

Developing a Green AI Governance Framework for Sustainable Digital Business Transformation

Syahyono^{1*} , Rifqi Fahrudin² , Tiurida Lily Anita³ , Nyree Ani⁴ 

¹Faculty of Business Management, Universitas Muhammadiyah Indonesia, Indonesia

²Faculty of Information Systems, Catur Insan Cendekia University, Indonesia

³Faculty of Digital Communication and Hotel Tourism, Bina Nusantara University, Indonesia

⁴Faculty of Retail Management, Pandawan Incorporation, New Zealand

¹syahyono@umindonesia.ac.id, ²rifqi.fahrudin@cic.ac.id, ³tiurida.anita@binus.ac.id, ⁴ashernuche@ijjis.asia

*Corresponding Author

Article Info

Article history:

Submission June 23, 2026

Revised July 30, 2026

Accepted August 14, 2026

Published August 28, 2026

Keywords:

Green AI

AI Governance

Sustainable Digital

Transformation

Business Sustainability



ABSTRACT

Amid the rapid growth of Artificial Intelligence (AI) adoption in business environments, concerns regarding energy consumption, carbon emissions, ethical accountability, and sustainable governance have become increasingly significant, creating the need for frameworks that align AI deployment with sustainability objectives and digital transformation strategies. **This study aims** to develop a green AI governance framework that supports sustainable digital business transformation by integrating environmental, governance, and technological considerations into AI implementation practices. **Using a Systematic Literature Review (SLR)**, relevant studies published between 2020 and 2025 were identified, screened, and analyzed to synthesize key themes, governance dimensions, and sustainability principles associated with green AI adoption in organizational contexts. **The findings reveal** that effective green AI governance is shaped by four interconnected dimensions including environmental sustainability, ethical and regulatory compliance, operational efficiency, and stakeholder accountability. Based on these findings, a conceptual framework is proposed that links AI lifecycle management, governance mechanisms, sustainability metrics, and business transformation outcomes to promote responsible and resource efficient AI deployment. **The study concludes** that organizations can enhance the sustainability and long term value of digital transformation initiatives by adopting a structured green AI governance approach that balances innovation, transparency, and environmental responsibility. The proposed framework contributes to both academic literature and managerial practice by offering strategic guidance for implementing sustainable AI systems while supporting organizational competitiveness and broader Sustainable Development Goals (SDGs).

This is an open access article under the [CC BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/) license.



DOI: <https://doi.org/10.34306/ajri.v8i1.1581>

This is an open-access article under the [CC BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/) license

(<http://creativecommons.org/licenses/by-nc-sa/4.0/>)

©Authors retain all copyrights

1. INTRODUCTION

The rapid advancement of AI has become a major driver of digital transformation across industries, enabling organizations to improve operational efficiency, automate decision making processes, and enhance business innovation [1]. The widespread adoption of AI technologies has accelerated the development of data

driven business models, creating new opportunities for competitiveness and organizational growth. However, the increasing computational demands of advanced AI systems, particularly large scale machine learning and generative AI models, have raised concerns regarding energy consumption, carbon emissions, and environmental sustainability [2]. As organizations continue to integrate AI into their digital transformation strategies, the need to balance technological innovation with sustainable development has become increasingly important [3].

In response to these challenges, the concept of green AI has emerged as an approach that emphasizes the development and deployment of energy efficient, environmentally responsible, and resource conscious AI systems [4]. Green AI seeks to minimize the environmental impact of AI technologies while maintaining their effectiveness and business value. Despite growing interest in green AI, many organizations still lack structured governance mechanisms to guide sustainable AI implementation. Existing AI governance frameworks primarily focus on ethics, transparency, accountability, and regulatory compliance while often overlooking environmental sustainability considerations [5]. This limitation creates a significant challenge for organizations pursuing sustainable digital transformation and long term business sustainability.

