

Digital Transformation and Management in the Industry 4.0 Era

Muhammad Faisal¹, Uray Andrey Indra Maulana², Rizki Fakhrol Yahya³, Rina Mayasafitri⁴,
Muhammad Zalviwan⁵

^{1,2,3,4,5} Universitas Panca Bhakti Pontianak, Indonesia

ARTICLE INFO

Keywords:

Digital
Transformation,
Management
Management,
Industry 4.0,
Digitalization,
Modern
Management.

Article history:

Received 2026-05-14

Revised 2026-06-12

Accepted 2026-07-24

ABSTRACT

The fourth industrial revolution is marked by the implementation of cyber-physical systems, the Internet of Things, big data analytics, and Artificial Intelligence which fundamentally changed the way organizations operate, make decisions, and manage human resources. The purpose of this study is to analyze the impact of digital transformation on management management on the dimensions of organizational structure, data-driven decision-making, human resource management, business process efficiency, and leadership. The method used was a systematic literature review of 20 international and national indexed journal references for the 2021–2026 period which were purposively selected. The results show that digital transformation is driving an organizational paradigm shift from hierarchical structures to collaborative networks, from intuitive to evidence-based decision-making, as well as from conventional HR management to digital HR with the integration of AI and big data analytics. The results of the NewVantage Partners report referenced by Berndtsson et al. (Berndtsson et al., 2023) show that only 19.3% of Fortune 1000 companies have successfully built a data-driven culture, while non-technical barriers account for 91.9% of the overall data-driven transformation challenges. The conclusions of the study show that the success of digital transformation in management management depends not only on the adoption of technology, but also on the readiness of the organization's culture, digital leadership, and the dynamic capabilities of human resources

This is an open access article under the CC BY SA license.



Corresponding Author:

Muhammad Faisal

Universitas Panca Bhakti Pontianak, Indonesia; m.faisal@upb.ac.id

1. INTRODUCTION

The development of digital technology has entered a new chapter marked by the Fourth Industrial Revolution or *Industry 4.0*. This era was marked by the integration of physical, digital, and biological technologies that gave birth to the concept of *cyber-physical systems* as the core of the transformation, along with the Internet of Things, big data analytics, and Artificial Intelligence. Dafflon, Moalla, and Ouzrout explain that CPS is a key component of Industry 4.0 that enables integration between the physical and cyber worlds through the connectivity of sensors, actuators, and computing systems (Dafflon et al., 2021).

The successful implementation of CPS requires transformation at the level of business processes, operating models, and organizational structures, so Industry 4.0 is a systemic change that goes beyond technology issues alone (Dafflon et al., 2021).

Key characteristics of Industry 4.0 include CPS interoperability, transparency of information through digital copies of the physical world, technical assistance based on real-time data analysis, and decentralization of decision-making. These characteristics collectively change the way organizations design, produce, and distribute products and services (Dafflon et al., 2021). In terms of organization, these changes require adaptation to a more flexible structure, collaborative culture, and HR competencies that are relevant to the digital era.

Digital transformation in the context of management management is becoming increasingly urgent for three main reasons. First, the complexity of the modern business environment requires the speed and precision of decision-making that only data-driven systems can meet. Second, stakeholders' expectations for personalized, fast, and transparent services are increasing along with the adoption of digital technology by the wider community. Third, global competition demands that organizations continue to innovate through the integration of digital technology into every management function.

Mihu, Pitic, and Bayraktar identified four main *drivers* of digital transformation, namely the rapid development of digital technologies, changing customer expectations, global competitive pressures, and the need for operational efficiency (Mihu et al., 2023). These four *drivers* directly or indirectly change the role of management in the organization, starting from planning, organizing, directing, to control. This change was then further accelerated by the impact of the Covid-19 pandemic which encouraged digital acceleration in various sectors.

