitive (C), decision-making (D), and ethical-organisational (E). Decision-making competencies (D) were present in all the publications (26/26), technological competencies in 24 publications (92%), cognitive competencies in 16 publications (62%), and ethical-organisational competencies in 14 publications (54%).

Decision-making competencies were mainly associated with forecasting, risk assessment, scenario analysis, and selecting action options. Technological competencies focused primarily on the ability to use AI tools and systems, work with data, and integrate algorithmic solutions into the project process. Cognitive competencies were linked to understanding the principles of model operation, conscious interpretation of results, and the assessment of the quality of data used by AI systems. Ethical-organisational competencies referred mainly to responsibility for supervising AI systems, data protection, transparency, auditability of solutions, and change management in teams working in a human-AI environment.

Across the literature, AI-related competencies were linked to project success mainly indirectly. Decision-making and technological competencies were associated most often with forecasting, risk assessment, resource allocation, and process efficiency. Cognitive competencies were connected to interpretation quality and judgement under uncertainty, whereas ethical-organisational competencies were associated with accountability, transparency, and responsible AI implementation.

4. Discussion

The dominant trend in the research is the technological perspective. The analysed publications focused mainly on the integration of AI tools and systems with design processes, the use of predictive analytics, the optimisation of time, costs, and resources, and the application of algorithms in risk assessment (Bragadin et al., 2023; Bulkrock et al., 2025; Costantino et al., 2015; Dam et al., 2019; Hazir, 2015; Kumar et al., 2021; Łukasik-Stachowiak, 2025; Sravanthi et al., 2023). In most works, AI is presented as a technology that streamlines processes and increases operational efficiency, rather than as an area that requires specific project management competencies. The results of the qualitative analysis confirmed this observation: technological competencies appeared in 92% of the publications, and decision-making competencies in 100%, while cognitive and ethical-organisational competencies were discussed far less frequently. In the reviewed literature, these competencies are associated with project success mainly through implementation quality, process efficiency, and the operational usability of AI tools in planning and control activities.

The identification of four categories of competencies: technological, cognitive, decision-making, and ethical-organisational, revealed a clear asymmetry in their representation. Technological and decision--making competences were most frequently described, reflecting the dominance of a tool-based approach and a focus on predicting disruptions, conducting scenario analysis, and providing decision support (Bragadin et al., 2023; Kumar et al., 2021; Sravanthi et al., 2023). Cognitive competencies related to understanding model operation, interpreting results, assessing data quality, and identifying algorithmic limitations were far less represented, appearing in only a few publications (Jing et al., 2025; Miller, 2021; Siripurapu et al., 2022). Ethical-organisational competencies, including AI system oversight, model transparency, data protection, and change management in teams working with algorithmic technologies (Bulkrock et al., 2025; Miller, 2022; Rehan et al., 2024a; 2024b) were even less discussed. This disproportion shows that the literature pays little attention to the project manager's role as an integrator of technology, team, and organisation.

A key finding of the review was that the relationship between AI-related competencies and project success is present in the literature, but mostly in an indirect and fragmented form. The analysed studies rarely operationalised this relationship explicitly. Instead, they suggested that project success improves when project managers can interpret algorithmic outputs, assess data quality, combine AI recommendations with contextual judgement, and oversee the responsible integration of AI into project processes. Thus, AI-related competencies do not appear as an isolated success factor, but rather as an enabling condition through which AI can contribute to project performance and broader project value.

The lack of a thematic cluster on project manager competencies in the bibliometric analysis confirmed that this area is not yet an established research stream. None of the analysed publications proposed a comprehensive model of AI PM competencies. The research focused primarily on the impact of AI tools and systems on project effectiveness, while referring much less frequently to the role of project manager competencies in implementing and applying AI systems (Rakade, 2020; Titu et al., 2025). This is particularly important because the project manager plays a key role in integrating AI systems into processes, teams, and organisational structures, especially in areas that require adaptation to technological change.

The results also indicated the need to link project managers' AI-related competencies to existing competency models. The DigComp 2.2 framework (Vuorikari et al., 2022), which covers, among other things, working with data, analysing information, digital responsibility, and cybersecurity, remains a particularly valuable reference point. Although DigComp is not a model dedicated to project managers, its assumptions corresponded well to the areas where the analysed literature revealed the most significant gaps, especially in cognitive and ethical-organisational competencies.

