West Science Information System and Technology
Vol. 3, No. 01, April 2025, pp. 75~83

Artificial Intelligence in Industry 4.0: A Bibliometric Analysis of Research Trends

Loso Judijanto
IPOSS Jakarta

Article Info

Article history:

Received April, 2025
Revised April, 2025
Accepted April, 2025

Keywords:

Artificial Intelligence;
Industry 4.0;
Bibliometric Analysis;
Machine Learning;
Smart Manufacturing

ABSTRACT

The integration of Artificial Intelligence (AI) into Industry 4.0 has revolutionized industrial processes through the implementation of intelligent automation, predictive analytics, and interconnected systems. This study conducts a comprehensive bibliometric analysis to map the research trends, thematic evolution, influential authors, and international collaboration networks within the domain of AI and Industry 4.0. Data were retrieved from the Scopus database, focusing on peer-reviewed journal articles published between 2013 and 2024. Using VOSviewer for data visualization, the analysis reveals five major thematic clusters, with "Industry 4.0," "machine learning," "Internet of Things," and "smart manufacturing" as dominant keywords. The temporal mapping indicates a shift from core technical research toward more strategic themes such as sustainability, digital transformation, and Industry 5.0. Author collaboration networks show regional clusters with limited interdisciplinary integration, while country-level analysis highlights India, Germany, China, and Italy as major contributors. The findings emphasize the field's dynamic growth and underscore the need for more inclusive, cross-disciplinary, and globally connected research agendas to fully realize the potential of AI in the context of Industry 4.0.

Corresponding Author:

Name: Loso Judijanto
Institution: IPOSS Jakarta
Email: losojudijantobumn@gmail.com

1. INTRODUCTION

The Fourth Industrial Revolution, widely known as Industry 4.0, marks a paradigm shift in the way industries operate by leveraging emerging technologies to automate and optimize processes. Characterized by the integration of cyber-physical systems, the Internet of Things (IoT), cloud computing, and big data analytics, Industry 4.0 transforms traditional manufacturing into smart and interconnected systems [1]. Among these enabling technologies, Artificial Intelligence (AI) plays a central role due to its ability to simulate human cognitive functions such as learning, reasoning, and decision-making. The convergence of AI and Industry 4.0 has led to a substantial transformation across sectors including manufacturing, logistics, healthcare, and finance [2]. The application of AI in Industry 4.0 is extensive, ranging from predictive maintenance and quality control to supply chain optimization and customer behavior analysis. Machine learning algorithms, natural language processing, computer vision, and robotics are now integral to smart manufacturing and intelligent decision-making [3]. For example, predictive analytics powered by AI enables factories to reduce downtime and anticipate failures, while intelligent robotics facilitate real-time adaptation to production demands. This evolution not only enhances operational efficiency but also fosters innovation, agility, and resilience in industrial systems.

Over the past decade, the academic and industrial interest in AI applications within Industry 4.0 has grown exponentially. Research in this area has become more multidisciplinary, involving fields such as engineering, computer science, data science, and business management. Numerous studies have explored technical, strategic, and ethical dimensions of AI integration into industrial ecosystems [4]. As a result, the body of literature continues to expand rapidly, reflecting both the maturity of certain applications and the emergence of novel AI techniques tailored for industrial use cases. Despite the rapid growth in publications, there is a pressing need to systematically analyze and synthesize the research landscape to identify prevailing trends, knowledge gaps, and future directions. Bibliometric analysis serves as a powerful method to uncover the intellectual structure and evolution of a research field by analyzing patterns in academic publications [5]. Through quantitative techniques, bibliometric studies can reveal influential authors, institutions, countries, keywords, and thematic clusters, thereby offering a macro-level understanding of the research ecosystem. In the context of AI and Industry 4.0, such analysis can illuminate how the field has progressed, what areas dominate current research, and which topics warrant further investigation.