The importance of sustainable AI practices is also reflected in the United Nations SDGs, particularly SDG 9 (industry, innovation, and infrastructure), SDG 12 (responsible consumption and production), and SDG 13 (climate action) [6]. These goals emphasize the need for innovative technologies that support economic growth while reducing environmental impacts and promoting responsible resource utilization. As AI adoption continues to expand, organizations are increasingly expected to align their digital transformation initiatives with sustainability objectives and global environmental commitments. Consequently, integrating green AI principles into AI governance has become a strategic priority for achieving both technological advancement and sustainable business outcomes [7].

Although previous studies have explored AI governance, sustainable technologies, and digital transformation independently, limited research has proposed a comprehensive framework that explicitly integrates green AI principles with governance mechanisms to support sustainable digital transformation [8]. This research addresses this gap by developing a green AI governance framework that synthesizes key dimensions of environmental sustainability, governance accountability, operational efficiency, and business sustainability. Through a SLR, this study aims to provide a conceptual foundation that guides organizations in implementing responsible AI practices while supporting sustainable digital transformation and contributing to the achievement of relevant SDGs [9].

2. LITERATURE REVIEW

This study employed a SLR methodology to develop a green AI governance framework for sustainable digital transformation [10]. The SLR approach was selected because it provides a rigorous, transparent, and replicable process for identifying, evaluating, and synthesizing existing knowledge from academic literature. As research on green AI and AI governance continues to expand across multiple disciplines, a systematic review enables the consolidation of diverse findings into a coherent body of knowledge. Furthermore, the method supports the identification of emerging trends, research gaps, governance challenges, and sustainability considerations associated with the adoption of AI in contemporary business environments. Through this approach, the study seeks to establish a comprehensive understanding of how green AI principles can contribute to business sustainability and long term digital transformation initiatives [11].

The research process consisted of several interconnected stages, including literature identification, article screening, eligibility assessment, thematic analysis, and framework development. Relevant publications were collected from reputable academic databases and evaluated using predefined inclusion and exclusion criteria to ensure quality and relevance [12]. The selected studies were subsequently analyzed to identify recurring themes related to green AI, AI governance, sustainable digital transformation, and business sustainability. The insights generated from this analysis formed the foundation for the proposed green AI governance framework, which aims to provide organizations with strategic guidance for implementing environmentally responsible AI systems while supporting sustainable organizational growth and alignment with the SDGs.

2.1. Research Design

This study employed a SLR approach to develop a green AI governance framework for sustainable digital business transformation [13]. The SLR method was selected because it provides a structured and transparent process for identifying, evaluating, and synthesizing existing knowledge from relevant academic literature. Compared with traditional literature reviews, SLR minimizes researcher bias by following predefined

procedures for article selection, screening, and analysis [14].

The objective of this method was to identify the key dimensions, governance mechanisms, sustainability principles, and implementation strategies associated with green AI and AI governance [15]. The synthesized findings were subsequently used to construct a conceptual framework that supports sustainable digital transformation while promoting business sustainability and environmental responsibility.

2.2. Inclusion and Exclusion Criteria

To ensure the quality and relevance of the selected studies, inclusion and exclusion criteria were established before conducting the screening process [16]. The inclusion criteria focused on peer reviewed journal articles written in English that explicitly discussed green AI, AI governance, sustainability frameworks, or practical insights relevant to governance and sustainability [17].

Conversely, conference abstracts, editorials, duplicate records, non English publications, and studies unrelated to AI governance or sustainability were excluded from the review process [18]. This filtering process improved the consistency and reliability of the literature synthesis by ensuring that only high quality and relevant studies were included in the final analysis.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Peer-reviewed journal articles	Conference abstracts, editorials, and book reviews
Published between 2020 and 2025	Publications published before 2020
English-language publications	Non-English publications
Studies focusing on green AI	Studies unrelated to green AI
Studies discussing AI governance	Studies not addressing governance aspects
Research related to Sustainable Digital Transformation	Research unrelated to digital transformation
Studies examining Business Sustainability	Studies lacking sustainability perspectives
Full-text articles available for review	Articles with inaccessible full text
Empirical, conceptual, or review studies	Duplicate publications
Publications indexed in reputable academic databases	Non-academic or non-peer-reviewed sources

Table 1 presents the inclusion and exclusion criteria applied during the article selection process [19]. The criteria ensured that the selected literature was relevant to green AI, AI governance, sustainable digital transformation, and business sustainability, while excluding studies that did not contribute directly to the objectives of this research [20].

