Journal of Contemporary Administration and Management (ADMAN)
ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

A Comprehensive Analysis of Optimizing the Role of Artificial Intelligence-Based Management Information Systems in Driving Digital Transformation and Enhancing Organizational Performance in the Industry 4.0 Era

L. Happy Amira S[1*], Rokhadi[2], Hariyanti[3], Heri Tugas Setyawati[4], Sukistanto[5]

[1-5]Sekolah Tinggi Ilmu Ekonomi Muhammadiyah Tuban, Jawa Timur, Indonesia

Email: happyamira84@gmail.com[1], rokhadi1010@gmail.com[2], hariyantidarmawan@gmail.com[3], ayi_tugas64@gmail.com[4], sukistanto777@gmail.com[5]

Abstract. This study aims to comprehensively analyze the role of Artificial Intelligence (AI)-based Management Information Systems (MIS) in supporting digital transformation and enhancing organizational performance in the Industry 4.0 era. A qualitative literature review with descriptive analysis was employed, using data sourced from 19 articles selected via Google Scholar from 2014–2024. The findings reveal that AI-based MIS significantly contribute to improving operational efficiency, supporting strategic decision-making, and fostering innovation. Case studies on PT Astra International Tbk, Bank BRI, and Tokopedia illustrate how AI implementation can optimize business processes and enhance organizational competitiveness. However, adopting this technology faces challenges such as infrastructure limitations, digital literacy gaps, and high implementation costs, particularly for SMEs. The study's implications include recommendations for organizations to prioritize infrastructure readiness and human resource development, as well as the importance of cross-sector collaboration to promote inclusive and sustainable digital transformation. This research provides theoretical contributions to the literature on AI's role in MIS and practical guidance for technology implementation across various sectors.

Keywords: Management Information Systems, Artificial Intelligence, Digital Transformation, Organizational Performance, Industry 4.0

1. Introduction

The Industry 4.0 era has revolutionized the business and organizational landscape through the integration of advanced technologies such as the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI) [1]. In this context, information technology plays a critical role in enabling more effective decision-making, operational efficiency, and sustainable innovation. One of the increasingly popular technological implementations is AI-based Management Information Systems (MIS), designed to optimize business processes and provide strategic insights through real-time data analysis. In this increasingly complex landscape, organizations across sectors face pressure to adopt such systems to maintain competitiveness in a dynamic global market.

AI-based MIS offer unique capabilities in processing data automatically, predicting market trends, and identifying new business opportunities [2]. These advantages provide organizations with speed and accuracy that were previously unattainable with traditional methods. Moreover, AI-powered MIS can detect operational risks and propose proactive solutions through machine learning and intelligent algorithms. Digital transformation driven by AI integration has become a strategic choice and necessity to support organizational sustainability and growth in the modern era.

However, implementing this technology also presents challenges, such as the need for advanced technological infrastructure, human resource readiness, and stricter data security measures. Many organizations in developing countries, including Indonesia, face significant digital divides that hinder their ability to fully harness the potential of AI-based MIS. Therefore, a comprehensive implementation strategy that includes

Journal of Contemporary Administration and Management (ADMAN)
ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

employee training, technology investment, and cross-sector collaboration is essential to ensure the successful adoption of these systems.

In Indonesia, digital transformation has become a national agenda through various government initiatives such as Making Indonesia 4.0 and the launch of Smart City programs. Numerous organizations, both in the public and private sectors, have begun integrating AI-based technologies into their operations. For instance, major companies like Gojek and Tokopedia have leveraged AI to manage large-scale operations and provide more personalized customer services. However, SMEs, the backbone of Indonesia's economy, often lag in this transformation due to limited resources [3].

The enhancement of organizational performance through AI-based MIS can be assessed from various aspects, such as operational efficiency, productivity improvement, and innovation capabilities. Previous studies indicate that organizations successfully integrating AI-based MIS can significantly improve operational efficiency and reduce costs [4]. However, another emerging challenge is how organizations can adjust their management structures to support the adoption of this technology, particularly in terms of data-driven decision-making.