This article provides a foundation for further research. The identified competences were scattered and did not form a coherent structure, hence it was necessary to conduct pilot and empirical studies to verify and refine them. The study had several limitations. First, the sources was derived from two major databases and a deliberately focused search strategy, which improved the analytical precision but may have omitted related terminology and additional relevant studies. Second, the qualitative coding was conducted by a single researcher, therefore the inter-rater agreement could not be reported. These limitations should be addressed in future reviews.

The review generally showed that the literature on AI in project management remains strongly technology-oriented, while project managers' competencies are conceptualised in a fragmented manner. This confirmed the need for further empirical studies on the role of AI-related competencies in AI-enabled project environments.

5. Conclusions

This article suggests that research on the use of artificial intelligence in project management primarily focuses on the technological dimension of AI tools and systems. In contrast, the project manager's competencies are being addressed in a fragmented and insufficiently structured manner. The four groups of AI-related competencies identified in the review, namely technological, cognitive, decision-making, and ethical-organisational, provide a sound analytical basis. However, the literature does not yet offer definitions or a consistent competency framework. The uneven distribution of competencies, with a clear dominance of technological and decision-making competencies, confirms that AI competencies for project managers are still at an early stage of development.

Based on the review, three main conclusions were formulated:

1. Existing project management competency models need to be expanded to include AI-related competencies, particularly in AI literacy, understanding how algorithms work, working with data, interpreting model results, and using AI responsibly. These areas are increasingly important because they influence not only the effective use of AI tools but also decision quality, risk assessment, and other dimensions of project success. The current models (ICB 4.0, PMI Talent Triangle, APM CF) do not adequately cover these elements.
2. The DigComp 2.2 framework provides a valuable reference point for systematising and clarifying project managers' AI-related competencies. Although DigComp is not a project management framework, it covers areas particularly relevant to working with AI tools and systems, including data analysis, information interpretation, digital responsibility, and security. The gaps identified in the literature relate precisely to these areas of project manager competence.

3. Further empirical research is needed, including pilot and substantive studies, to verify the importance of individual AI-related competencies in project managers' work and to determine the extent to which these competencies influence project success and the quality of AI's use in project practice. Existing publications do not present a consistent model of AI competencies for project managers, stressing the need to conceptualise, operationalise, and validate them more systematically.

The article provides a basis for further research aimed at developing an expanded model of project managers' competencies that takes into account the growing role of artificial intelligence in project processes and embeds these competencies within a broader digital competency framework.

References

Almeida, P. M., Fernandes, G., & Santos, J. M. R. C. A. (2025). Artificial Intelligence Tools for Project Management: A Knowledge-Based Perspective. *Project Leadership and Society*, *6*, 100196. https://doi.org/10.1016/j.plas.2025.100196

Association for Project Management [APM]. (2023). *APM Competence Framework* (3rd edition). https://www.apm.org.uk/media/1cflfk3t/apm-competence-framework-3rd-editionfinalrevised.pdf

Association for Project Management [APM]. (2025). *AI Use in Project Management Nearly Doubles in Just Two Years: APM Survey Finds*. Retrieved June 24, 2026, from https://www.apm.org.uk/news/ai-use-in-project-management-nearly-doubles-in-just-two-years-apm-survey-finds/

Bento, J., Pereira, L., Gonçalves, R., Dias, Á., & Lopes da Costa, R. (2022). Artificial Intelligence in Project Management: A Systematic Literature Review. *International Journal of Technology Intelligence and Planning*, *13*(2), 143-163. https://doi.org/10.1504/ijtip.2022.126841

Bragadin, M. A., Pozzi, L., & Kähkönen, K. (2023). Multi-Objective Genetic Algorithm for the Time, Cost, and Quality Trade-Off Analysis in Construction Projects. In G. Lindahl, & S. C. Gottlieb (Eds.), *SDGs in Construction Economics and Organization* (pp. 193-207). Springer. https://doi.org/10.1007/978-3-031-25498-7_14