In Indonesia, the urgency of digital transformation is increasingly real, especially in the MSME segment which is the backbone of the national economy. Research by Kurniawati et al. shows that the digital transformation of Indonesian MSMEs occurred massively during the Covid-19 pandemic, although they still face challenges in the form of limited facilities, infrastructure, and the quality of human resources (Kurniawati et al., 2021). Sijabat added that the practice of business digitalization accompanied by knowledge management significantly affects the performance of MSMEs in Indonesia (Sijabat, 2022). Wati and Rajuddin also emphasized that digital transformation driven by AI, IoT, big data, and cloud computing is significantly affecting business management in Indonesia (Wati & Rajuddin, 2025).

Based on this description, this study considers it important to conduct a systematic study on the influence of digital transformation on management management in the Industry 4.0 era. This study is expected to make a theoretical contribution and practical implications for the development of management science and organizational adaptation in the digital era.

2. METHODS

This study uses a qualitative approach with a systematic literature review design. The SLR approach was chosen because it is suitable for identifying, evaluating, and synthesizing empirical evidence from various previous studies that are relevant to the topic of digital transformation and management management in the Industry 4.0 era. SLR allows researchers to build a comprehensive narrative based on strong and structured evidence.

The data sources in this study are scientific journal articles published internationally and nationally, with the following inclusion criteria: published between 2021 and 2026 indexed by reputable international databases such as Scopus or Web of Science, or indexed by SINTA for Indonesian national journals discussing the topic of digital transformation, Industry 4.0, management management, or a combination of these three topics, and can be accessed online. The primary data sources include 20 journal articles that were purposively selected based on topic relevance and methodological quality. These articles include international journals published by MDPI, Springer, Emerald, and Frontiers, as well as Indonesian national journals indexed by SINTA. All sources can be found through a search on Google Scholar using specific keywords according to the research topic.

The data collection technique is carried out through two main stages, namely:

Stage 1: Identification and Search of Literature.

The literature search was conducted using keywords such as "digital transformation", "Industry 4.0", "management", "digitalization", "digital leadership", "human resource management", "data-driven decision making", "digital organizational culture", and its variations in Indonesian such as "digital transformation", "management management", and "Industry 4.0". The search was conducted on the Scopus, Web of Science, Google Scholar, and SINTA databases.

Stage 2: Literature Selection and Evaluation.

The selection is carried out based on the inclusion criteria that have been set. Each article that passed the selection was evaluated in terms of methodological quality using a critical appraisal instrument that was adjusted to the research design of each article. The selection process follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure transparency and reproducibility.

The data analysis technique used in this study is thematic analysis. The analysis process is carried out through the following stages: Data familiarization by reading all articles carefully; Identify codes that are relevant to the research topic; Grouping of codes into main themes based on the management dimensions studied; Theme review to ensure consistency and coherence; and Writing a synthesis report that connects the findings with the research objectives. The analysis dimension includes five main themes: (a) the impact of digital transformation on organizational structure, (b) its impact on data-driven decision-making, (c) its impact on HR management, (d) its impact on business process efficiency and innovation, and (e) digital leadership 4.0.

3. RESULTS AND DISCUSSION

Literature Source Profile

Based on the selection results, as many as 20 journal articles were identified in accordance with the research inclusion criteria. Of the total articles, 14 articles came from international journals published in English, while the other 6 articles came from Indonesian national journals. All articles have topics relevant to the research theme, namely digital transformation, management management, and Industry 4.0. The year of publication range is 2021 to 2025, with the year distribution as follows: 4 articles in 2021, 3 articles in 2022, 5 articles in 2023, 5 articles in 2024, and 3 articles in 2025.

Implementation of Digital Transformation

The implementation of digital transformation in organizations in the Industry 4.0 era takes place gradually. Dafflon et al. explain that the CPS implementation process starts from simple connectivity to full integration between physical and cyber systems (Dafflon et al., 2021). The implementation stages include: digitization of manual processes into electronics, integration of systems through digital platforms, application of data analytics for decision-making, and implementation of CPS that enables real-time interaction between machines and information systems.