Furthermore, existing literature demonstrates that adopting AI in MIS positively correlates with strategic decision-making [5]. AI facilitates faster data collection and deeper analysis, providing substantial competitive advantages. However, there is an urgent need to develop more inclusive and ethical policies regarding AI use, especially in terms of data privacy and its impact on human employment. Further research is required to explore how AI-based MIS can be optimally utilized without compromising human values and sustainability.

In this framework, understanding how this technology can be integrated into organizations while considering internal and external factors is crucial. Internal factors include organizational culture, digital literacy levels, and organizational structures, while external factors encompass government regulations, industry competition, and market demand. An in-depth analysis of these factors can help organizations design more effective strategies to adopt and manage AI-based MIS in achieving their strategic goals.

Thus, this study aims to comprehensively analyze how optimizing the role of AI-based MIS can drive digital transformation and enhance organizational performance. Using a literature review approach, this research seeks to provide deep theoretical insights and practical recommendations for organizations aiming to effectively leverage this technology to address challenges and seize opportunities in the Industry 4.0 era.

1.1. Management Information Systems (MIS)

Management Information Systems (MIS) is a framework that integrates information technology, human resources, and business processes to support the collection, storage, processing, and distribution of information within an organization [6]. The primary goal of MIS is to enhance operational efficiency, enable data-driven decision-making, and provide strategic insights to management. MIS encompasses not only software and hardware but also the procedures and policies that guide how information is managed. In the modern context, MIS has evolved to leverage technologies such as cloud computing and data analytics to deliver more responsive solutions to business needs.

1.2. Artificial Intelligence (AI)

Artificial Intelligence (AI) is a branch of technology that enables computer systems to simulate human intelligence, including capabilities such as learning (machine learning), understanding natural language, recognizing patterns, and making autonomous decisions [7]. In organizations, AI is employed to boost operational efficiency through process automation, big data analysis, and algorithm-based decision-making. Applications include chatbots for customer service, predictive analytics for inventory management, and recommendation systems for marketing. AI not only accelerates workflows but also creates new opportunities for innovation across various industries.

1.3. Digital Transformation

Digital transformation refers to the process of integrating digital technologies into all aspects of an organization’s operations, fundamentally changing how they operate and deliver value to customers [8]. This process involves leveraging technologies such as big data, IoT, cloud computing, and AI to enhance efficiency, productivity, and competitiveness. Digital transformation also requires a cultural shift within organizations, emphasizing innovation, collaboration, and adaptability to technological changes. In the business world, digital transformation has been proven to drive revenue growth, improve customer experiences, and expand access to global markets.

1.4. Organizational Performance

Journal of Contemporary Administration and Management (ADMAN)
ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

Organizational performance refers to the level of effectiveness and efficiency with which an organization achieves its strategic objectives [9]. Performance is measured using various indicators, such as productivity, profitability, customer satisfaction, and innovation capability. In the modern context, organizational performance is assessed not only through financial outcomes but also through social impact and sustainability. Technologies such as MIS and AI play a vital role in enhancing organizational performance by providing tools for data-driven decision-making, reducing operational costs, and creating added value through innovative products and services.

1.5. Industry 4.0

Industry 4.0 represents the fourth industrial revolution, characterized by the integration of digital technologies into manufacturing and operational processes [10]. This concept encompasses advanced technologies such as IoT, AI, robotics, big data, and cyber-physical systems to create smart factories. The goal of Industry 4.0 is to enhance production efficiency, flexibility, and quality through automation and real-time data analytics. Its impact extends beyond manufacturing to sectors like logistics, banking, and healthcare, where these technologies enable innovation and the transformation of business models on a comprehensive scale.

