

INTEGRATING ARTIFICIAL INTELLIGENCE INTO SUSTAINABLE DIGITAL BUSINESS ECOSYSTEMS IN INDONESIA

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ABSTRACT

This study examines the role of Artificial Intelligence (AI) in supporting sustainable economic growth within Indonesia's digital business environment. Employing a systematic literature review (SLR) guided by the PRISMA 2020 protocol and complemented by qualitative content analysis, this research synthesizes 30 peer-reviewed studies to examine how AI is implemented across sectors such as e-commerce, financial technology, and digital services. The review addresses three research questions: how AI is utilized within Indonesia's digital business ecosystems (RQ1), how it contributes to sustainability-related outcomes such as efficiency, innovation, and competitiveness (RQ2), and what challenges and enabling factors shape its effective adoption (RQ3). The findings indicate that AI improves operational efficiency, reduces costs, and fosters innovation in products and services, while strengthening competitiveness and inclusive stakeholder collaboration within digital ecosystems. However, several challenges persist, including limited technological readiness, data privacy concerns, ethical issues, and workforce adaptation. The study contributes a structured synthesis linking AI integration to sustainability outcomes in a developing-economy context and offers theoretical and managerial implications for advancing responsible AI-driven digital transformation.

Keywords: Artificial intelligence (AI), digital business ecosystems, sustainable economic growth, digital transformation, Indonesia.

1. INTRODUCTION

The rapid development of digital technologies has reshaped business activities worldwide, enabling new forms of value creation, collaboration, and competition [1], [2]. Advances in internet connectivity, cloud computing, and data analytics have transformed traditional business structures into interconnected systems where multiple actors—firms, consumers, governments, and technology providers—interact dynamically [3]. These changes have increased the need for adaptive strategies that support innovation and long-term economic resilience [4]. In Indonesia, this transformation has accelerated significantly, supported by national initiatives such as *Making Indonesia 4.0* and the widespread adoption of digital platforms [5], [6]. The expansion of e-commerce, financial technology, and digital

services has strengthened economic participation and market accessibility, particularly for small and medium enterprises [7]. However, the benefits of digitalization are unevenly distributed, reflecting disparities in infrastructure, technological capability, and human capital across regions [8].

Within this context, Artificial Intelligence (AI) has become an important driver of digital transformation [9], [10]. AI enables organizations to process large datasets, automate routine processes, and generate predictive insights that improve decision-making. These capabilities are closely linked to key dimensions of sustainability, including efficiency in resource utilization, innovation capacity, and long-term competitiveness [11]. Despite its potential, the relationship between AI adoption and sustainable economic outcomes remains insufficiently articulated, particularly in developing country contexts. Existing studies on AI and digital ecosystems have largely focused on technological capabilities or general economic impacts [12]. While systematic literature reviews (SLRs) have been conducted, few explicitly connect AI integration with sustainability outcomes in a structured manner, especially within Indonesia's socio-economic setting. As a result, there is a need for a more focused synthesis that clarifies how AI contributes to sustainable development while acknowledging contextual challenges [13].

At the same time, the adoption of AI presents several structural and ethical challenges [14]. These include limited technological readiness, high implementation costs, data privacy concerns, and regulatory uncertainty [15]. In addition, issues such as algorithmic bias and workforce displacement highlight the importance of responsible and inclusive AI deployment. These challenges indicate that technological advancement alone is insufficient; it must be accompanied by institutional support, policy alignment, and capacity building [16]. Based on these considerations, this study aims to analyze the role of AI in supporting sustainable economic growth within Indonesia's digital business environment through a systematic literature review [17]. This study examines how AI is utilized within digital business ecosystems in Indonesia, how it contributes to sustainability-related outcomes such as efficiency, innovation, and competitiveness, and what challenges and enabling factors influence its effective adoption.

This study contributes by providing a structured synthesis of existing literature that links AI implementation with sustainability outcomes, offering insights relevant for policymakers, practitioners, and researchers [18]. Rather than proposing new theoretical models, the paper emphasizes contextual understanding and practical implications in a developing economy setting [19]. This study is limited to secondary data derived from existing literature and focuses on conceptual and contextual analysis without empirical validation, which may limit the generalizability of findings. Therefore, future research is encouraged to incorporate empirical approaches to strengthen the evidence on AI-driven sustainability outcomes.

2. LITERATURE REVIEW

2.1. Digital Business Ecosystem and AI Integration

The concept of a digital business ecosystem refers to a network of interconnected actors including firms, consumers, governments, and technology providers that interact through digital platforms to create and exchange value. Unlike traditional linear business models, digital ecosystems emphasize collaboration, co-creation, and dynamic value generation [20]. This transformation is driven by rapid advancements in digital technologies, which enable real-time data exchange, platform-based interactions, and scalable innovation across industries.

Artificial Intelligence (AI) plays a central role in strengthening the functionality of digital ecosystems. AI technologies, such as machine learning, natural language processing, and predictive analytics, enhance the ability of organizations to process complex data, automate decision-making, and improve operational efficiency [21]. Through these capabilities, AI enables firms to respond more effectively to market changes, optimize resource allocation, and deliver personalized services. As a result, AI integration is increasingly viewed as a key enabler of competitive advantage within digital environments.

In the context of sustainability, AI contributes to improving efficiency, reducing operational waste, and supporting innovation-driven growth. For example, AI can optimize supply chain management, enhance energy efficiency, and support data-driven strategic planning [22]. However, the effectiveness of AI integration depends on several factors, including technological readiness, data availability, and organizational capability [23]. Therefore, understanding the interaction between AI and digital ecosystems is essential for achieving.