Trenerry et al. identified that an organization's readiness for digital transformation is influenced by multi-level factors, namely: individual factors (digital skills, psychological readiness), organizational factors (digital culture, structure, strategy), and environmental factors (regulations, infrastructure, business ecosystem) (Trenerry et al., 2021). These three factors interact with each other and determine the speed and success of the implementation of digital transformation.

In Indonesia, the implementation of digital transformation shows significant variation between sectors and organizational scales. Kurniawati et al. found that MSMEs in Indonesia accelerated digital transformation during the Covid-19 pandemic, but still faced obstacles in the form of high investment costs, limited infrastructure, and a lack of human resources with digital competence (Kurniawati et al., 2021). This condition is different from large companies that generally have more resources to invest in digital technology.

Rahmadyah and Aslami emphasized the importance of a structured change management strategy to facilitate the effective implementation of digital transformation (Rahmadyah & Aslami, 2022).

Without a good change strategy, investment in digital technology will not produce optimal impact due to resistance from employees and lack of organizational readiness.

The Influence of Digital Transformation on Management Management

Digital transformation is driving significant changes to organizational structures. Ammirato et al. found through a review of 566 articles that one of the main pillars of HRM research in the Industry 4.0 era is organizational aspects that include changes in work design, organizational structure, and work processes (Ammirato et al., 2023). This change takes place from a hierarchical and functional structure to a more flexible and adaptive network structure.

Cetindamar and Phaal explain that digital technology allows organizations to operate with a more flat structure, as a number of coordinating functions previously performed by midfield managers can now be performed by information systems (Cetindamar & Phaal, 2021). This allows for faster decision-making and employee empowerment at different levels of the organization. Trenerry et al. added that changes in organizational structure due to digital transformation also include the transformation of work models, including the implementation of hybrid work, remote work, and the use of digital collaboration technology (Trenerry et al., 2021).

One of the most significant impacts of digital transformation on management management is the shift from intuitive decision-making to data-driven decision-making. Szukits and Móricz show that analytical culture plays an important role in realizing data-driven decision-making (Szukits & Móricz, 2023). This study found that analytical culture is not easy to build, but once it is built, it will become a competitive force that supports organizational performance.

Szukits and Móricz explain that to benefit from business analytics, top-level management must be open to putting data ahead of intuition and prior knowledge (Szukits & Móricz, 2023). The results of this research also found that business analytics tools and techniques form an evidence-based decision-making culture that also touches organizational structures, roles, and processes (Szukits & Móricz, 2023).

It is important to note that the results of Berndtsson et al.'s research citing the 2022 NewVantage Partners report show that only 19.3% of Fortune 1000 companies have successfully built a data-driven culture, while 26.5% of companies have successfully become data-driven organizations (Berndtsson et al., 2023). Furthermore, the main obstacles stem from non-technical factors that account for 91.9% of the overall challenges, such as lack of understanding, limited skills, lack of management support, and lack of supporting strategies (Berndtsson et al., 2023). These findings confirm that investments in analytics technology and data infrastructure do not automatically result in data-driven decisions; A commensurate investment in organizational culture and human capacity is required.

Digital transformation fundamentally changes the practice of human resource management. Ammirato et al. found that the second pillar in HRM research in the Industry 4.0 era is the human-centric aspect, which emphasizes the importance of developing digital competencies, employee well-being, and a balance between automation and the human dimension (Ammirato et al., 2023). This approach ensures that technology does not replace humans, but rather increases human capacity.

Dwivedi and Gupta explained that the integration of technologies such as AI, machine learning, IoT, and big data analytics is the main focus in the study of HRM transformation in the Industry 4.0 era (Dwivedi & Gupta, 2024). This technology significantly improves the process of recruitment, onboarding, performance management, and employee development. AI-driven tools in particular have been shown to improve the efficiency and accuracy of candidate selection, while big data analytics provide deeper insights into employee performance and organizational health (Dwivedi & Gupta, 2024).