2. Method

This study employs a literature review method with a qualitative approach to explore and analyze the theme of optimizing the role of Artificial Intelligence (AI)-based Management Information Systems (MIS) in driving digital transformation and improving organizational performance in the Industry 4.0 era. A qualitative approach was selected to holistically understand the phenomenon by exploring relevant literature, providing an in-depth understanding of various related aspects. The data collection process involved searching for literature in the Google Scholar database. The scope was limited to scholarly articles published between 2014 and 2024 to ensure relevance to the latest developments in technology and management. Keywords such as “Artificial Intelligence in Management Information Systems,” “Digital Transformation,” “Organizational Performance,” and other related terms were used for the search. The initial search yielded 30 relevant articles. A rigorous selection process was conducted based on inclusion and exclusion criteria. The inclusion criteria comprised articles discussing the use of AI in MIS, its impact on digital transformation, and its influence on organizational performance. Articles focusing solely on the technical aspects of AI without connections to management information or organizational performance were excluded from the analysis. After the selection process, 19 articles met the criteria and were used as the primary sources for analysis. Data analysis was carried out using a descriptive method, where information obtained from the literature was analyzed to identify patterns, themes, and relationships between variables. This approach allowed the integration of findings from various sources to provide a comprehensive understanding of how AI-based MIS can be optimized to enhance organizational performance. The analysis process involved grouping information, interpreting data, and constructing narratives based on the selected articles' findings. Data reliability was ensured through source triangulation, as the analyzed articles were derived from reputable journals with significant citations in the fields of technology and management. Research validity was enhanced by ensuring that all literature used was relevant to the research focus and supported the achievement of the study's objectives. Through this approach, the study aims to provide theoretical and practical contributions to understanding the role of AI in supporting digital transformation and organizational performance.

3. Result and Discussion

Artificial Intelligence (AI)-powered Management Information Systems (MIS) have become a key catalyst in driving digital transformation, enabling organizations to compete more effectively in the Industry 4.0 era by delivering operational efficiency and data-driven innovation. The integration of AI into MIS facilitates large-scale real-time data processing and provides predictive analytics capabilities that enhance the accuracy of strategic decision-making and adaptive responses to market dynamics. With machine learning algorithms and natural language processing, AI identifies hidden patterns in data that were previously undetectable, offering actionable insights for optimizing business processes, personalizing customer services, and managing risks. Moreover, AI strengthens interdepartmental collaboration by automating workflows, increasing team productivity, and accelerating the achievement of strategic goals. Empirical studies highlight that organizations successfully implementing AI in their MIS systems report significant improvements in efficiency, innovation, and competitiveness in global markets, achieved through a strategic alignment between technology and organizational vision [11].

Journal of Contemporary Administration and Management (ADMAN)
ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

The digital transformation initiative at PT Astra International Tbk exemplifies how AI-powered MIS can revolutionize business operations, particularly in managing complex supply chains. Astra accurately mapped market demand patterns by integrating AI technology for predictive data analytics, enabling more precise production planning and efficient inventory management, thereby minimizing waste and overstock [12]. Additionally, AI algorithms identified critical points within the supply chain, improving responsiveness to potential disruptions and enhancing operational resilience. These initiatives boosted operational efficiency, reduced production cycle times, and improved delivery reliability, significantly adding value to customer experiences. This case study underscores that adopting AI-powered MIS is not merely a technical tool but a strategic element capable of creating competitive advantages through faster, more accurate, and adaptive data-driven decision-making.

The application of AI in MIS within the banking sector, such as Bank BRI's implementation of BRIBot, demonstrates how this technology can transform customer experiences and significantly expand financial inclusion. BRIBot, an AI-based chatbot, handles various customer inquiries in real time, from providing service information to resolving basic complaints, directly enhancing operational efficiency and customer satisfaction [13]. Furthermore, AI's capability for deep transaction data analysis allows BRI to identify specific customer needs, opening opportunities for offering personalized financial products, such as microcredit, with more measurable risks. This approach strengthens the bank's relationship with existing customers and extends services to previously underserved market segments, such as remote communities. Consequently, BRI enhances its financial performance through operational efficiency and product development while contributing to Indonesia's national economic agenda by promoting equitable access to financial services.

Despite the significant potential of AI-powered MIS to enhance organizational efficiency and competitiveness, its implementation often faces complex challenges, particularly among SMEs in Indonesia. Limited technological infrastructure remains a major barrier, with inadequate access to high-speed internet and advanced hardware, especially in remote areas. Additionally, low digital literacy among employees results in resistance to adopting new technologies, slowing the digital transformation process. High implementation costs, including AI software acquisition and staff training, pose significant burdens for SMEs often operating on constrained budgets. Data reveals that fewer than 20% of Indonesian SMEs have adopted digital technologies in their operations, highlighting a substantial gap in digital readiness [14]. This limitation restricts their ability to compete in an increasingly competitive global market where speed and technology-driven innovation are key success factors. Thus, government and private sector support in providing funding, training, and inclusive digital infrastructure is crucial to help SMEs overcome these challenges and maximize the benefits of AI-powered MIS.