2.3. Article Selection Process

The article selection process followed a systematic screening procedure adapted from the PRISMA framework to ensure a transparent and consistent identification of relevant studies. Initially, articles were identified through database searches using predefined keywords and search combinations designed to capture publications related to the research objectives [21]. Duplicate records were removed before conducting title and abstract screening to eliminate repeated publications and exclude articles that were not relevant to the scope of the study. Subsequently, full text assessments were performed to evaluate the relevance, suitability, and substantive contribution of each article. The inclusion and exclusion criteria were applied consistently throughout these stages to ensure that only publications meeting the established requirements were retained for the final literature review.

The screening process enabled the identification of studies that specifically addressed green AI, governance mechanisms, sustainability metrics, environmental responsibility, and digital transformation initiatives [22]. The selected articles were further examined to identify relevant concepts, recurring themes, and relationships among the key areas addressed in the study. This process provided a structured basis for synthesizing the existing literature and identifying the main dimensions relevant to the research objectives. The final set of selected articles formed the foundation for the thematic analysis and subsequent framework development, supporting the integration of key findings into a comprehensive conceptual structure.

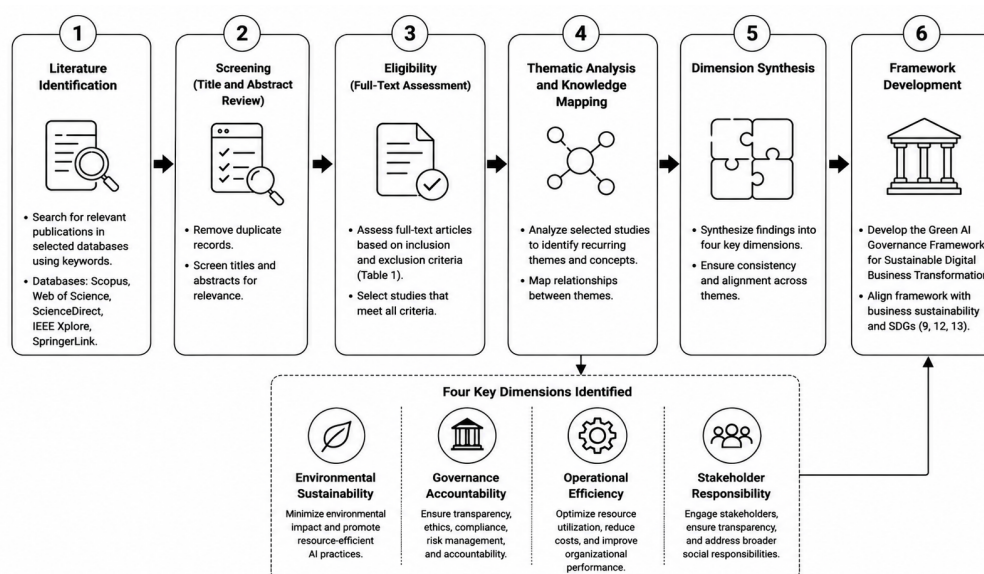


Figure 1. Research Methodology for Developing the Green AI Governance Framework

Figure 1 presents the research methodology adopted in this study. The process consists of five stages including identification, screening, eligibility assessment, literature synthesis, and framework development. Relevant studies were systematically collected, evaluated, and synthesized to identify key themes related to green AI, AI governance, sustainable digital transformation, and business sustainability [23]. The findings from the thematic analysis were subsequently utilized to develop the proposed green AI governance framework, which serves as the primary outcome of this research and supports organizational sustainability and SDGs alignment [24].