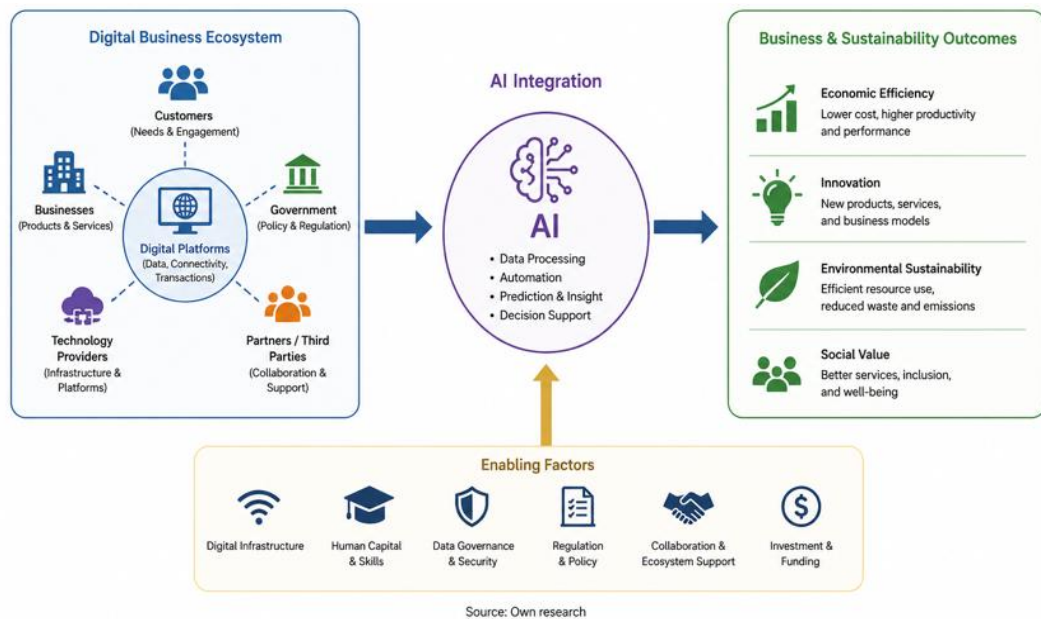


Figure 1. Conceptual framework of AI integration in digital business ecosystems and sustainability outcomes.

Source: own research

As shown in Figure 1, the framework positions AI capabilities (machine learning, predictive analytics, and automation) as the central mechanism linking digital-ecosystem actors firms, consumers, government, and technology providers to three interrelated outcome constructs: operational efficiency, innovation capacity, and competitiveness. These three constructs jointly determine the ecosystem's sustainability performance, while contextual factors such as technological readiness, regulatory frameworks, and human capital moderate the strength of this relationship. This explicit mapping of constructs and directional relationships clarifies how the review's later findings (Section 4) are organized around the same three outcome pathways.

2.2. AI and Sustainable Economic Growth

Sustainable economic growth refers to the ability of an economy to grow over time while maintaining environmental balance, social inclusion, and efficient resource utilization [24]. In recent years, AI has been increasingly associated with sustainability due to its capacity to

enhance productivity and support innovation [25]. AI-driven systems can improve efficiency in production processes, reduce costs, and enable more accurate forecasting, which collectively contribute to long-term economic stability.

In digital business ecosystems, AI supports sustainability through three primary mechanisms [26]. First, it improves operational efficiency by automating repetitive tasks and optimizing resource use. Second, it fosters innovation by enabling the development of new products, services, and business models. Third, it enhances competitiveness by allowing firms to respond quickly to market demands and technological changes. These three mechanisms correspond directly to RQ2 of this review (Section 3.1) and highlight the strategic importance of AI in achieving sustainable development goals [27].

However, the relationship between AI and sustainability is not without challenges. Issues such as unequal access to technology, high implementation costs, and limited digital skills can hinder the widespread adoption of AI [28]. Additionally, concerns related to data privacy, ethical use, and regulatory frameworks must be addressed to ensure responsible AI deployment challenges that correspond to RQ3 of this review. Therefore, while AI offers significant opportunities for sustainable growth, its implementation must be carefully managed to maximize benefits and minimize risks.

2.3. Supporting Data and Illustration

Supporting data and illustrations are presented to strengthen the conceptual understanding of AI integration within digital business ecosystems and its contribution to sustainable economic outcomes. Table 1 synthesizes twelve dimensions drawn from the reviewed literature, mapping each AI application to its sectoral context in Indonesia and its associated sustainability impact.

Table 1. Supporting Data on AI Integration in Sustainable Digital Business Ecosystems in Indonesia

No	Dimension	AI Application	Sector/Context (Indonesia)	Sustainability Impact
1	Operational Efficiency	Process automation, predictive analytics	E-commerce, logistics	Cost reduction, faster operations
2	Innovation	Personalized recommendation systems	E-commerce, digital platforms	New products/services, better user experience
3	Decision-Making	Data analytics, AI-based forecasting	Fintech, banking	Better risk management and planning
4	Resource Optimization	Smart resource allocation systems	Manufacturing, supply chain	Reduced waste, efficient resource use
5	Inclusivity	AI-driven digital platforms	SMEs, startups	Increased market access
6	Competitiveness	AI-enabled business intelligence	Multi-sector	Faster response to market changes
7	Collaboration	Platform integration and data sharing	Digital ecosystem stakeholders	Improved coordination
8	Challenges: Technology	Infrastructure and system readiness	Rural vs urban Indonesia	Unequal adoption
9	Challenges: Ethics	Data privacy and algorithm bias	Cross-sector	Trust and regulatory issues

No	Dimension	AI Application	Sector/Context (Indonesia)	Sustainability Impact
10	Challenges: Human Capital	Skills gap and workforce adaptation	Labor market	Need for reskilling/upskilling
11	Policy & Regulation	AI governance frameworks	Government initiatives	Sustainable adoption
12	Long-term Impact	AI-driven digital transformation	National economy	Sustainable economic growth

Source: own research

2.4. Empirical research

The exploration of economic policy and digital transformation has been widely discussed in previous studies, particularly in relation to technology adoption and economic growth. Empirical research shows that the integration of digital technologies, including AI, has a positive impact on productivity, innovation, and firm performance [29]. In many developing countries, digitalization has enabled businesses to expand market reach, improve efficiency, and enhance competitiveness in both local and global markets.

Several studies highlight that AI adoption contributes significantly to operational improvements, such as cost reduction, process automation, and enhanced decision-making accuracy [30]. For instance, AI applications in e-commerce and financial technology sectors have been shown to improve customer experience, risk management, and service efficiency. However, empirical findings also indicate that the benefits of AI are not evenly distributed, as firms with greater technological capability and resources tend to gain more advantages [31].

In the Indonesian context, empirical evidence suggests that digital transformation is progressing rapidly but faces structural challenges, including infrastructure gaps, regulatory uncertainty, and limited human capital. Studies also emphasize the importance of government support, policy alignment, and cross-sector collaboration in facilitating effective technology adoption [32]. These findings reinforce the need to examine AI integration not only from a technological perspective but also from institutional and socio-economic dimensions.

Overall, existing empirical research provides valuable insights into the role of AI in economic development but often lacks a comprehensive synthesis that connects digital ecosystems, AI integration, and sustainability outcomes precisely the gap this review's three research questions are designed to address.