Previous bibliometric studies have addressed AI broadly or in relation to specific sectors, but a focused bibliometric analysis on AI in Industry 4.0 remains limited. While some studies have examined AI adoption in smart manufacturing or its impact on supply chain management, they often lack a holistic and comprehensive perspective of the research trends across disciplines and geographies [6]. As the field continues to evolve dynamically, a detailed bibliometric review can provide critical insights for scholars, practitioners, and policymakers seeking to navigate the complexities and opportunities at the intersection of AI and Industry 4.0. Although the literature on Artificial Intelligence and its integration within Industry 4.0 has experienced significant growth, the current body of research remains fragmented and lacks a cohesive understanding of its development trajectory. The absence of a comprehensive bibliometric analysis hinders the ability of scholars and stakeholders to recognize emerging themes, influential contributors, and research gaps in the domain. This limitation poses challenges in aligning academic research with industrial practices and policy formulation. Without a clear mapping of the intellectual landscape, efforts to advance the practical and theoretical underpinnings of AI in Industry 4.0 risk redundancy and inefficiency. This study aims to conduct a bibliometric analysis of scholarly publications on Artificial Intelligence in the context of Industry 4.0 to identify research trends, thematic evolution, and influential contributors within the field.

1.1 Industry 4.0: A Socio-Technical Paradigm

Industry 4.0, first popularized by the German government in 2011, is conceptualized as the fourth industrial revolution, following mechanization (Industry 1.0), mass production (Industry 2.0), and automation (Industry 3.0). This revolution is characterized by the fusion of physical and digital systems through the adoption of cyber-physical systems (CPS), Internet of Things (IoT), cloud computing, and big data analytics [7]. The core theoretical perspective underpinning Industry 4.0 is the socio-technical systems theory, which posits that optimal organizational performance is achieved when the social and technical subsystems are jointly optimized [8]. From this perspective, the implementation of Industry 4.0 technologies must not only focus on technical upgrades but also consider organizational culture, human capital, and change management. AI, as an intelligent decision-making and automation tool, contributes to the technical layer of Industry 4.0, enabling real-time data processing, self-learning algorithms, and predictive capabilities that enhance operational efficiency and strategic agility [9].

1.2 Artificial Intelligence: The Cognitive Automation Engine

Artificial Intelligence refers to the development of systems capable of performing tasks that normally require human intelligence. These include learning, reasoning, problem-solving, perception, and language understanding [10]. The theoretical framework behind AI stems from cognitive science and machine learning. It assumes that intelligent behavior can be modeled through algorithms that mimic human cognition or through statistical and probabilistic models that optimize decision outcomes over time. AI is operationalized in Industry 4.0 through technologies such as supervised and unsupervised learning, neural networks, deep learning, natural language processing (NLP), and computer vision. These technologies are deployed across various industrial applications including autonomous production lines, smart supply chains, human-machine collaboration, and intelligent quality control systems [11]. The adaptive systems theory is also relevant here, describing AI-enabled systems as those that can evolve and self-optimize in dynamic environments—a key trait of Industry 4.0 ecosystems.

1.3 Technology Acceptance and Organizational Readiness

In analyzing AI adoption within Industry 4.0, several models offer theoretical support. Among them, the Technology Acceptance Model (TAM) [12] and the Technology-Organization-Environment (TOE) framework are most widely used. TAM posits that the perceived usefulness and ease of use of a technology influence users' willingness to adopt it. This model can explain the human factors influencing the integration of AI tools in industrial environments, particularly from an employee or managerial perspective. The TOE framework expands the view by including organizational (e.g., resources, size, culture) and environmental (e.g., market dynamics, regulatory factors) elements in determining technology adoption. In the context of Industry 4.0, these theories help explain not only individual acceptance of AI tools but also broader strategic and systemic integration within organizations.

1.4 The Knowledge Management Perspective

Another critical perspective lies in knowledge management theory, which is relevant to the understanding of how organizations create, share, and apply knowledge, particularly in technology-intensive settings. AI contributes to knowledge creation by extracting patterns from large datasets, enabling real-time insights, and supporting informed decision-making. As such, the Nonaka and Takeuchi knowledge spiral model becomes relevant, especially in highlighting the transformation of tacit to explicit knowledge within industrial organizations. In an Industry 4.0 environment, AI systems function as enablers of knowledge externalization and combination—two crucial phases in the SECI model. Machine learning, for instance, allows firms to capture and analyze unstructured data, making implicit operational patterns explicit and actionable. This reinforces the symbiotic relationship between human expertise and intelligent automation, underscoring the necessity of continuous learning and innovation.