2.4. Data Analysis and Synthesis

The selected articles were analyzed using thematic analysis to identify recurring concepts, governance dimensions, sustainability factors, and implementation strategies [25]. Thematic analysis was chosen because it enables the systematic categorization of qualitative findings from multiple studies while facilitating the identification of patterns across the literature [26].

Several key themes emerged during the analysis process, including environmental sustainability, governance accountability, operational efficiency, stakeholder transparency, and responsible AI implementation [27]. These themes were grouped into broader conceptual categories to support framework development and establish relationships between green AI practices and sustainable digital transformation outcomes [28].

2.5. Framework Development Approach

The development of the green AI governance framework was based on the synthesis of the identified themes and governance dimensions [29]. The framework integrates sustainability principles, AI lifecycle management, governance mechanisms, and business transformation objectives into a unified structure. This approach ensures that environmental considerations are embedded throughout the AI adoption process.

The proposed framework aims to provide organizations with practical guidance for implementing green AI while maintaining governance accountability and supporting business sustainability [30]. Furthermore, the framework aligns with the United Nations SDGs, particularly SDG 9 (industry, innovation and infrastructure), SDG 12 (responsible consumption and production), and SDG 13 (climate action), thereby contributing to sustainable and responsible digital transformation initiatives.

3. RESEARCH METHOD

This study employed a SLR to systematically identify, evaluate, and synthesize relevant studies related to Green AI, AI governance, sustainable digital transformation, and business sustainability [29]. The method

was selected to provide a structured and transparent approach for examining existing research, identifying recurring themes, and determining the key dimensions relevant to sustainable AI implementation.

The research process consisted of literature identification, study selection, thematic analysis, and framework development [31]. The synthesized findings were used to identify the main dimensions of Green AI governance and to develop a conceptual framework that integrates environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility within sustainable digital business transformation.

3.1. Research Design and Literature Search

A SLR was adopted to provide a structured and transparent process for identifying and synthesizing relevant academic studies. The review focused on research addressing green AI, AI governance, sustainable digital transformation, business sustainability, environmental sustainability, and responsible AI implementation [32]. Relevant publications were collected from Scopus, Web of Science, ScienceDirect, IEEE Xplore, and SpringerLink. These databases were selected because they provide peer reviewed literature covering artificial intelligence, information systems, digital transformation, governance, sustainability, and related fields [33]. The literature search was limited to studies published between 2020 and 2025 to capture recent developments in Green AI and sustainable AI governance [34]. The research process consisted of literature identification, screening, eligibility assessment, thematic analysis, and framework development. The overall process is presented in Figure 2.

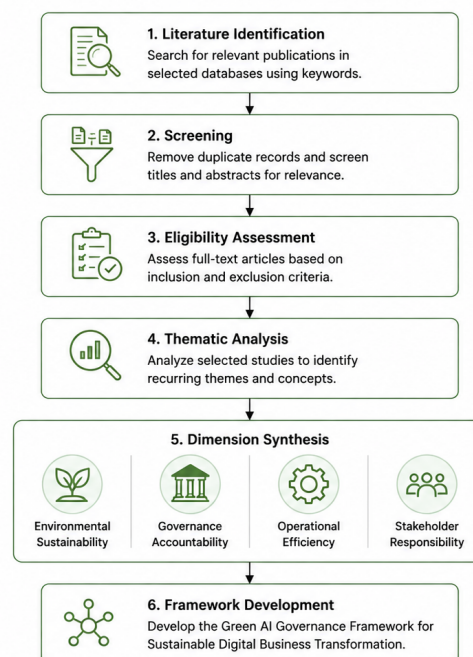


Figure 2. Research Methodology for Developing the Green AI Governance Framework

Figure 2 illustrates the systematic research process used to develop the proposed green AI governance framework. The process begins with literature identification and screening, followed by eligibility assessment and thematic analysis of the selected studies [35]. The identified themes are then synthesized into four key dimensions, namely environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility, which serve as the conceptual foundation for developing the green AI governance framework for sustainable digital business transformation.