To address the challenges of AI technology adoption among SMEs, various initiatives have been launched to support digitalization and enhance their competitiveness. For example, Google Indonesia’s Gapura Digital and Women Will programs provide intensive training for SME owners, especially women, on utilizing digital technologies to improve operational efficiency, marketing, and financial management. These programs introduce tools like Google My Business and teach essential skills such as digital marketing and data analysis, enabling SMEs to access broader markets. Additionally, platforms like Kredivo leverage AI to offer fast and affordable financing solutions for SMEs, allowing better working capital management and accelerating business growth. Kredivo assists SMEs that might lack access to traditional banking services by integrating AI for credit assessment and personalized services [15]. These initiatives illustrate the importance of collaboration between public, private, and community sectors in creating an ecosystem that supports inclusive digital transformation, ensuring that SMEs can harness technology to boost productivity and competitiveness in global markets.

Amazon serves as a prime example of a global company that has successfully leveraged the sophistication of AI in its Management Information System (MIS) to optimize logistics operations and inventory management with remarkable efficiency. Amazon analyzes historical data and customer purchasing trends to accurately predict product demand by employing AI-based algorithms. This capability enables the company to design more efficient distribution networks, optimize warehouse locations, and expedite delivery processes [16]. This AI-driven automation ensures just-in-time stock management and faster shipping, ultimately improving customer satisfaction while reducing operational costs. Although Amazon is a large-scale enterprise, its achievements demonstrate that adopting AI in MIS is not exclusive to large organizations. SMEs, with appropriate strategies and adaptation, can implement similar technologies to enhance their operational efficiency, such as demand forecasting, inventory management, and service speed. This highlights that, with proper infrastructure and access to technology, AI can serve as a highly relevant and beneficial solution for organizations of all sizes.

AI has unlocked significant opportunities for innovation in human resource management, especially through its integration into Management Information Systems (MIS), revolutionizing how organizations recruit, manage, and develop employees. For instance, Tokopedia utilizes AI to optimize its recruitment process by

Journal of Contemporary Administration and Management (ADMAN)
ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

deploying advanced algorithms capable of screening thousands of job applications in a short time, identifying candidates best suited to the company's needs and culture [17]. This AI utilization enhances the efficiency and speed of the selection process while reducing human bias often present in traditional recruitment methods, such as preferences for candidates based on background or personal identity. AI's ability to analyze data objectively and deeply ensures that hiring decisions are based more on the compatibility of skills and experience rather than subjective factors. This demonstrates how AI integration into MIS can have broad and holistic impacts within an organization, extending beyond logistics or production functions to strengthen diversity, inclusion, and the quality of human resources, all of which are crucial for supporting overall organizational performance.

The adoption of AI in Management Information Systems (MIS) offers numerous advantages but requires a cautious approach to ensure sustainability and social acceptance. One of the primary challenges is ethical concerns, particularly regarding data privacy and its impact on human employment. The collection and processing of large-scale data by AI systems necessitate robust protections for customers' personal information to prevent privacy breaches that could erode public trust. Additionally, fears surrounding job displacement due to automation and AI must also be addressed. Studies indicate that customer trust in organizations using AI heavily depends on the transparency of data management and the company's accountability for social impacts [18]. To mitigate these risks, organizations must develop clear ethical policies and internal regulations governing AI usage, adhering to principles of fairness, privacy, and sustainability. Proper management of these factors will enable organizations to adopt AI responsibly while maintaining healthy relationships with customers and the broader community, ensuring that technology adoption is both long-term and widely accepted.