2. METHODS

This study utilizes a quantitative bibliometric analysis to explore the development, structure, and emerging trends in the research domain of Artificial Intelligence in Industry 4.0. The data were sourced from the Scopus database, chosen for its extensive coverage of peer-reviewed literature across science, technology, and engineering disciplines. A comprehensive search was conducted using combinations of keywords such as “Artificial Intelligence,” “AI,” “Industry 4.0,” and “Fourth Industrial Revolution,” connected by Boolean operators to ensure the inclusion of relevant articles. The search was limited to journal articles published in English between 2013 and 2024, reflecting the period during which Industry 4.0 and AI have gained significant academic and industrial momentum. After retrieving the dataset, a rigorous screening and data cleaning process was carried out to eliminate duplicates and unrelated entries. The final dataset was then imported into VOSviewer, a widely used software tool for constructing and visualizing bibliometric networks. Using VOSviewer, the study conducted co-authorship analysis, keyword co-occurrence analysis, and citation analysis to identify influential authors, journals, countries, and thematic clusters.

3. RESULTS AND DISCUSSION

3.1 Keyword Co-Occurrence Network Visualization

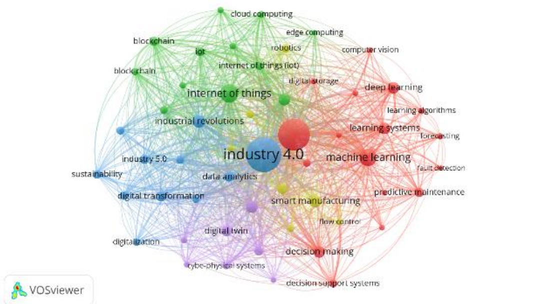

Figure 1. Network Visualization
Source: Data Analysis, 2025

At the center of the visualization is the term “Industry 4.0,” shown as the largest and most connected node, signifying its dominant presence across the research landscape. Its central location and extensive connections indicate that it serves as the thematic nucleus, linking various technological, strategic, and analytical subdomains. Closely tied to it are prominent keywords like “machine learning,” “internet of things,” “smart manufacturing,” and “data analytics,” reflecting the multidisciplinary nature of Industry 4.0, where AI technologies serve as key enablers of digital transformation across industries. On the right side of the map, the red cluster centers around “machine learning,” “deep learning,” “predictive maintenance,” and “learning systems.” This cluster represents the AI-focused technical core of Industry 4.0 research. The strong linkages between terms like “learning algorithms,” “computer vision,” and “fault detection” highlight how machine learning techniques are being applied for real-time monitoring, forecasting, and automation within smart factories. The presence of “decision support systems” and “decision making” suggests an increasing emphasis on AI-driven operational intelligence in industrial contexts.

To the upper left, the green cluster revolves around “internet of things (IoT),” “cloud computing,” “edge computing,” and “robotics.” This area of the map represents the infrastructural and cyber-physical aspects of Industry 4.0, where data collection and connectivity are foundational. The co-occurrence of terms like “digital storage” and “IoT” with AI-related keywords reflects how real-time data from interconnected devices is increasingly used to train intelligent models, enabling adaptive manufacturing environments. This cluster also signifies the importance of distributed computing systems in facilitating scalable AI applications. Located on the left side of the map, the blue cluster contains terms like “digital transformation,” “digitalization,” “sustainability,” and “industry 5.0.” This grouping reflects the broader organizational and strategic dimensions of Industry 4.0, including its evolution and long-term implications. The presence of “sustainability” alongside technological terms suggests a growing discourse on how AI and digital technologies can be harnessed to achieve environmentally responsible and socially inclusive industrial practices. Moreover, “industry 5.0” hints at the emerging transition toward more human-centric innovation, where collaboration between humans and machines is emphasized.

At the bottom center, the purple cluster encompasses keywords such as “smart manufacturing,” “cyber-physical systems,” “digital twin,” and “decision making.” This thematic area illustrates the integration of digital and physical production systems, a hallmark of Industry 4.0. The close proximity of “digital twin” and “cyber-physical systems” reflects the growing use of real-time simulation and modeling to enhance production efficiency and fault prediction. The inclusion of “decision making” emphasizes AI’s role in enabling autonomous, data-driven decisions within these interconnected systems.