3. METHODOLOGY

3.1. Research design

This study employed a qualitative research approach [33] using a systematic literature review (SLR) guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 statement (PRISMA 2020) [45], which updates the original PRISMA statement [46]. The qualitative approach was selected because the study focuses on interpreting concepts, trends, and strategic implications rather than measuring variables quantitatively [34]. PRISMA was chosen over a purely narrative review because it provides a transparent, auditable protocol for search, screening, and synthesis, which is essential given the applied/practitioner relevance of the topic [35].

To operationalize this design, the review was guided by three research questions (RQs), derived directly from the objectives stated in Section 1:

1. RQ1: How is AI utilized within digital business ecosystems in Indonesia?

- 2. RQ2: How does AI adoption contribute to sustainability-related outcomes such as efficiency, innovation, and competitiveness?
- 3. RQ3: What challenges and enabling factors influence the effective adoption of AI within Indonesia's digital business ecosystem?

These three RQs structure both the data-extraction template (Section 3.6) and the mapping of the 30 included studies presented in Table 4 (Section 4.1), where each study is tagged against the RQ it primarily addresses.

3.2. Search Strategy

The literature search was conducted systematically using three primary sources, namely Scopus, Google Scholar, and official institutional repositories, to ensure comprehensive coverage of peer-reviewed journal articles and authoritative reports relevant to the intersection of artificial intelligence, digital business ecosystems, and sustainability. These sources were selected because they provide extensive academic literature as well as policy and institutional documents that support a comprehensive understanding of the research topic. The search strategy employed Boolean operators to combine three major conceptual domains: artificial intelligence, digital business ecosystems and digital transformation, and sustainability. To improve the relevance of the retrieved literature, geographical terms related to Indonesia and developing economies were also incorporated into the search queries.

The search syntax was adapted to the indexing characteristics of each database. In Scopus, the search was conducted using the TITLE-ABS-KEY field with the following Boolean query: *TITLE-ABS-KEY ("Artificial Intelligence" OR AI OR "Machine Learning" OR "Generative AI") AND ("digital business ecosystem" OR "digital transformation" OR "digital economy" OR "digital innovation") AND (sustainab OR "sustainable development" OR "sustainable growth" OR ESG) AND (Indonesia OR "developing econom"))*. Meanwhile, Google Scholar employed a broader keyword search using the expression **("Artificial Intelligence" OR AI) AND ("digital business ecosystem" OR "digital transformation" OR "digital economy") AND (sustainab OR "sustainable development") AND (Indonesia OR "developing countries")*. Official institutional repositories were searched using equivalent combinations of these keywords, adjusted to the search functionality of each repository, with particular attention given to reports and publications issued by government agencies, universities, international organizations, and research institutions.

The search was restricted to publications published between 2020 and 2025 to capture recent developments in artificial intelligence and sustainable digital transformation. Only publications written in English or Indonesian and available in full-text format were included in the review. The literature search was completed on 15 July 2026, after which all retrieved records were exported, screened, and assessed for eligibility in accordance with the PRISMA 2020 guidelines to ensure methodological transparency and reproducibility throughout the review process.

3.3. Inclusion and Exclusion Criteria

The retrieved studies were screened based on predefined inclusion and exclusion criteria to ensure their relevance, quality, and methodological consistency. These criteria were applied throughout the screening process to identify studies that directly addressed the research objectives. The inclusion and exclusion criteria used in this review are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Topic relevance	Studies that explicitly examine the application of Artificial Intelligence (AI) in digital business ecosystems, digital	Studies that only mention AI without providing substantial

Criteria	Inclusion	Exclusion
	transformation, or their relationship with sustainability.	discussion relevant to the research objectives.
Publication type	Peer-reviewed journal articles and indexed conference proceedings.	Non-peer-reviewed publications, including blogs, opinion articles, reports without peer review, unpublished theses, and dissertations.
Language	Publications written in English or Indonesian.	Publications written in other languages without an accessible English or Indonesian translation.
Publication period	Studies published between 2020 and 2025.	Studies published outside the 2020–2025 period.
Full-text availability	Full-text articles available for review.	Publications with only abstracts available or inaccessible full-text documents.
Duplication	The first or most complete version of a study.	Duplicate records identified across multiple databases.

Source: own research

These criteria were applied systematically during the identification, screening, eligibility, and inclusion stages of the PRISMA 2020 review process to ensure that only high-quality and relevant studies were included in the final analysis.

3.4. Screening and Eligibility Assessment Procedure

The SLR process followed four PRISMA stages: (1) identification of records through database searching, (2) screening of titles/abstracts against the inclusion and exclusion criteria in Section 3.3, (3) eligibility assessment through full-text review, and (4) inclusion of studies in the final qualitative synthesis. Screening was conducted independently against the criteria above; records that clearly fell outside the topic scope were removed at the identification/screening stage, while full-text review was used to resolve borderline cases and to verify methodological relevance. This structured, staged approach is intended to ensure the transparency and reproducibility of study selection, consistent with PRISMA reporting requirements [45], [46].

A total of 423 records were initially identified across the databases searched. After the staged screening and eligibility assessment described above, 30 studies met all inclusion criteria and were retained for the final qualitative synthesis presented in Table 4.

3.5. Quality Assessment

Studies that passed the eligibility stage were subsequently subjected to a quality assessment to ensure their methodological rigor and relevance before being included in the final review. A custom quality assessment rubric, adapted from established systematic literature review guidelines, was employed to evaluate each study. The assessment comprised four criteria: (1) clarity of the research objectives, (2) transparency and appropriateness of the research methodology, (3) relevance of the findings to the research questions of this review, and (4) credibility and recency of the publication source.

Each criterion was scored using a binary scale (1 = criterion fulfilled; 0 = criterion not fulfilled), resulting in a maximum score of four points for each study. Studies achieving a minimum score of 3 out of 4 were considered to meet the required quality standards and were included in the final synthesis. Studies with substantial methodological limitations or insufficient reporting were excluded, even if they were relevant to the review topic. Following

the quality assessment process, all included studies satisfied the predefined quality threshold and were retained for data extraction and synthesis.

3.6. Data Extraction and Coding Process

Data were extracted from each of the 30 selected studies using a structured review matrix designed to ensure consistency throughout the review process. The extracted information included the author(s), publication year, article title, research methodology, country or research context, key findings, and the primary research question (RQ1, RQ2, or RQ3) addressed by each study. A summary of the data extraction matrix, including the reference number of each included study as listed in the reference section, is presented in Table 4.