Umasankar et al. conducted an empirical study and found that digitizing HR through AI improves the quality of strategic decisions and operational efficiency (Umasankar et al., 2023). These results support the findings of Ammirato et al. that digital technology is not just a tool, but a catalyst for change in HRM practices (Ammirato et al., 2023).

Amalia added that the change in the HRM paradigm due to the digital revolution includes a shift in focus from administration to strategic direction, from paper-based recruitment to data-driven recruitment, and from conventional training to simulation-based and AI-based training (Amalia, 2024). Cark emphasizes that an effective digital HRM strategy requires integration between technology adoption and a human-centric approach that prioritizes employee well-being (Cark, 2024).

Digital transformation directly affects the efficiency and innovation of business processes. Schneider et al. show that organizational dynamic capabilities mediate the relationship between digital transformation and organizational performance through improved business models and process efficiency (Schneider et al., 2023). These results show that digital transformation needs to be accompanied by changes in business models and organizational processes in order to have an optimal positive impact.

Pradana et al. found that digital organizational culture, characterized by openness to change, collaboration, and experimentation, has a positive influence on company performance (Pradana et al., 2022). This digital culture is the main supporter in streamlining business processes and encouraging sustainable innovation (Pradana et al., 2022).

In the context of MSMEs, Mardiana et al. show that the implementation of digital transformation and AI as an innovation can improve the operational efficiency of MSMEs, especially in terms of supply chain management, digital marketing, and customer service (Mardiana et al., 2024). Sijabat added that business digitalization combined with good knowledge management practices has resulted in a significant increase in MSME performance (Sijabat, 2022).

Based on the results of a synthesis of 20 references, the positive impact of digital transformation on management management includes: increasing the speed and accuracy of decision-making through data analytics; increased operational efficiency through business process automation; human resource empowerment through access to information and digital collaboration; increased innovation through data-driven experimentation; and increased organizational competitiveness through faster adaptation to market changes.

In the dimension of organizational structure, the main positive impact is in the form of a more flexible, flat, and adaptive organization (Ammirato et al., 2023; Cetindamar & Phaal, 2021). In the HR dimension, digital transformation allows for more accurate recruitment, more personalized development, and more data-driven performance evaluations (Dwivedi & Gupta, 2024; Umasankar et al., 2023). In the business process dimension, automation and system integration result in reduced operational costs and improved service quality (Pradana et al., 2022; Schneider et al., 2023).

Despite having a significant positive impact, digital transformation also faces various challenges. The results of the study show the main challenges in the form of: resistance to change from employees and management; limitations of digital skills among human resources; high initial investment costs, especially for MSMEs; concerns related to data security and privacy; the digital divide between organizations; and the speed of regulatory adaptation that often lags behind technological developments.

Berndtsson et al. point out that 91.9% of digital transformation challenges are non-technical, so investment in the human and cultural aspects of the organization is just as important as investment in technology (Berndtsson et al., 2023). These findings confirm that digital transformation approaches that focus too much on technological aspects without paying attention to the human and cultural dimensions are less likely to succeed.

Haleem et al. found that failure to build an effective Leadership 4.0 is one of the main causes of digital transformation failure (Haleem et al., 2024). Leaders who lack the emotional, cognitive, and ability to manage human-machine interactions will struggle to lead digital transformation effectively.

Rahmadyah and Aslami added that change management challenges that occur during digital transformation are often the main obstacles to successful implementation (Rahmadyah & Aslami, 2022). Without a good change management strategy, organizations will struggle to integrate new technologies with existing business processes.

Practical and Theoretical Implications

Theoretical Implications: This study contributes to the management literature by presenting a comprehensive synthesis of the impact of digital transformation on management management. The integration of the concepts of Dynamic Capabilities, Data-Driven Decision Making, and Leadership 4.0 in one analytical framework adds to the theoretical understanding of how digital technology is systematically changing management practices.

Practical Implications: This study provides guidance for organizations to design a comprehensive digital transformation strategy, encompassing technology investment, HR development, organizational structure changes, and digital culture development. For MSMEs in Indonesia, the results show the need for a phased approach and ecosystem support to accelerate digital transformation.