Bulkrock, O., BaniMustafa, A., & Qusef, A. (2025). Data-Driven Decision-Making in IT Projects: A Regression Application in Software Estimation. In *2025 International Conference on New Trends in Computing Sciences (ICTCS).* https://doi.org/10.1109/ICTCS65341.2025.10989401

Costantino, F., Di Gravio, G., & Nonino, F. (2015). Project Selection in Project Portfolio Management: An Artificial Neural Network Model Based on Critical Success Factors. *International Journal of Project Management*, *33*(8), 1744-1754. https://doi.org/10.1016/j.ijproman.2015.07.003

Craveiro, M., & Domingues, L. (2025). Artificial Intelligence on Project Management Performance Domains. *Procedia Computer Science*, *256*, 1583-1590. https://doi.org/10.1016/j.procs.2025.02.294

Dam, H. K., Tran, T., Ghose, A., Grundy, J., & Kamei, Y. (2019). Towards Effective AI-Powered Agile Project Management. In *2019 IEEE/ACM 41st International Conference on Software Engineering: New Ideas and Emerging Results (ICSE-NIER)* (pp. 41-44). https://doi.org/10.1109/ICSE-NIER.2019.00019

Feylizadeh, M. R., Mahmoudi, A., Bagherpour, M., & Li, D.-F. (2018). Project Crashing Using a Fuzzy Multi-Objective Model Considering Time, Cost, Quality, and Risk under Fast Tracking Technique: A Case Study. *Journal of Intelligent & Fuzzy Systems*, *35*(3), 3615-3631. https://doi.org/10.3233/JIFS-18171

Goyal, A., & Gupta, S. (2025). The Impact of Risk Assessment on Project Success based on a Data-Driven Approach. In *2025, the 4th International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE)* (pp. 1-7). https://doi.org/10.1109/ICDCECE65353.2025.11034967

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R Package and Shiny App for Producing PRISMA 2020-Compliant Flow Diagrams, with Interactivity for Optimised Digital Transparency and Open Synthesis. *Campbell Systematic Reviews*, *18*(2), e1230. https://doi.org/10.1002/cl2.1230

Hanafi, A. G., Nawi, M. N. M., Abdul Rahim, M. K. I., Abdul Nifa, F. A., Omar, M. F., & Mohamed, O. (2022). Project Managers Selection in the Construction Industry: Towards the Integration with Artificial Emotional Intelligence and Technology. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *29*(1), 160-176. https://doi.org/10.37934/araset.29.1.160176

Hazır, Ö. (2015). A Review of Analytical Models, Approaches, and Decision Support Tools in Project Monitoring and Control. *International Journal of Project Management*, *33*(4), 808-815. https://doi.org/10.1016/j.ijproman.2014.09.005

Hughes, L., Mavi, R. K., Aghajani, M., Fitzpatrick, K., Gunaratnege, S. M., Shekarabi, S. A. H., Hughes, R., Khanfar, A., Khatavakhotan, A., Mavi, N. K., Li, K., Mahmoud, M., Malik, T., Mutasa, S., Nafar, F., Yates, R., Alahmad, R., Jeon, I.,

& Dwivedi, Y. K. (2025). Impact of Artificial Intelligence on Project Management (PM): Multi-Expert Perspectives on Advancing Knowledge and Driving Innovation Toward PM2030. *Journal of Innovation & Knowledge*, *10*(5), 100772. https://doi.org/10.1016/j.jik.2025.100772

International Project Management Association [IPMA]. (2015). *Individual Competence Baseline for Project, Programme and Portfolio Management* (version 4.0). Retrieved June 24, 2026, from https://products.ipma.world/wp-content/uploads/2016/03/IPMA_ICB_4_0_WEB.pdf

Isah, M. A., & Kim, B.-S. (2025). Question-Answering System Powered by a Knowledge Graph and a Generative Pretrained Transformer to Support Risk Identification in Tunnel Projects. *Journal of Construction Engineering and Management*, *151*(1), 04024193. https://doi.org/10.1061/JCEMD4.COENG-15230

Jing, L., Marian, M. L., Junqi, W., Alturise, F., & Alkhalaf, S. (2025). Exploring the Association between Cultural Intelligence and Project Performance with the Mediation of Artificial Intelligence Abilities. *Journal of Organizational and End User Computing (JOEUC)*, *37*(1), 1-28. https://doi.org/10.4018/JOEUC.372070