3.2. Study Selection and Data Analysis

The study selection process followed a systematic procedure adapted from the PRISMA approach to ensure a transparent and consistent identification of relevant studies. Following the initial literature search, all identified records were collected and duplicate publications were removed before the screening stage. The

remaining records were then reviewed based on their titles and abstracts to assess their relevance to the research objectives and overall scope of the study [36]. Studies that did not meet the predefined criteria were excluded from further consideration. The selected studies were subsequently evaluated through a full text assessment to determine their relevance, suitability, and contribution to the literature synthesis. Only studies that met the established criteria were included in the final review. The inclusion and exclusion criteria applied throughout this selection process are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication	Peer reviewed articles	Other publication types
Period	2020 to 2025	Before 2020
Language	English	Non English
Access	Full text available	Full text unavailable
Relevance	Related to the study topics	Not relevant to the study

Table 2 presents the inclusion and exclusion criteria applied to ensure that the selected studies were relevant and appropriate for the objectives of this research [37]. The screening process considered several aspects, including publication type, publication period, language, accessibility, and relevance to the main topics of Green AI, AI governance, sustainable digital transformation, and business sustainability. Only peer reviewed articles published between 2020 and 2025, written in English, and available in full text were included in the analysis. Studies that did not meet these criteria or were not directly related to the focus of the research were excluded. The application of these criteria helped maintain the consistency and quality of the literature selection process and provided a reliable basis for the subsequent thematic analysis and framework development.

3.3. Framework Development

The framework was developed by synthesizing the four dimensions identified through the thematic analysis. Environmental sustainability represents the reduction of energy consumption, computational waste, and environmental impacts associated with AI systems. Governance accountability represents transparency, ethical decision making, regulatory compliance, risk management, and accountability throughout the AI life-cycle [2]. Operational efficiency represents the effective use of computational and organizational resources while maintaining AI performance. Stakeholder responsibility represents stakeholder engagement, transparent communication, and alignment between AI implementation and stakeholder expectations.

The four dimensions were integrated into a conceptual framework in which Green AI Governance functions as the central mechanism connecting responsible AI implementation with sustainable digital transformation and business sustainability [38]. The framework also considers the contribution of sustainable AI governance to SDG 9, SDG 12, and SDG 13. The resulting framework provides a conceptual foundation for organizations seeking to integrate environmental responsibility, governance accountability, operational efficiency, and stakeholder considerations into AI driven digital transformation.

3.4. Article Selection Process

The article selection process followed a systematic procedure consisting of identification, screening, and eligibility assessment. Relevant publications were first collected from the selected academic databases, after which duplicate and irrelevant records were removed [39]. The remaining studies were screened based on their titles and abstracts to determine their relevance to the main topics of green AI, AI governance, sustainable digital transformation, and business sustainability.

Studies that passed the initial screening were subsequently assessed through full text evaluation using the predefined inclusion and exclusion criteria [40]. Only articles that met the established criteria and provided relevant contributions to the objectives of this study were selected for further analysis. This systematic selection process ensured that the final literature sample provided an appropriate basis for identifying key themes and developing the proposed framework.

3.5. Data Analysis and Thematic Synthesis

The selected studies were analyzed using thematic analysis to identify recurring concepts and relevant relationships across the literature [41]. The analysis focused on themes related to green AI, governance mechanisms, environmental sustainability, operational efficiency, stakeholder responsibility, and sustainable digital

transformation. The identified concepts were compared and grouped according to their conceptual similarities to determine the main dimensions emerging from the reviewed studies.