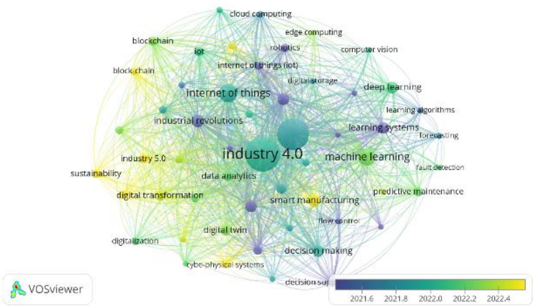

Figure 2. Overlay Visualization
Source: Data Analysis, 2025

This visualization presents a temporal analysis of keyword co-occurrence in the literature on Artificial Intelligence in Industry 4.0, using color gradients to represent the average publication year of each keyword. Darker tones (blue/purple) indicate older research (around 2021–2022), while lighter tones (green to yellow) represent more recent research trends (approaching 2023–2024). The term “industry 4.0” remains central and relatively mature, shown in green-blue, indicating it has been a consistent focal point over time. Other foundational keywords like “machine learning,” “internet of things,” and “data analytics” also appear in shades of green and teal, reflecting their establishment as core topics since the early development of AI in industrial contexts.

The yellowish areas, such as “sustainability,” “industry 5.0,” “blockchain,” and “digital transformation,” indicate newer or emerging themes. These keywords suggest a shift in scholarly focus toward next-generation topics, especially the integration of ethical, sustainable, and human-centric perspectives in technological transformation. For instance, “industry 5.0” appears as a more recent development that emphasizes collaboration between humans and intelligent systems, moving beyond the automation-centric view of Industry 4.0. Similarly, “blockchain” and “digital transformation” are gaining prominence in more recent years as organizations explore decentralized, secure, and scalable infrastructure to support intelligent manufacturing ecosystems.

In contrast, keywords such as “deep learning,” “learning systems,” “decision support systems,” and “predictive maintenance” tend to appear in cooler tones, indicating they were already actively studied in earlier phases (circa 2021). This shows that while these technical applications remain important, scholarly attention is increasingly expanding into more strategic and systemic concerns, such as sustainability and organizational innovation. The map reveals an evolution in research focus, from core technical implementation toward broader interdisciplinary and societal considerations, signaling the maturation and diversification of the AI and Industry 4.0 research field.

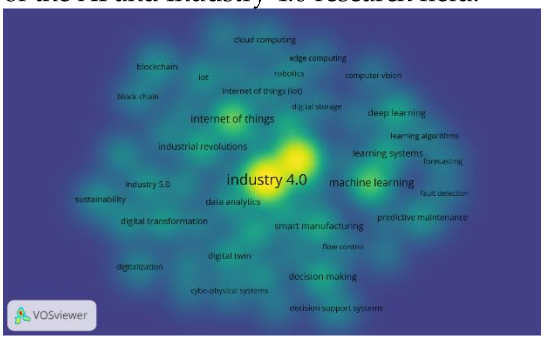

Figure 3. Density Visualization
Source: Data Analysis, 2025

This density visualization map highlights the concentration and frequency of co-occurring keywords in the literature on Artificial Intelligence in Industry 4.0. The areas shown in bright yellow and green indicate high-density regions, representing keywords that appear most frequently and are most strongly interconnected in the analyzed publications. At the core of this heatmap is “industry 4.0,” which has the highest intensity, reaffirming its role as the central and most extensively studied concept. Surrounding it are other high-density terms like “internet of things,” “machine learning,” “data analytics,” and “smart manufacturing,” suggesting these topics are critical pillars within the research field and often co-occur in studies. In contrast, keywords located toward the edges of the map, such as “sustainability,” “blockchain,” “industry 5.0,” and “decision support systems,” appear in cooler shades of blue and green, indicating they are less frequent but still present in the discourse. This suggests these topics may be emerging or niche within the broader context. While they are not yet dominant, their presence shows a gradual broadening of research focus to include sustainability, human-centric approaches (as seen in "industry 5.0"), and secure data infrastructures like blockchain.