AI holds substantial potential to support organizational sustainability, particularly in addressing pressing environmental challenges. For instance, Unilever has integrated AI technology into its sustainability programs to monitor and reduce energy consumption and carbon emissions at its production facilities. Using AI systems capable of real-time data analysis, Unilever identifies inefficiencies in energy usage and implements measures to optimize production processes, reducing energy consumption in turn [19]. This contributes to lower operational costs and supports the company's sustainability goals by minimizing its carbon footprint and improving resource efficiency. Additionally, AI-powered carbon emissions monitoring enables Unilever to comply with stringent environmental regulations and enhance transparency in reporting its environmental impact. This demonstrates that AI applications not only benefit operational and financial performance but also play a vital role in broader sustainability strategies, making it an essential tool for companies looking to adapt to evolving environmental demands.

The implementation of AI-based Management Information Systems (MIS) presents significant opportunities to drive digital transformation and enhance organizational performance. However, success largely depends on organizational readiness, well-thought-out implementation strategies, and active stakeholder support. Organizations that are prepared to address technological challenges, such as infrastructure limitations and digital skill gaps, and can design effective strategies will be able to harness AI's potential to improve operational efficiency, decision-making, and innovation. Moreover, support from governments, private sectors, and communities is crucial in creating an ecosystem that fosters inclusive and sustainable AI adoption. For example, digital skills training for employees and infrastructure improvements can accelerate the adoption process. Organizations can boost their competitiveness and contribute to inclusive economic growth by creating new jobs by optimally utilizing AI, enhancing productivity, and supporting sustainability initiatives. This positions AI as a critical catalyst in digital transformation, oriented toward a more efficient, responsive, and sustainable future.

4. Conclusion

This study demonstrates that Management Information Systems (MIS) powered by Artificial Intelligence (AI) play a significant role in driving digital transformation and enhancing organizational performance in the Industry 4.0 era. AI enables faster, more accurate, and real-time data processing, supporting strategic decision-making, operational efficiency, and innovation aligned with market dynamics. Case studies highlighted, such as PT Astra International Tbk, Bank BRI, and Tokopedia, emphasize the tangible benefits of implementing AI-based MIS. However, challenges such as limited infrastructure, digital literacy, and implementation costs underscore the need for strategic approaches and cross-sector collaboration in adopting this technology.

The findings of this research have both theoretical and practical implications. Theoretically, this study enriches the literature on the role of AI in Management Information Systems and its impact on digital transformation and organizational performance. Practically, the findings offer guidance for organizations on adopting and optimizing AI to support their operations and business strategies. Furthermore, governments and

educational institutions can use these findings to design training programs and policies that promote digital transformation, especially for SMEs facing challenges in adopting advanced technologies.

Organizations aiming to adopt AI-based MIS should begin by identifying their specific needs while ensuring the readiness of their technological infrastructure and the competencies of their human resources. At the same time, governments need to provide regulatory support and incentives, such as subsidies or funding, to accelerate the adoption of digital technologies, particularly for SMEs integrating AI into their operations. Furthermore, academics and researchers should focus on conducting further studies to explore the specific impacts of AI technologies on various aspects of organizational performance, including sustainability and innovation, with empirical studies using quantitative data offering valuable complements to the findings of this literature review.

This study has several limitations. First, as a literature review, its findings are limited to analyzing available literature and do not include empirical data from field studies. Second, this research does not directly test the effectiveness of AI technologies across different sectors, making the results more conceptual than practical. Therefore, future research is required to explore real-world implementations across various organizational contexts.

References

[1] A. S. George, "The Fourth Industrial Revolution: A Primer on Industry 4.0 and its Transformative Impact," *Partners Universal Innovative Research Publication (PUIRP)*, vol. 2, no. 1, pp. 16–40, 2024.

[2] J. P. Bharadiya, "Machine Learning and AI in Business Intelligence: Trends and Opportunities," *International Journal of Computer (IJC)*, vol. 48, no. 1, pp. 123–134, 2023.

[3] F. Sudirjo, A. M. A. Ausat, S. Rijal, Y. Riady, and S. Suherlan, "ChatGPT: Improving Communication Efficiency and Business Management of MSMEs in the Digital Age," *Innovative: Journal Of Social Science Research*, vol. 3, no. 2, pp. 643–652, 2023, doi: https://doi.org/10.31004/innovative.v3i2.347.