Kozhakhmetova, A., Mamyrbayev, A., Zhidebekkyzy, A., & Bilan, S. (2024). Assessing the Impact of Artificial Intelligence on Project Efficiency Enhancement. *Knowledge and Performance Management*, *8*(2), 109-126. https://doi.org/10.21511/kpm.08(2).2024.09

Kumar, V., Pandey, A., & Singh, R. (2021). Can Artificial Intelligence be a Critical Success Factor of Construction Projects? Practitioner Perspectives. *Technology Innovation Management Review*, *11*(11-12), 17-32. https://doi.org/10.22215/timreview/1471

Łukasik-Stachowiak, K. (2025). The Use of Artificial Intelligence in Project Management. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, (217), 281-299. https://dx.doi.org/10.29119/1641-3466.2025.217.17

Maher, M., & Alneamy, J. S. (2022). An Overview of Machine Learning Approaches to Software Development Cost Estimation. In *2022 8th International Conference on Contemporary Information Technology and Mathematics (ICCITM)* (pp. 153-158). https://doi.org/10.1109/ICCITM56309.2022.10032008

Miller, G. J. (2018). Comparative Analysis of Big Data Analytics and BI Projects. In M. Ganzha, L. Maciaszek, & M. Paprzycki (Eds.), *Proceedings of the Federated Conference on Computer Science and Information Systems* (vol. 15, pp. 701-705). https://doi.org/10.15439/2018F125

Miller, G. J. (2019). Quantitative Comparison of Big Data Analytics and Business Intelligence Project Success Factors. In E. Ziemba (Eds.), *Information Technology for Management: Emerging Research and Applications* (vol. 346, pp. 53-72). Springer. https://doi.org/10.1007/978-3-030-15154-6_4

Miller, G. J. (2021). Artificial Intelligence Project Success Factors: Moral Decision-Making with Algorithms. In M. Ganzha, L. Maciaszek, M. Paprzycki, & D. Ślęzak (Eds.), *Proceedings of the 16th Conference on Computer Science and Intelligence Systems* (vol. 25, pp. 379-390). https://doi.org/10.15439/2021F26

Miller, G. J. (2022). Artificial Intelligence Project Success Factors—Beyond the Ethical Principles. In E. Ziemba, & W. Chmielarz (Eds.), *Information Technology for Management: Business and Social Issues* (vol. 442, pp. 65-96). Springer. https://doi.org/10.1007/978-3-030-98997-2_4

Müller, W., Grassinger, R., Schnebel, S., Stratmann, J., Weitzel, H., Aumann, A., Bernhard, G., Gaidetzka, M., Heiberger, L., Kreyer, I., Schmidt, C., Uhl, P., Visotschnig, M., & Widmann, J. (2021). Integration of Digital Competences into a Teacher Education Program: A Sensitive Approach. In *Proceedings of the 13th International Conference on Computer Supported Education* (vol. 1, pp. 232-242). SciTePress. https://doi.org/10.5220/0010527202320242

Okika, M. C., Vermeulen, A., & Pretorius, J. H. C. (2025). A Systematic Approach to Identify and Manage Supply Chain Risks in Construction Projects. *Journal of Financial Management of Property and Construction*, *30*(1), 42-66. https://doi.org/10.1108/JFMPC-09-2023-0057

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews. *BMJ*, *372*. https://doi.org/10.1136/bmj.n71

Project Management Institute [PMI]. (2021). *A Guide to the Project Management Body of Knowledge and the Standard for Project Management* (7th edition).

Project Management Institute [PMI]. (2024). *Artificial Intelligence and Project Management: A Global Chapter-Led Survey 2024*. Retrieved June 24, 2026, from https://www.pmi.org/-/media/pmi/documents/public/pdf/artificial-intelligence/community-led-ai-and-project-management-report.pdf

Rakade, T. (2020). To Study the Emerging Trends in Project Management: AI in Project Management and Emotional Intelligence, and to Assess Their Effects in the Industry. In H. Keathley, J. Enos, & M. Parrish (Eds.), *Proceedings of the*

American Society for Engineering Management 2020 International Annual Conference (pp. 1-6). American Society for Engineering Management.