3.2 Co-Authorship Visualization

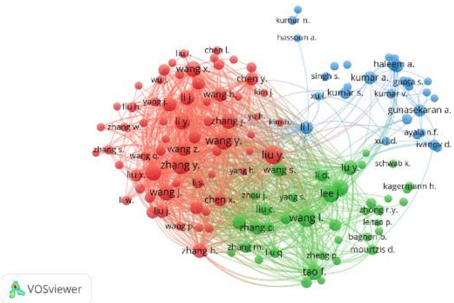

Figure 4. Author Visualization
Source: Data Analysis, 2025

This co-authorship network visualization illustrates the collaboration patterns among prolific authors in the field of Artificial Intelligence in Industry 4.0. The map is divided into distinct clusters, each representing groups of authors who frequently co-publish. The red cluster, which is the most densely populated, features a tightly-knit group of researchers—such as Wang Y., Zhang Y., Liu Y., and Chen Y.—who appear to be leading contributors, often working with colleagues within the same regional or institutional networks, likely centered in East Asia. The green cluster includes notable figures like Lee J., Tao F., and Zhong R.Y., suggesting strong collaborations in smart manufacturing and digital twin research, possibly spanning institutions in China, Singapore, or Korea. Meanwhile, the blue cluster—including authors like Haleem A., Gunasekaran A., Ivanov D., and Kumar S. represents a more dispersed network, with collaborations likely stemming from Europe and South Asia, focused on broader strategic, organizational, or supply chain dimensions of Industry 4.0.

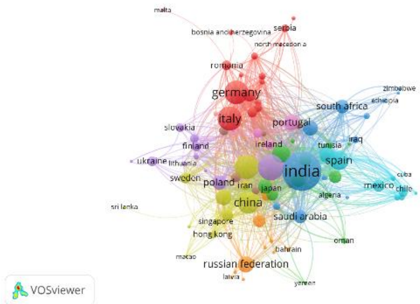

Figure 6. Country Visualization
Source: Data Analysis, 2025

This VOSviewer country collaboration network visualizes the global distribution and cooperative relationships in the field of Artificial Intelligence in Industry 4.0 research. The size of each node indicates the publication volume from that country, while the lines represent co-authorship or research collaboration. India appears as the most prominent and central node, reflecting its leading role in publication output and strong international research links, particularly with countries like Spain, Saudi Arabia, and South Africa. Other major contributors include Germany, China, Italy, and the Russian Federation, each forming dense collaborative sub-networks often reflecting regional or linguistic ties. The map also highlights increasing contributions from emerging economies such as Poland, Portugal, and Iran, suggesting a broadening of research participation beyond traditional Western and East Asian powerhouses.

DISCUSSION

This bibliometric analysis provides a comprehensive view of the scholarly landscape surrounding the integration of Artificial Intelligence (AI) in the context of Industry 4.0. Using data from the Scopus database and visualizations generated through VOSviewer, this study explored thematic trends, keyword evolution, author collaboration networks, and international research distribution. The findings highlight several critical developments that not only affirm the central role of AI in Industry 4.0 but also reveal shifting research priorities, emerging areas of interest, and evolving patterns of academic collaboration.

Central Themes and Research Density

The keyword co-occurrence map clearly places "Industry 4.0" at the core of the research domain, indicating its role as the conceptual anchor for a wide array of subtopics. Surrounding this central theme are frequently associated keywords such as "machine learning," "internet of things," "smart manufacturing," "data analytics," and "predictive maintenance." These terms form tightly interconnected clusters, reflecting the interdisciplinary nature of research in this area. This aligns with prior literature suggesting that AI, in combination with IoT and data systems, is driving the digitization and automation of industrial processes [13]. The red cluster, primarily dominated by machine learning-related terms, suggests a strong technical emphasis in earlier literature. Research in this cluster typically explores applications like real-time monitoring, fault detection, intelligent forecasting, and optimization. Meanwhile, the green cluster is centered around the infrastructure and connectivity layer—such as IoT, cloud computing, robotics, and edge computing—that enables AI implementation in physical environments. These two clusters, when viewed together, reinforce the layered structure of Industry 4.0, wherein data collection technologies and intelligent analytics systems operate symbiotically.