The thematic synthesis resulted in the identification of four key dimensions, namely environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility [42]. These dimensions were subsequently synthesized to examine their relationships and their contribution to sustainable digital business transformation. The results of this analysis provided the conceptual foundation for the development of the proposed green AI Governance Framework.

4. RESULT AND DISCUSSION

The systematic literature review identified four key dimensions that form the foundation of the proposed green AI governance framework including environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility. These dimensions emerged from the thematic synthesis of the selected studies and represent the main factors supporting responsible AI implementation and sustainable digital business transformation. The results indicate that these dimensions are interconnected and should be considered collectively when developing a sustainable approach to AI governance.

4.1. Key Dimensions of Green AI Governance

Environmental sustainability emphasizes the reduction of energy consumption, computational waste, and environmental impacts associated with AI systems. Governance accountability focuses on transparency, ethical decision making, regulatory compliance, risk management, and organizational responsibility. Operational efficiency highlights the effective use of computational and organizational resources, while stakeholder responsibility emphasizes engagement, transparent communication, and alignment with stakeholder expectations.

The findings show that these four dimensions provide complementary perspectives for sustainable AI implementation. Environmental sustainability addresses the ecological consequences of AI, governance accountability ensures appropriate oversight, operational efficiency connects sustainability with organizational performance, and stakeholder responsibility strengthens trust and social responsibility. Together, these dimensions establish the conceptual basis of the proposed framework.

Table 3. Key Dimensions of the Green AI Governance Framework

Dimension		Primary Focus	Key Contribution
Environmental Sustainability	Sus-	Reducing energy consumption, computational waste, and environmental impacts	Supports environmentally responsible AI implementation
Governance Accountability	Account-	Ensuring transparency, ethical decision making, compliance, and risk management	Strengthens responsible oversight and organizational accountability
Operational Efficiency		Optimizing computational and organizational resources	Improves resource utilization and organizational performance
Stakeholder Responsibility		Promoting engagement, transparent communication, and stakeholder alignment	Strengthens trust, social responsibility, and long-term sustainability

As summarized in Table 3, the four dimensions address complementary aspects of sustainable AI implementation, with each dimension contributing to a different but interconnected area of responsible AI adoption. Environmental sustainability focuses on minimizing ecological impacts, governance accountability emphasizes transparency and responsible oversight, operational efficiency supports the effective use of resources, and stakeholder responsibility promotes trust and alignment with broader organizational expectations. Rather than operating independently, these dimensions collectively provide the conceptual foundation for the proposed green AI governance framework. Their integration highlights the importance of balancing environmental, organizational, and social considerations to support responsible AI implementation and sustainable digital business transformation.

4.2. Integration of the Green AI Governance Framework

The results demonstrate that the four dimensions should not be implemented independently. Environmental sustainability provides the basis for reducing the ecological impact of AI systems, while governance accountability establishes appropriate mechanisms for oversight and responsible decision making. Operational

efficiency connects sustainable AI practices with organizational performance, and stakeholder responsibility ensures that AI implementation remains aligned with the expectations of relevant stakeholders.

The integration of these dimensions forms the proposed green AI governance framework, with green AI governance serving as the central mechanism linking responsible AI implementation, sustainable digital transformation, and business sustainability. The framework also highlights the potential contribution of sustainable AI practices to SDG 9, SDG 12, and SDG 13. Figure 3 illustrates the relationships among the four dimensions within the overall framework.