The extracted data were analyzed using a two-stage qualitative content analysis approach. In the first stage, open coding was conducted by carefully reviewing the findings of each study and assigning descriptive codes that represented the main concepts and ideas, such as cost reduction, predictive analytics, digital innovation, data privacy, and sustainability practices. In the second stage, the generated codes were organized into broader thematic categories based on conceptual similarities. These themes were subsequently aligned with the three research questions, namely operational efficiency, innovation and business competitiveness, and implementation challenges and enabling conditions. This thematic organization provided the analytical framework for presenting the findings in Section 4.

The coding process was conducted manually using the structured review matrix and a conceptual mapping framework to ensure systematic categorization and consistency across the selected studies. Manual coding was considered appropriate because of the manageable number of included studies and enabled an in-depth interpretation of the evidence without the use of specialized qualitative data analysis software.

3.7. PRISMA Flow Diagram

Figure 2 illustrates the PRISMA 2020 flow diagram, which summarizes the four stages of the literature selection process: identification, screening, eligibility assessment, and final inclusion. The diagram provides a transparent overview of the study selection process, beginning with the identification of records from multiple databases and ending with the studies included in the final synthesis. Table 3 presents the corresponding number of records at each stage, including duplicate removal, title and abstract screening, full-text eligibility assessment, and the final inclusion of eligible studies, in accordance with the PRISMA 2020 reporting guidelines [45].

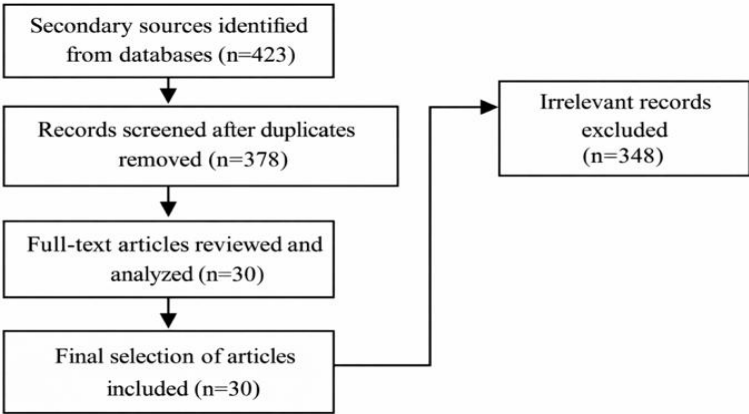


Figure 2. PRISMA Flow Diagram of Literature Selection Process

Source: own research

Table 3. PRISMA Screening Summary

Stage	N	Notes / Reasons for Exclusion
Records identified through database searching	423	Records retrieved from Scopus, Google Scholar, and official institutional repositories.
Duplicate records removed	45	Duplicate records identified across databases and removed before screening.
Records screened (title and abstract)	378	Records assessed based on title and abstract.
Records excluded at screening	348	Excluded because they were not directly related to the research topic, did not discuss Artificial Intelligence in digital business ecosystems or sustainability, were non-peer-reviewed publications, or did not meet the language and publication period criteria.
Full-text articles assessed for eligibility	30	Full-text articles evaluated against the predefined eligibility criteria.
Full-text articles excluded, with reasons	0	No full-text articles were excluded because all eligible studies met the predefined inclusion criteria and quality standards.
Studies included in the final synthesis	30	Studies included in the qualitative synthesis.

Source: own research

4. RESULTS AND DISCUSSION

4.1. Results

Based on database searches from Google Scholar, Scopus-indexed journals, and official institutional sources, 423 articles were initially identified using keywords such as Artificial Intelligence, digital transformation, digital business ecosystem, and sustainable development. After the screening and eligibility process described in Section 3.4–3.5, 30 articles were selected for further analysis. The selected studies, published between 2020 and 2025, vary in methodology and geographical focus, ranging from literature reviews and bibliometric analyses to case studies and quantitative analyses. Seven studies focus specifically on Indonesia, four on China, and the remainder on emerging economies, SMEs, or cross-country and cross-industry contexts, indicating broad academic interest in AI integration. Each study listed in Table 4 corresponds to an entry in the reference list, as indicated by its reference number.

Table 4 presents the complete set of all 30 studies included in the final synthesis (not a selective subset), mapped against the research question (RQ1, RQ2, or RQ3) each study primarily addresses, following the coding procedure described in Section 3.6. Of the 30 studies, 10 primarily address RQ1 (how AI is utilized within Indonesia's digital business ecosystems), 14 primarily address RQ2 (AI's contribution to efficiency, innovation, and competitiveness), and 6 primarily address RQ3 (challenges and enabling factors).

The results show that AI plays a key role in digital business ecosystems by enabling automation, data processing, and improved decision-making. AI technologies, particularly machine learning and predictive analytics, are widely applied in sectors such as e-commerce and financial technology to enhance operational efficiency and reduce costs. In addition, AI supports innovation by enabling personalized services, improving customer experience, and facilitating the development of new business models.

Furthermore, the findings indicate that AI strengthens competitive advantage by increasing organizational agility and responsiveness to market changes. In terms of sustainability, AI contributes to economic growth by improving resource efficiency, reducing operational waste, and supporting inclusive participation, especially for small and medium enterprises. However, several challenges are identified, including technological readiness, data privacy and security concerns, ethical issues, and workforce adaptation.

Table 4. Mapping Results of 30 Articles Based on Research Questions

No	Author(s) [Ref.]	Year	Focus of the Study	Thematic Category	Context	RQ
1	Adytia et al. [1]	2024	Regulatory arrangements and use of AI for personal data protection	Regulation and data privacy	Indonesia	RQ3
2	Ahmed et al. [2]	2025	Impact of AI and machine learning on business analytics	Data-driven decision-making	Cross- industry	RQ1
3	Ailani [3]	2022	AI in fostering ethical business practices in digital marketing	Ethics and responsible AI	Indonesia	RQ3
4	Yaşar [5]	2024	AI in business operations, decision- making, and efficiency	Operational efficiency	Cross- industry	RQ1
5	Sahetapy et al. [6]	2025	Big data and AI strategies for business development	AI utilization strategies	Indonesia	RQ1
6	Sánchez et al. [8]	2025	AI adoption in SMEs based on the TOE–DOI framework	Adoption barriers and enablers	SMEs	RQ3
7	Soomro et al. [9]	2025	Impact of AI technologies on the sustainable performance of SMEs	Sustainable performance	SMEs	RQ2
8	Perifanis & Kitsios [11]	2023	Influence of AI on business value in the digital era	Business value and competitiveness	Global (review)	RQ2
9	Nathalie et al. [12]	2024	Optimizing digital business processes through AI in e- commerce	Process optimization	E-commerce	RQ1
10	Mhlanga [14]	2020	Impact of AI on digital financial inclusion	Financial inclusion	Fintech	RQ2
11	Martín-Peña et al. [16]	2024	Digital platforms and business ecosystems for sustainable business models	Ecosystem sustainability	Digital platforms	RQ2
12	Manginte & Boari [18]	2025	AI adoption, productivity, and economic	Productivity and workforce	Indonesia	RQ1