Thematic Evolution Over Time

Temporal keyword analysis adds another dimension to the discussion, illustrating how research foci have evolved from foundational technologies toward broader and more strategic issues. Earlier terms, displayed in cooler shades (blue/purple), include "machine learning," "predictive maintenance," "learning algorithms," and "decision support systems." These represent the core technological competencies necessary to enable smart manufacturing systems. Their early appearance in the research timeline suggests they were essential to laying the groundwork for intelligent automation in industrial contexts. In contrast, more recent terms—highlighted in yellow and light green—include "sustainability," "industry 5.0," "blockchain," and "digital transformation." These emerging themes reflect a broadening of the research agenda. Industry 5.0, for example, moves beyond the machine-centric view of Industry 4.0 to emphasize human-machine collaboration and personalization, aligning industrial innovation with social and ethical dimensions [14]. Similarly, the inclusion of sustainability as a trending term suggests an increasing concern for environmental impact, aligning with the global push for green and circular economies. The recent appearance of "blockchain" also highlights new trust and security infrastructures being explored for industrial data management and AI governance.

Research Hotspots and Emerging Niches

The density visualization confirms the thematic centrality and research saturation around "Industry 4.0" and its closely tied keywords. Bright yellow areas in the heatmap indicate topics that have received significant attention, such as "data analytics," "smart manufacturing," and "machine learning." These hotspots represent mature research areas where conceptual foundations and technical frameworks are relatively well-established. However, the map also reveals less-explored but emerging niches, particularly on the periphery. Terms like "cyber-physical systems," "digital twin," "sustainability," and "industry 5.0" appear in darker, cooler areas, suggesting lower research density. Yet, their strategic placement—still connected to core clusters—indicates their growing relevance and potential for future exploration. These insights provide valuable direction for scholars seeking to contribute to underdeveloped areas of the field while addressing critical challenges such as resilience, ethics, and sustainability.

Author Collaboration and Academic Influence

The co-authorship network map reveals significant clustering among researchers, with three main collaborative communities. The red cluster, consisting largely of Chinese and East Asian researchers (e.g., Wang Y., Zhang Y., Liu Y.), demonstrates intensive internal collaboration. This suggests the presence of strong regional networks, possibly facilitated by shared institutional affiliations and national funding mechanisms. These authors appear to dominate technical research domains, particularly in machine learning, robotics, and manufacturing optimization. The green cluster includes influential figures like Tao F. and Lee J., who are often cited for work on digital twins, CPS, and smart factory frameworks. Their contributions often bridge the technical and architectural dimensions of AI integration. Meanwhile, the blue cluster, featuring authors such as Gunasekaran A., Ivanov D., and Kumar S., reflects a more global and interdisciplinary orientation, with a focus on strategic management, supply chains, and policy implications of Industry 4.0. The separation among these clusters reveals a lack of integration between technical and managerial research communities. Although each group contributes significantly to the literature, there appears to be limited collaboration across domains, suggesting an opportunity for more interdisciplinary convergence in future studies.

Global Research Contributions and International Collaboration

The country collaboration map provides a macro-level view of international involvement in the AI–Industry 4.0 research space. India, Germany, China, Italy, and the Russian Federation emerge as leading contributors in terms of publication volume and centrality in the network. Notably, India appears as a major global hub with widespread collaborations, especially with European and Middle Eastern countries. This signals India's growing prominence not just in technical development but also in global academic influence. European countries such as Germany, Italy, Portugal, and Poland form a dense regional network, reflecting strong cross-border collaboration within the EU research space, often incentivized by European Commission funding. On the other hand, countries like China and Russia also show strong internal productivity but are somewhat more regionally concentrated in their co-authorship patterns. Interestingly, several African and Latin American nations—such as South Africa, Ethiopia, Mexico, and Chile—appear in the network, although with fewer connections. This suggests a gradual global diversification of research participation, though disparities in access to research funding and infrastructure may still limit broader inclusivity.

Strategic Implications and Future Directions

The findings from this bibliometric analysis carry several strategic implications. First, the technological core of AI in Industry 4.0 is well-established, particularly in relation to machine learning, predictive analytics, and IoT systems. Future research may benefit from transitioning from isolated technical studies to integrated frameworks that combine infrastructure, intelligence, and decision-making processes. Second, the growing emphasis on sustainability, ethics, and human-machine interaction reflects a shift toward more holistic and socially responsive research agendas. As organizations increasingly align their digital transformation strategies with ESG (Environmental, Social, Governance) goals, AI applications must adapt to meet these evolving expectations. Additionally, the relatively fragmented collaboration patterns among author groups and regions suggest opportunities for greater synergy. Bridging the gap between highly technical domains and strategic disciplines—such as industrial management, public policy, and organizational behavior—could lead to more robust, scalable, and inclusive AI solutions. Furthermore, expanding international collaboration beyond established hubs to include underrepresented regions could promote global innovation equity and stimulate diverse perspectives on digital transformation.