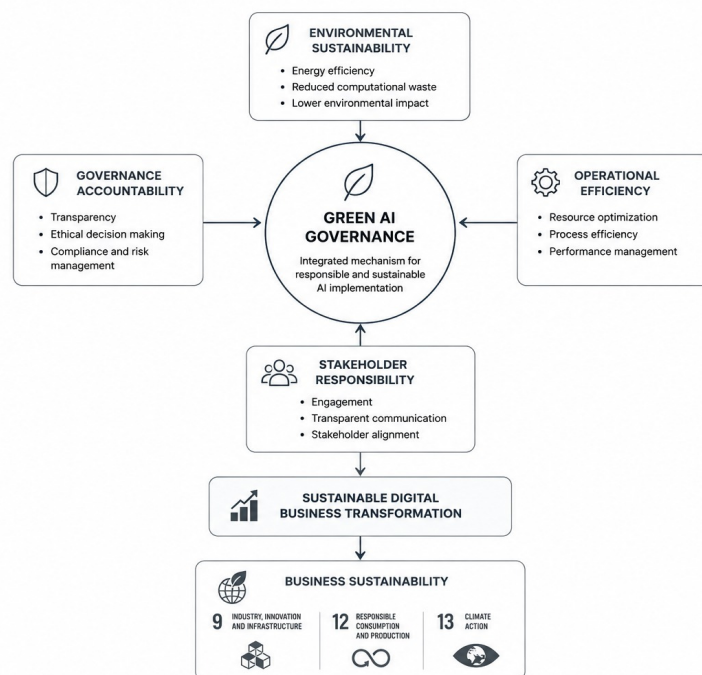


Figure 3. Proposed Green AI Governance Framework.

Figure 3 illustrates the proposed green AI governance framework, in which environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility are integrated as the four key dimensions supporting responsible and sustainable AI implementation. These interconnected dimensions collectively strengthen green AI governance as a central mechanism for achieving sustainable digital business transformation and long term business sustainability, while contributing to SDG 9, SDG 12, and SDG 13.

4.3. Implications for Sustainable Digital Business Transformation

The findings indicate that green AI governance provides a strategic foundation for integrating sustainability into AI driven digital transformation. By incorporating the four dimensions, organizations can improve accountability, reduce environmental impacts, optimize resources, and strengthen stakeholder engagement.

The framework also contributes to sustainable development by supporting responsible innovation, efficient resource use, and environmental responsibility. In this context, Green AI Governance provides a conceptual approach for aligning AI adoption with sustainable digital business transformation and long term organizational sustainability.

5. MANAGERIAL IMPLICATIONS

The proposed green AI governance framework provides practical guidance for managers seeking to implement AI in a sustainable and responsible manner. As organizations increasingly adopt AI technologies to support digital transformation, managers must ensure that innovation initiatives are aligned with environmental sustainability objectives and governance requirements. The findings suggest that decision makers should integrate green AI principles into organizational strategies by establishing clear policies related to energy efficient

AI systems, carbon footprint monitoring, ethical AI practices, and regulatory compliance. Such initiatives can help organizations balance technological advancement with long term business sustainability goals.

Furthermore, managers should adopt a holistic governance approach that incorporates environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility throughout the AI lifecycle. This requires cross functional collaboration among executives, IT professionals, sustainability officers, and other stakeholders to ensure that AI systems are developed, deployed, and monitored responsibly. By embedding these governance dimensions into organizational processes, companies can enhance transparency, reduce operational risks, improve resource utilization, and strengthen stakeholder trust in AI driven decision making.

The framework also offers strategic value for organizations aiming to align their digital transformation initiatives with global sustainability priorities. By adopting green AI governance practices, organizations can contribute to sustainable digital transformation while supporting business sustainability and relevant SDGs, particularly SDG 9 (industry, innovation and infrastructure), SDG 12 (responsible consumption and production), and SDG 13 (climate action). Consequently, the proposed framework serves as a managerial reference for building sustainable, accountable, and future oriented AI ecosystems that create both business value and positive societal impact.

6. CONCLUSION

This study developed a green AI governance framework for sustainable digital transformation through a SLR of research related to green AI, AI governance, business sustainability, and digital transformation. The findings identified four key dimensions that consistently influence the successful implementation of sustainable AI initiatives including environmental sustainability, governance accountability, operational efficiency, and stakeholder responsibility. These dimensions collectively highlight the importance of integrating environmental and governance considerations into AI adoption strategies to ensure responsible innovation and long term organizational value creation.