4. CONCLUSION

Based on the results of a systematic study of 20 journal references for the 2021–2026 period, it can be concluded that: Digital transformation fundamentally changes the organizational structure in management management, from a rigid hierarchical structure to a network structure that is more flexible, flat, and adaptive to environmental changes (Ammirato et al., 2023; Cetindamar & Phaal, 2021; Trenerry et al., 2021). Digital transformation drives data-driven decision-making in management, but the success of its implementation is highly dependent on the organization's analytical culture (Szukits & Móricz, 2023). Only a small percentage of companies have managed to build a data-driven culture (Berndtsson et al., 2023), which shows that investing in the human and cultural aspects is just as important as investing in technology.

Digital transformation is changing the practices of human resource management, from a conventional approach to digitalization that integrates AI, IoT, and big data analytics in the process of recruitment, development, and performance evaluation (Amalia, 2024; Ammirato et al., 2023; Dwivedi & Gupta, 2024; Umasankar et al., 2023). A human-centric approach remains essential so that technology does not replace the human dimension (Cark, 2024). Digital transformation improves the efficiency and innovation of business processes in management management, particularly through automation, system integration, and data-driven experimentation (Pradana et al., 2022; Schneider et al., 2023). Organizational dynamic capabilities play an important role as an important mediator in the relationship between digital transformation and organizational performance. Digital leadership 4.0 is a critical factor in determining the success of digital transformation in management (Haleem et al., 2024). Leaders who have emotional intelligence, cognitive readiness, agility, and collaboration are needed to lead organizations in the digital age.

REFERENCES

- Amalia, M. R. (2024). The Impact of Digital Era 4.0 Transformation on Human Resources Management. *Management Studies and Business Journal (PRODUCTIVITY)*, 1(1), 89–98. <https://doi.org/10.62207/9btfqx28>
- Ammirato, S., Felicetti, A. M., Linzalone, R., Corvello, V., & Kumar, S. (2023). Still our most important asset: A systematic review on human resource management in the midst of the fourth industrial revolution. *Econstor (Econstor)*, 8(3), 100403–100403. <https://doi.org/10.1016/j.jik.2023.100403>
- Berndtsson, M., Jonsson, A., Carlsson, M., & Svahn, T. (2023). A Strategy for Scaling Advanced Analytics. *University Library of Skövde (University of Skövde)*, 66(12), 29–31. <https://doi.org/10.1145/3582075>
- Cark, Ö. (2024). Digital Human Resources Management Strategy. In *Advances in business strategy and competitive advantage book series* (pp. 207–220). IGI Global. <https://doi.org/10.4018/979-8-3693-3743-1.ch010>
- Cetindamar, D., & Phaal, R. (2021). Technology Management in the Age of Digital Technologies. *UTS ePRESS (University of Technology Sydney)*, 70(7), 2507–2515. <https://doi.org/10.1109/tem.2021.3101196>