[4] V. G. Cannas, M. P. Ciano, M. Saltalamacchia, and R. Secchi, "Artificial intelligence in supply chain and operations management: a multiple case study research," *Int J Prod Res*, vol. 62, no. 9, pp. 3333–3360, May 2024, doi: 10.1080/00207543.2023.2232050.

[5] M. Ghorbani Asiabar, M. Ghorbani Asiabar, and A. Ghorbani Asiabar, "Artificial Intelligence in Strategic Management: Examining Novel AI Applications in Organizational Strategic Decision-Making," Sep. 17, 2024. doi: 10.20944/preprints202409.1330.v1.

[6] A. Berisha Shaqiri, "Management Information System and Decision-Making," *Academic Journal of Interdisciplinary Studies*, vol. 3, no. 2, pp. 19–23, Jun. 2014, doi: 10.5901/ajis.2014.v3n2p19.

[7] M. A. K. Harahap, A. M. A. Ausat, and M. S. Kurniawan, "Toward Competitive Advantage: Harnessing Artificial Intelligence for Business Innovation and Entrepreneurial Success," *Jurnal Minfo Polgan*, vol. 13, no. 1, pp. 254–261, 2024.

[8] T. Saarikko, U. H. Westergren, and T. Blomquist, "Digital transformation: Five recommendations for the digitally conscious firm," *Bus Horiz*, vol. 63, no. 6, pp. 825–839, Nov. 2020, doi: 10.1016/j.bushor.2020.07.005.

[9] A. D. Subagja, A. M. A. Ausat, and Suherlan, "The Role of Social Media Utilization and Innovativeness on SMEs Performance," *Jurnal IPTEK-KOM (Jurnal Ilmu Pengetahuan dan Teknologi Komunikasi)*, vol. 24, no. 2, pp. 85–102, 2022, doi: https://doi.org/10.17933/iptekkom.24.2.2022.85-102.

[10] C. O. Esangbedo, J. Zhang, M. O. Esangbedo, S. D. Kone, and L. Xu, "The role of industry-academia collaboration in enhancing educational opportunities and outcomes under the digital driven Industry 4.0," *Journal of Infrastructure, Policy and Development*, vol. 8, no. 1, pp. 1–32, Dec. 2023, doi: 10.24294/jipd.v8i1.2569.

[11] K. Kalaignanam, K. R. Tuli, T. Kushwaha, L. Lee, and D. Gal, "Marketing Agility: The Concept, Antecedents, and a Research Agenda," *J Mark*, vol. 85, no. 1, pp. 35–58, Jan. 2021, doi: 10.1177/0022242920952760.

[12] M. Zaenuddin, "Google Perkenalkan Produk AI Baru Bernama Project Astra, Apa Itu?," www.kompas.com.

[13] CNBC Indonesia, "BRI Kenalkan Conversational Banking hingga Robot Cash Management," www.cnbcindonesia.com.

[14] A. M. A. Ausat and T. Peirisal, "Determinants of E-commerce Adoption on Business Performance : A Study of MSMEs in Malang City , Indonesia," *Journal On Optimizations Of Systems At Industries*, vol. 20, no. 2, pp. 104–114, 2021, doi: 10.25077/josi.v20.n2.p104-114.2021.

[15] F. Saputra, "Tekan Angka Kredit Macet, Kredivo Gunakan Teknologi AI," keuangan.kontan.co.id.

[16] AWS, "Pelanggan Amazon Q Developer," aws.amazon.com.

ISSN: 2988-0394 Print / 2988-3121 Online
Vol 2, Issue 3, December 2024, Page 554-560
DOI: https://doi.org/10.61100/adman.v2i3.234

[17] Tokopedia, "Mengulik Peran Artificial Intelligence Dalam Perkembangan Teknologi Lewat START Summit Extension," www.tokopedia.com.
[18] Y. Chen, C. Prentice, S. Weaven, and A. Hisao, "The influence of customer trust and artificial intelligence on customer engagement and loyalty – The case of the home-sharing industry," *Front Psychol*, vol. 13, Aug. 2022, doi: 10.3389/fpsyg.2022.912339.
[19] DTI, "Unilever Menerapkan Robot dan AI dalam Produk Kecantikan," digitaltransformation.co.id.