			transformation of Generation Z			
13	Liao et al. [19]	2024	Digital transformation, innovation, and business ecosystems	Ecosystem innovation	Global (review)	RQ2
14	Mishra & Tripathi [20]	2021	AI business model as an integrative business approach	AI-based business models	Cross-industry	RQ1
15	Jankovic & Curovic [21]	2023	Strategic integration of AI for sustainable businesses	Data management and user engagement	Cross-industry	RQ3
16	Joseph [22]	2025	Leveraging AI to inspire innovation in business ecosystems	Innovation	Business ecosystems	RQ2
17	Sjödin et al. [23]	2021	AI capabilities enabling business model innovation	Business model innovation	Industrial firms	RQ2
18	Mhlanga [24]	2021	AI in Industry 4.0 and the Sustainable Development Goals	Sustainable development	Emerging economies	RQ2
19	Lin et al. [25]	2024	Influence of AI on regional economic growth	Economic growth	China	RQ2
20	Feng et al. [26]	2024	AI and the transformation of green economic growth	Green growth	China	RQ2
21	Gupta et al. [27]	2024	Economic policy and AI implementation for sustainable growth	Policy opportunities and challenges	Policy context	RQ3
22	Fan & Liu [28]	2021	AI and sustainable economic growth via industrial structural change	Sustainable growth	China	RQ2
23	Utama et al. [36]	2025	AI-based business management strategy in Indonesian industry	AI utilization strategies	Indonesia	RQ1
24	Sungkono & Widana [37]	2024	AI as a catalyst for digital economic transformation	Digital economic transformation	Indonesia	RQ1
25	Prathama [38]	2025	AI implementation by PT Gojek Indonesia	Efficiency and competitiveness	Indonesia	RQ1
26	Ningsih & Murti [39]	2024	Business model innovation of start-ups in the digital economy	Start-up business models	Start-ups	RQ1
27	Kulkov et al. [40]	2024	Organizational and technical approaches to AI-driven sustainable development	Enabling conditions	Global	RQ3
28	Qian et al. [41]	2023	AI and green economic growth	Green growth	China	RQ2

29	Yoganandham & Kareem [42]	2025	Strategic digital transformation for sustainable business growth	Economic resilience	Multi-sector	RQ2
30	Hong & Xiao [44]	2024	Blockchain and AI in supply chains for a sustainable digital economy	Supply chain sustainability	Supply chains	RQ2

Source: own research

4.2. Keyword Co-occurrence Network Visualization

To complement the thematic clustering derived from the manual coding process (Section 3.6), a keyword co-occurrence analysis was conducted to visualize the conceptual relationships among the studies included in this review. The analysis was performed using VOSviewer version 1.6.20 based on bibliographic data exported from Scopus, including article titles, abstracts, and author keywords from the 30 selected studies. A minimum keyword occurrence threshold of two was applied to exclude infrequently occurring terms, and the default association strength normalization and clustering parameters in VOSviewer were used to generate the network visualization.

Figure 3 presents the keyword co-occurrence network of the reviewed literature, where node size represents the frequency of keyword occurrence, edge thickness indicates the strength of co-occurrence between keywords, and different colors represent clusters of conceptually related themes.

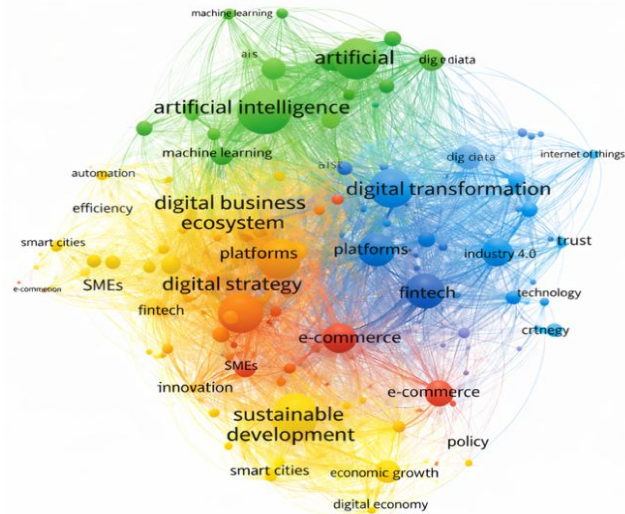


Figure 3. Keyword co-occurrence network of the reviewed literature

Source: own research

The network visualization indicates that Artificial Intelligence constitutes the central concept and is strongly connected with digital transformation, digital business ecosystems, digital innovation, and sustainability-related themes [38-40]. These relationships suggest that AI functions as a key enabler of digital business processes and ecosystem integration across the reviewed studies. Additional clusters associated with platforms, fintech, e-commerce, innovation, and the digital economy further demonstrate the multidimensional application of AI in supporting business development and organizational transformation. Sustainability-

related keywords are closely linked to economic growth, smart systems, and digital technologies, highlighting the contribution of AI-enabled digital transformation to sustainable business development. Meanwhile, themes such as policy, trust, governance, and technological readiness appear as complementary factors that influence the successful implementation and adoption of AI within digital business ecosystems [41-42]. Overall, the keyword co-occurrence analysis supports the thematic patterns identified through manual coding by demonstrating consistent conceptual relationships among the principal themes discussed in the selected literature.

4.3. Discussion

The identified challenges particularly data privacy, ethical concerns, and workforce readiness highlight the complexity of AI implementation. These issues suggest that successful integration requires a balanced approach that combines technological advancement with governance and capacity building [43]. In this regard, policymakers play a critical role in creating supportive environments through regulation, investment, and education.