4. CONCLUSION

This bibliometric analysis has provided valuable insights into the evolving landscape of research at the intersection of Artificial Intelligence and Industry 4.0. By examining publication patterns, keyword co-occurrences, author collaborations, and country-level contributions, the study has revealed a vibrant and rapidly expanding body of knowledge characterized by strong technical foundations in machine learning, IoT, and smart manufacturing, alongside emerging interests in sustainability, digital transformation, and human-centric innovation. The analysis highlights not only the central role of AI in enabling intelligent industrial systems but also the increasing interdisciplinarity and global collaboration that shape the field. However, it also uncovers the need for deeper integration across technical and strategic domains, as well as greater inclusion of underrepresented regions in international research efforts. These findings underscore the importance of continued cross-sector and cross-border collaboration to address the complex challenges and opportunities presented by AI-driven industrial transformation in the era of Industry 4.0 and beyond.

REFERENCES

[1] R. S. Peres, X. Jia, J. Lee, K. Sun, A. W. Colombo, and J. Barata, "Industrial artificial intelligence in industry 4.0-systematic review, challenges and outlook," *IEEE access*, vol. 8, pp. 220121–220139, 2020.

[2] Z. Jan *et al.*, "Artificial intelligence for industry 4.0: Systematic review of applications, challenges, and opportunities," *Expert Syst. Appl.*, vol. 216, p. 119456, 2023.

[3] J. Lee, H. Davari, J. Singh, and V. Pandhare, "Industrial Artificial Intelligence for industry 4.0-based manufacturing systems," *Manuf. Lett.*, vol. 18, pp. 20–23, 2018.

[4] A. Dingli, F. Haddod, and C. Klüver, *Artificial intelligence in industry 4.0*, vol. 928. Springer, 2021.

[5] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.*, vol. 133, pp. 285–296, 2021.

[6] M. Dopico, A. Gómez, D. De la Fuente, N. García, R. Rosillo, and J. Puche, "A vision of industry 4.0 from an artificial intelligence point of view," in *Proceedings on the international conference on artificial intelligence (ICAI)*, The Steering Committee of The World Congress in Computer Science, Computer …, 2016, p. 407.

[7] A. Azizi, *Applications of artificial intelligence techniques in industry 4.0*. Springer, 2019.

[8] N. Kraus, K. Kraus, O. Shtepa, M. Hryhorkiv, and I. Kuzmuk, "Artificial intelligence in established of industry 4.0," *WSEAS Trans. Bus. Econ.*, no. 19, pp. 1884–1900, 2022.

[9] M. Javaid, A. Haleem, R. P. Singh, and R. Suman, "Artificial intelligence applications for industry 4.0: A literature-based study," *J. Ind. Integr. Manag.*, vol. 7, no. 01, pp. 83–111, 2022.

[10] S. K. Sood, K. S. Rawat, and D. Kumar, "A visual review of artificial intelligence and Industry 4.0 in healthcare," *Comput. Electr. Eng.*, vol. 101, p. 107948, 2022.

[11] S. Mithas, Z. Chen, T. J. V Saldanha, and A. De Oliveira Silveira, "How will artificial intelligence and Industry 4.0 emerging technologies transform operations management?," *Prod. Oper. Manag.*, vol. 31, no. 12, pp. 4475–4487, 2022.

[12] F. D. Davis, "Technology acceptance model: TAM," *Al-Suqri, MN, Al-Aufi, AS Inf. Seek. Behav. Technol. Adopt.*, vol. 205, p. 219, 1989.

[13] D. Mathew, N. C. Brintha, and J. T. W. Jappes, "Artificial intelligence powered automation for industry 4.0," in *New horizons for Industry 4.0 in modern business*, Springer, 2023, pp. 1–28.

[14] J. Ribeiro, R. Lima, T. Eckhardt, and S. Paiva, "Robotic process automation and artificial intelligence in industry 4.0–a literature review," *Procedia Comput. Sci.*, vol. 181, pp. 51–58, 2021.