Rehan, A., Thorpe, D., & Heravi, A. (2024a). A Framework for Leadership Practices and Communication in the Context of the Construction Sector. *Project Leadership and Society*, *5*, 100142. https://doi.org/10.1016/j.plas.2024.100142

Rehan, A., Thorpe, D., & Heravi, A. (2024b). Project Manager's Leadership Behavioural Practices: A Systematic Literature Review. *Asia Pacific Management Review*, *29*(2), 165-178. https://doi.org/10.1016/j.apmrv.2023.12.005

Singla, A., Sukharevsky, A., Yee, L., Chui, M., Hall, B., & Balakrishnan, T. (2025a). *The State of AI in 2025: Agents, Innovation, and Transformation*. McKinsey & Company.

Singla, A., Sukharevsky, A., Yee, L., Chui, M., & Hall, B. (2025b). The *State of AI: How Organisations Are Rewiring to Capture Value*. McKinsey & Company.

Siripurapu, A., Nowpada, R. S., & Rao, K. S. (2022). Improving Dijkstra's Algorithm for Estimating Project Characteristics and Critical Path. *Reliability: Theory & Applications*, *17*(4(71), 65-73. https://doi.org/10.24412/1932-2321-2022-471-65-73

Sravanthi, J., Sobti, R., Semwal, A., Shravan, M., Al-Hilali, A. A., & Bader Alazzam, M. (2023). AI-Assisted Resource Allocation in Project Management. In *2023, the 3rd International Conference on Advanced Computing and Innovative Technologies in Engineering (ICACITE)* (pp. 70-74). https://doi.org/10.1109/ICACITE57410.2023.10182760

Titu, A. M., Pană, M. M., & Moldoveanu, A. M. (2025). The Impact of Artificial Intelligence in the Project Manager Role. In D. Cavallucci, S. Brad, & P. Livotov (Eds.), *World Conference of AI-Powered Innovation and Inventive Design* (vol. 736). Springer. https://doi.org/10.1007/978-3-031-75923-9_27

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens: With New Examples of Knowledge, Skills, and Attitudes*. Publications Office of the European Union. https://doi.org/10.2760/115376

Zarghami, S. A., & Zwikael, O. (2022). Measuring Project Resilience: Learning from the Past to Enhance Decision Making in the Face of Disruption. *Decision Support Systems*, *160*, 113831. https://doi.org/10.1016/j.dss.2022.113831

Kompetencje sztucznej inteligencji a sukces projektu – analiza trendów badawczych

Streszczenie

Cel: Celem artykułu jest systematyczna analiza literatury dotyczącej kompetencji kierowników projektów związanych ze sztuczną inteligencją (AI) oraz ocena, w jaki sposób kompetencje te są ujmowane w kontekście zarządzania projektami.

Metodyka: Badanie przeprowadzono zgodnie z metodyką PRISMA 2020, wykorzystując analizę bibliometryczną (VOSviewer) oraz jakościową analizę treści. Do analizy bibliometrycznej włączono 38 publikacji, a jakościowej – 26 prac, zakodowanych w czterech kategoriach kompetencji: technologicznych, poznawczych, decyzyjnych i etyczno-organizacyjnych.

Wyniki: Literatura koncentruje się głównie na technologicznym wymiarze AI, a kompetencje kierowników projektów są opisywane marginalnie i niespójnie. Dominują kompetencje technologiczne i decyzyjne, natomiast poznawcze i etyczno-organizacyjne pozostają słabo rozwinięte, a spójny model AI kierownika projektu nie istnieje.

Implikacje i rekomendacje: Modele kompetencji kierowników projektów wymagają rozszerzenia o elementy AI, w kompetencje rozumienia AI, pracę z danymi, decyzje wspierane algorytmicznie i etykę technologii. Ramy DigComp 2.2 mogą wspierać ich uporządkowanie.

Oryginalność/wartość: Artykuł prezentuje lukę między rosnącą rolą AI a obecnymi modelami kompetencji kierowników projektów oraz wyznacza kierunki dalszych badań.

Słowa kluczowe: sztuczna inteligencja, zarządzanie projektami, kompetencje kierowników projektów, kompetencje cyfrowe