Compared to previous studies, this research emphasizes the interconnected relationship between AI, digital ecosystems, and sustainability outcomes [44]. Rather than viewing AI as an isolated factor, the findings underline the importance of systemic alignment between technology, institutions, and stakeholders. This perspective provides a more comprehensive understanding of how AI can effectively support sustainable economic growth, particularly in developing country contexts such as Indonesia.

The findings confirm that AI is not only a supporting tool but a strategic driver within digital business ecosystems [40]. Its ability to simultaneously improve efficiency and foster innovation suggests that AI contributes to both short-term performance and long-term competitiveness. This dual role explains why organizations that adopt AI tend to be more adaptive in dynamic digital environments.

Compared with prior reviews such as Perifanis and Kitsios [11] and Liao et al. [19], which examine AI, digital transformation, and business value at a general or cross-country level, the present review differs by anchoring its synthesis specifically in Indonesia's developing-economy context, where infrastructure gaps and regulatory uncertainty condition how AI's efficiency and innovation benefits materialize. This is consistent with, yet more contextually specific than, findings reported by Mhlanga [24] on AI's role across emerging economies more broadly. Where prior reviews tend to treat efficiency, innovation, and challenges as separate strands, the present synthesis's explicit RQ-based mapping (Section 4.1) shows these three strands are interdependent: efficiency and innovation gains identified under RQ1–RQ2 are consistently conditioned by the enabling factors and constraints identified under RQ3, a pattern less explicitly foregrounded in the comparator reviews.

From a sustainability perspective, the results indicate that AI contributes indirectly through efficiency gains, innovation, and expanded market access [41]. However, these benefits depend heavily on enabling conditions such as infrastructure, regulatory frameworks, and human capital. This implies that AI adoption alone is insufficient; its impact is shaped by the broader institutional and technological context. As a result, disparities in readiness may lead to unequal distribution of benefits across regions and sectors [42].

Theoretically, these findings extend digital-ecosystem and sociotechnical-systems perspectives by showing that AI's contribution to sustainability is not a direct technological effect but an institutionally mediated one a nuance that is often implicit rather than explicitly theorized in the technology-adoption literature this review draws on. The identified challenges particularly data privacy, ethical concerns, and workforce readiness highlight the complexity of AI implementation. These issues suggest that successful integration requires a balanced

approach that combines technological advancement with governance and capacity building [43]. In this regard, policymakers play a critical role in creating supportive environments through regulation, investment, and education.

The novelty of this review, relative to the comparator studies discussed above, lies in (a) its explicit three-RQ structure linking utilization, sustainability outcomes, and enabling/constraining conditions, and (b) its Indonesia-specific synthesis of 30 studies spanning e-commerce, fintech, and SME contexts, which prior general or single-country reviews have not combined in this way.

4.4. Theoretical and Managerial Contributions

This review identifies a specific research gap: while AI-adoption and digital-transformation literatures are both well developed, few studies explicitly connect AI's technological capabilities to sustainability outcomes through the lens of institutional enabling conditions in a single developing-economy setting. This review's synthesis addresses that gap by mapping 30 studies onto three RQs that jointly capture utilization, outcomes, and conditions.

Theoretically, the review contributes by positioning institutional and infrastructural readiness as a moderating rather than merely contextual factor between AI adoption and sustainability outcomes, refining how digital-ecosystem frameworks account for uneven benefit distribution in developing economies.

Managerially, the findings suggest that firms should pair AI investment with parallel investment in data-governance practices and workforce reskilling to realize sustainability benefits rather than treating AI adoption as a standalone efficiency initiative. For policymakers, the review implies that regulatory clarity on data privacy and algorithmic accountability is a precondition not merely a complement to broad-based, inclusive AI-driven growth, particularly for SMEs with limited capacity to absorb regulatory uncertainty.

Future research directions include empirical (survey- or case-based) validation of the efficiency–innovation–competitiveness pathways identified here, comparative studies across ASEAN economies to test the generalizability of the Indonesia-specific findings, and longitudinal research tracking how regulatory developments affect AI-driven sustainability outcomes over time.

5. CONCLUSION

This study concludes that the integration of Artificial Intelligence (AI) into digital business ecosystems plays an important role in supporting sustainable economic growth in Indonesia. Synthesizing 30 studies through a PRISMA-guided systematic literature review, the findings show that AI enhances operational efficiency through automation and data-driven decision-making, while also fostering innovation in products, services, and business models. In addition, AI strengthens competitiveness by improving organizational agility and responsiveness to market changes, and supports broader participation of stakeholders, including small and medium enterprises.

Theoretically, the review contributes by reframing institutional and infrastructural readiness as a moderating condition linking AI adoption to sustainability outcomes, rather than a peripheral contextual factor, thereby refining digital-ecosystem perspectives applied to developing economies. Practically, the findings imply that firms and policymakers should treat AI investment, data-governance capacity, and workforce reskilling as complementary rather than sequential priorities, and that regulatory clarity is a precondition for inclusive, sustainability-oriented AI adoption.

Despite these contributions, several limitations remain. This study is based on secondary literature and conceptual/contextual analysis without empirical validation, which may limit the generalizability of its conclusions. The review is also limited to studies retrievable through the databases and search strategy described in Section 3.2, which may not capture all relevant grey literature or non-English/non-Indonesian sources. Given these limitations, future research is encouraged to incorporate empirical approaches — such as surveys, case studies, or longitudinal designs — and comparative cross-country analysis to strengthen and extend the evidence on AI-driven sustainability outcomes in Indonesia and other developing economies.