- Dafflon, B., Moalla, N., & Ouzrout, Y. (2021). The challenges, approaches, and used techniques of CPS for manufacturing in Industry 4.0: a literature review. *The International Journal of Advanced Manufacturing Technology*, 113, 2395–2412. <https://doi.org/10.1007/s00170-020-06572-4>
- Dwivedi, P., & Gupta, L. S. (2024). Revolutionizing Human Resource: Leveraging Industry 4.0 Technologies for Enhanced Performance and Engagement. *International Journal of Innovative Science and Research Technology (IJISRT)*, 686–691. <https://doi.org/10.38124/ijisrt/ijisrt24jul380>
- Haleem, A., Javaid, M., & Singh, R. P. (2024). Perspective of leadership 4.0 in the era of fourth industrial revolution: A comprehensive view. *Journal of Industrial Safety*, 1(1), 100006–100006. <https://doi.org/10.1016/j.jinse.2024.100006>
- Kurniawati, E., Idris, I., Handayati, P., & Osman, S. (2021). Digital transformation of MSMEs in Indonesia during the pandemic. *Journal of Entrepreneurship and Sustainability Issues*, 9(2), 316–331. [https://doi.org/10.9770/jesi.2021.9.2\(21\)](https://doi.org/10.9770/jesi.2021.9.2(21))
- Mardiana, R., Fahdillah, Y., Kadar, M., Hassandi, I., & Mandasari, R. (2024). Implementasi Transformasi Digital dan Kecerdasan Buatan Sebagai Inovasi Untuk UMKM pada Era Revolusi Industri 4.0. *Jurnal Ilmiah Manajemen Dan Kewirausahaan (JUMANAGE)*, 3(1). <https://doi.org/10.33998/jumanage.2024.3.1.1552>
- Mihu, C., Pitic, A. G., & Bayraktar, D. (2023). Drivers of Digital Transformation and their Impact on Organizational Management. *Studies in Business and Economics*, 18(1), 149–170. <https://doi.org/10.2478/sbe-2023-0009>
- Monge, M. E. C., & Soriano, D. R. (2023). The role of digitalization in business and management: a systematic literature review. *Review of Managerial Science*, 18(2), 449–491. <https://doi.org/10.1007/s11846-023-00647-8>
- Pradana, M., Silvianita, A., Syarifuddin, S., & Renaldi, R. (2022). The Implication of Digital Organisational Culture on Firm Performance. *Frontiers in Psychology*, 13, 840699–840699. <https://doi.org/10.3389/fpsyg.2022.840699>
- Puhovichová, D., & Jankelová, N. (2021). Leadership in Conditions of Industry 4.0. *SHS Web of Conferences*, 115, 3013–3013. <https://doi.org/10.1051/shsconf/202111503013>
- Rahmadyah, N., & Aslami, N. (2022). Strategi Manajemen perubahan perusahaan di era transformasi digital. *JEBDEKER Jurnal Ekonomi Manajemen Akuntansi Bisnis Digital Ekonomi Kreatif Entrepreneur*, 2(2), 78–83. <https://doi.org/10.56456/jebdeker.v2i2.117>
- Schneider, M., Kanbach, D. K., Kraus, S., & Dabić, M. (2023). Transform Me If You Can: Leveraging Dynamic Capabilities to Manage Digital Transformation. *IEEE Transactions on Engineering Management*, 71, 9094–9108. <https://doi.org/10.1109/tem.2023.3319406>
- Sijabat, R. (2022). The Effects of Business Digitalization and Knowledge Management Practices on Business Performance: Findings from Indonesian Micro, Small, and Medium Enterprises. *BISNIS & BIROKRASI Jurnal Ilmu Administrasi Dan Organisasi*, 29(2). <https://doi.org/10.20476/jbb.v29i2.1350>
- Szukits, Á., & Móricz, P. (2023). Towards data-driven decision making: the role of analytical culture and centralization efforts. *Review of Managerial Science*, 18(10), 2849–2887. <https://doi.org/10.1007/s11846-023-00694-1>
- Trenerry, B., Chng, S., Wang, Y., Suhaila, Z. S., Lim, S. S., Lu, H., & Oh, P. H. (2021). Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors. *Frontiers in Psychology*, 12, 620766–620766. <https://doi.org/10.3389/fpsyg.2021.620766>
- Umasankar, M., Subramanian, P., Srivastava, S., & Dwivedi, A. (2023). A study of Artificial Intelligence impacts on Human Resource Digitalization in Industry 4.0. *Decision Analytics Journal*, 7, 100249–100249. <https://doi.org/10.1016/j.dajour.2023.100249>
- Wati, K. L., & Rajuddin, W. O. N. (2025). Transformasi Digital Dalam Manajemen Bisnis: Tantangan Dan Peluang Di Era Industri 4.0. *Jurnal Ekonomi dan Bisnis*, 5(1), 206–213. <https://doi.org/10.56145/ekobis.v5i1.317>