REFERENCES

- [1] N. A. P. Adytia, S. Arief, and D. Astesa, "Regulatory Arrangements and Utilization of Artificial Intelligence (AI) in Realizing Personal Data Protection in Indonesia," *KnE Soc. Sci.*, pp. 920–927, Jan. 2024, doi: <https://doi.org/10.18502/kss.v8i21.14807>
- [2] F. Ahmed et al., "Revolutionizing Business Analytics: The Impact of Artificial Intelligence and Machine Learning," *Am. J. Adv. Technol. Eng. Solut.*, vol. 1, no. 01, pp. 147–173, Feb. 2025, doi: <https://doi.org/10.63125/f7yjsxw69>
- [3] A. W. Ailani, "Exploring the Role of Artificial Intelligence in Fostering Ethical Business Practices: Insights from Digital Marketing Advancements in Indonesia," *Int. Conf. Educ. Soc. Sci. Technol. ICESST*, vol. 1, no. 2, pp. 296–305, Dec. 2022, doi: <https://doi.org/10.55606/icesst.v1i2.393>
- [4] S. M. Williamson and V. Prybutok, "Balancing Privacy and Progress: A Review of Privacy Challenges, Systemic Oversight, and Patient Perceptions in AI-Driven Healthcare," *Appl. Sci.*, vol. 14, no. 2, p. 675, Jan. 2024, doi: <https://doi.org/10.3390/app14020675>
- [5] T. Yaşar, "Artificial Intelligence in Business Operations: Exploring How AI Technologies Are Reshaping Processes, Enhancing Decision-Making, and Driving Efficiency Across Various Industries," *Hum. Comput. Interact.*, vol. 8, no. 1, pp. 53–53, Nov. 2024, doi: <https://doi.org/10.62802/r78f9a37>
- [6] H. Sahetapy et al., "Big Data and Artificial Intelligence: Implications and Strategies for Business Development in Indonesia," *J. Mark. Manag. Innov. Bus. Rev.*, vol. 3, no. 1, pp. 65–77, Mar. 2025, doi: <https://doi.org/10.63416/mrb.v3i1.321>
- [7] H. W. Volberda et al., "Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms," *Long Range Plann.*, vol. 54, no. 5, Art. no. 102110, Oct. 2021, doi: <https://doi.org/10.1016/j.lrp.2021.102110>
- [8] E. Sánchez, R. Calderón, and F. Herrera, "Artificial Intelligence Adoption in SMEs: Survey Based on TOE–DOI Framework, Primary Methodology and Challenges," *Appl. Sci.*, vol. 15, no. 12, Art. no. 6465, Jan. 2025, doi: <https://doi.org/10.3390/app15126465>
- [9] R. B. Soomro et al., "A SEM–ANN analysis to examine impact of artificial intelligence technologies on sustainable performance of SMEs," *Sci. Rep.*, vol. 15, no. 1, Art. no. 5438, Feb. 2025, doi: <https://doi.org/10.1038/s41598-025-86464-3>
- [10] D. Plekhanov, H. Franke, and T. H. Netland, "Digital transformation: A review and research agenda," *Eur. Manag. J.*, vol. 41, no. 6, pp. 821–844, Dec. 2023, doi: <https://doi.org/10.1016/j.emj.2022.09.007>
- [11] N.-A. Perifanis and F. Kitsios, "Investigating the Influence of Artificial Intelligence on Business Value in the Digital Era of Strategy: A Literature Review," *Information*, vol. 14, no. 2, Art. no. 85, Feb. 2023, doi: <https://doi.org/10.3390/info14020085>
- [12] J. Nathalie, G. Jacqueline, N. A. Yusuf, and L. W. Ming, "Optimizing Digital Business Processes through Artificial Intelligence: A Case Study in E-Commerce Systems | *ADI*

- Journal on Recent Innovation*," Dec. 2024, Accessed: Apr. 28, 2026. [Online]. Available: <https://adi-journal.org/index.php/ajri/article/view/1120>
- [13] B. Murdoch, "Privacy and artificial intelligence: challenges for protecting health information in a new era," *BMC Med. Ethics*, vol. 22, no. 1, Art. no. 122, Sep. 2021, doi: <https://doi.org/10.1186/s12910-021-00687-3>
- [14] D. Mhlanga, "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion," *Int. J. Financ. Stud.*, vol. 8, no. 3, Art. no. 45, Sep. 2020, doi: <https://doi.org/10.3390/ijfs8030045>
- [15] C. Mennella et al., "Ethical and regulatory challenges of AI technologies in healthcare: A narrative review," *Heliyon*, vol. 10, no. 4, Feb. 2024, doi: <https://doi.org/10.1016/j.heliyon.2024.e26297>
- [16] M.-L. Martín-Peña, P. C. Lorenzo, and N. Meyer, "Digital platforms and business ecosystems: a multidisciplinary approach for new and sustainable business models," *Rev. Manag. Sci.*, vol. 18, no. 9, pp. 2465–2482, Sep. 2024, doi: <https://doi.org/10.1007/s11846-024-00772-y>
- [17] G. Mann, S. Karanasios, and C. F. Breidbach, "Orchestrating the digital transformation of a business ecosystem," *J. Strateg. Inf. Syst.*, vol. 31, no. 3, Art. no. 101733, Sep. 2022, doi: <https://doi.org/10.1016/j.jsis.2022.101733>
- [18] S. Y. Manginte and Y. Boari, "Dampak Adopsi AI terhadap Produktivitas dan Transformasi Ekonomi Generasi Z di Indonesia: Implikasi pada Pendidikan, Ketenagakerjaan, dan Gaya Hidup di Era Digital," *Warmadewa Econ. Dev. J. WEDJ*, vol. 8, no. 1, pp. 38–55, Jun. 2025, doi: <https://doi.org/10.22225/wedj.8.1.2025.38-55>
- [19] H.-T. Liao, C.-L. Pan, and Z. Wu, "Digital transformation and innovation and business ecosystems: A bibliometric analysis for conceptual insights and collaborative practices for ecosystem innovation," *Int. J. Innov. Stud.*, vol. 8, no. 4, pp. 406–431, Dec. 2024, doi: <https://doi.org/10.1016/j.ijis.2024.04.003>
- [20] S. Mishra and A. R. Tripathi, "AI business model: an integrative business approach," *J. Innov. Entrep.*, vol. 10, no. 1, Art. no. 18, Jul. 2021, doi: <https://doi.org/10.1186/s13731-021-00157-5>
- [21] S. D. Jankovic and D. M. Curovic, "Strategic Integration of Artificial Intelligence for Sustainable Businesses: Implications for Data Management and Human User Engagement in the Digital Era," *Sustainability*, vol. 15, no. 21, Art. no. 15208, Jan. 2023, doi: <https://doi.org/10.3390/su152115208>
- [22] E. Joseph, "Leveraging AI to Inspire Innovation in Traditional and Digital Business Ecosystems," *J. Bus. Ecosyst. JBE*, vol. 6, no. 1, pp. 1–18, 2025, doi: <https://doi.org/10.4018/JBE.383049>
- [23] D. Sjödin et al., "How AI capabilities enable business model innovation: Scaling AI through co-evolutionary processes and feedback loops," *J. Bus. Res.*, vol. 134, pp. 574–587, Sep. 2021, doi: <https://doi.org/10.1016/j.jbusres.2021.05.009>
- [24] D. Mhlanga, "Artificial Intelligence in the Industry 4.0, and Its Impact on Poverty, Innovation, Infrastructure Development, and the Sustainable Development Goals: Lessons from Emerging Economies?," *Sustainability*, vol. 13, no. 11, Art. no. 5788, Jan. 2021, doi: <https://doi.org/10.3390/su13115788>
- [25] S. Lin et al., "The influence of AI on the economic growth of different regions in China," *Sci. Rep.*, vol. 14, no. 1, Art. no. 9169, Apr. 2024, doi: <https://doi.org/10.1038/s41598-024-59968-7>

- [26] C. Feng et al., "How does artificial intelligence affect the transformation of China's green economic growth? An analysis from internal-structure perspective," *J. Environ. Manage.*, vol. 351, Art. no. 119923, Feb. 2024, doi: <https://doi.org/10.1016/j.jenvman.2023.119923>
- [27] G. K. Gupta et al., "Economic Policy and AI Implementation: Navigating the Opportunities and Challenges for Sustainable Growth," in *2024 International Conference on Knowledge Engineering and Communication Systems (ICKECS)*, Apr. 2024, pp. 1–6. doi: <https://doi.org/10.1109/ICKECS61492.2024.10616921>
- [28] D. Fan and K. Liu, "The Relationship between Artificial Intelligence and China's Sustainable Economic Growth: Focused on the Mediating Effects of Industrial Structural Change," *Sustainability*, vol. 13, no. 20, Art. no. 11542, Jan. 2021, doi: <https://doi.org/10.3390/su132011542>
- [29] P. Leão and M. M. da Silva, "Impacts of digital transformation on firms' competitive advantages: A systematic literature review," *Strateg. Change*, vol. 30, no. 5, pp. 421–441, 2021, doi: <https://doi.org/10.1002/jsc.2459>
- [30] I. Yoo and C.-G. Yi, "Economic Innovation Caused by Digital Transformation and Impact on Social Systems," *Sustainability*, vol. 14, no. 5, Art. no. 2600, Jan. 2022, doi: <https://doi.org/10.3390/su14052600>
- [31] L. Xia, S. Baghaie, and S. Mohammad Sajadi, "The digital economy: Challenges and opportunities in the new era of technology and electronic communications," *Ain Shams Eng. J.*, vol. 15, no. 2, Art. no. 102411, Feb. 2024, doi: <https://doi.org/10.1016/j.asej.2023.102411>
- [32] M. B. Tudose, A. Georgescu, and S. Avasilcăi, "Global Analysis Regarding the Impact of Digital Transformation on Macroeconomic Outcomes," *Sustainability*, vol. 15, no. 5, Art. no. 4583, Jan. 2023, doi: <https://doi.org/10.3390/su15054583>
- [33] Sugiyono, *Metode Penelitian Bisnis: Pendekatan Kuantitatif, Kualitatif, Kombinasi dan R&D*. Alfabeta, 2018.
- [34] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE, 2014.
- [35] Sugiyono, *Metode penelitian pendidikan: (pendekatan kuantitatif, kualitatif dan R & D)*. Alfabeta, 2008.
- [36] Y. A. Utama, P. Nurtantio, and Y. Wismantoro, "Business management strategy based on AI to build opportunities with the 'kulino' approach in the Indonesian industry," *Multidiscip. Sci. J.*, vol. 7, 2025, doi: <https://doi.org/10.31893/multiscience.2025ss0232>
- [37] Sungkono and I. D. K. K. Widana, "Optimizing Artificial Intelligence (AI) as a Catalyst for Digital Economic Transformation to Increase National Economic Growth," *Tech. Soc. Sci. J.*, 2024, doi: <https://doi.org/10.47577/tssj.v58i1.11174>
- [38] T. M. Prathama, "Influence Implementation Intelligence Artificial Intelligence by PT. Gojek Indonesia in Increase Efficiency Operations, Sustainability Business, Speed Decision Making, and Competitive Excellence in Indonesia's Technology Industry," *Int. Stud. Conf. Bus. Educ. Econ. Account. Manag. ISC-BEAM*, 2025, doi: <https://doi.org/10.21009/isc-beam.013.18>
- [39] R. Ningsih and W. Murti, "Innovation of Business Models in the Digital Economy: A Case Study of Start-up Companies," *J. Compr. Sci. JCS*, 2024, doi: <https://doi.org/10.59188/jcs.v3i12.2930>
- [40] I. Kulkov et al., "Artificial intelligence-driven sustainable development: Examining organizational, technical, and processing approaches to achieving global goals," *Sustain. Dev.*, vol. 32, no. 3, pp. 2253–2267, 2024, doi: <https://doi.org/10.1002/sd.2773>

- [41] Y. Qian et al., "Can artificial intelligence improve green economic growth? Evidence from China," *Environ. Sci. Pollut. Res.*, vol. 30, no. 6, pp. 16418–16437, Feb. 2023, doi: <https://doi.org/10.1007/s11356-022-23320-1>
- [42] G. Yoganandham and A. A. Kareem, "Strategic Digital Transformation for Sustainable Business Growth and Economic Resilience – An Empirical Assessment," *Int. J. Latest Technol. Eng. Manag. Appl. Sci.*, vol. 14, no. 7, pp. 449–455, Aug. 2025, doi: <https://doi.org/10.51583/IJLTEMAS.2025.1407000054>
- [43] X. Zhao and A. Aaron, "Artificial Intelligence for Sustainable Development: Quantile Evidence From FinTech, Human Capital, and Green Energy in G7 Economies," *Sustain. Dev.*, vol. 34, no. 1, pp. 362–375, 2026, doi: <https://doi.org/10.1002/sd.70268>
- [44] Z. Hong and K. Xiao, "Digital economy structuring for sustainable development: the role of blockchain and artificial intelligence in improving supply chain and reducing negative environmental impacts," *Sci. Rep.*, vol. 14, no. 1, Art. no. 3912, Feb. 2024, doi: <https://doi.org/10.1038/s41598-024-53760-3>
- [45] M. J. Page et al., "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews," *BMJ*, vol. 372, p. n71, Mar. 2021, doi: <https://doi.org/10.1136/bmj.n71>
- [46] D. Moher, A. Liberati, J. Tetzlaff, D. G. Altman, and PRISMA Group, "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement," *PLoS Med.*, vol. 6, no. 7, p. e1000097, Jul. 2009, doi: <https://doi.org/10.1371/journal.pmed.1000097>