The primary novelty of this study lies in the development of a comprehensive green AI governance framework that explicitly integrates sustainability principles with AI governance mechanisms and digital transformation objectives. While previous studies have examined green AI, AI governance, and sustainability independently, limited research has combined these dimensions into a unified framework that supports sustainable digital transformation and business sustainability. By establishing the relationships among environmental responsibility, governance accountability, operational efficiency, and stakeholder engagement, this study contributes a conceptual foundation that can guide organizations in implementing sustainable and accountable AI practices.

Despite its contributions, this study is subject to limitations inherent in SLR research, as the proposed framework has not yet been empirically validated in real world organizational settings. Therefore, future research should focus on testing and validating the framework across different industries, organizational sizes, and geographical contexts. Further studies may also investigate the development of measurable green AI performance indicators, sustainability assessment models, and governance maturity frameworks to strengthen the practical implementation of green AI governance. Such efforts will contribute to advancing sustainable digital transformation while supporting business sustainability and the achievement of relevant SDGs.

7. DECLARATIONS

7.1. About Authors

Syahyono (SS)  <https://orcid.org/0000-0002-2177-2312>

Rifqi Fahrudin (RF)  <https://orcid.org/0000-0001-9782-7204>

Tiurida Lily Anita (TL)  <https://orcid.org/0000-0003-0167-1204>

Nyree Ani (NA)  <https://orcid.org/0009-0009-0623-1911>

7.2. Author Contributions

Conceptualization: RF; Methodology: TL; Software: SS; Validation: NA and RF; Formal Analysis: TL and SS; Investigation: NA; Resources: SS; Data Curation: RF; Writing Original Draft Preparation: TL and

SS; Writing Review and Editing: RF and NA; Visualization: SS; All authors, SS, RF, TL and NA have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

In line with our commitment to research transparency, the dataset underlying this study has been archived in the Zenodo Repository <https://doi.org/10.5281/zenodo.22105103>.

7.4. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

REFERENCES

- [1] A. Aldoseri, K. N. Al-Khalifa, and A. M. Hamouda, "Ai-powered innovation in digital transformation: Key pillars and industry impact," *Sustainability*, vol. 16, no. 5, p. 1790, 2024.
- [2] V. Bolón-Canedo, L. Morán-Fernández, B. Cancela, and A. Alonso-Betanzos, "A review of green artificial intelligence: Towards a more sustainable future," *Neurocomputing*, vol. 599, p. 128096, 2024.
- [3] Q. Aini, D. Manongga, U. Rahardja, I. Sembiring, and Y.-M. Li, "Understanding behavioral intention to use of air quality monitoring solutions with emphasis on technology readiness," *International Journal of Human-Computer Interaction*, pp. 1–21, 2024.
- [4] F. Ahmad, S. Dwivedi, Z. H. Khan, and N. Mittal, "Advancing green artificial intelligence: strategies for a sustainable future," in *Energy Efficient Algorithms and Green Data Centers for Sustainable Computing*. IGI Global Scientific Publishing, 2025, pp. 291–322.
- [5] P. Goktas and A. Grzybowski, "Shaping the future of healthcare: ethical clinical challenges and pathways to trustworthy ai," *Journal of clinical medicine*, vol. 14, no. 5, p. 1605, 2025.
- [6] U. Rahardja, Q. Aini, A. S. Bist, S. Maulana, and S. Millah, "Examining the interplay of technology readiness and behavioural intentions in health detection safe entry station," *JDM (Jurnal Dinamika Manajemen)*, vol. 15, no. 1, pp. 125–143, 2024.
- [7] B. Feng, X. Chen, and H. Tang, "Ai-driven green governance: Assessing the impact of artificial intelligence on corporate sustainability performance," *Journal of Innovation & Knowledge*, vol. 11, p. 100869, 2026.
- [8] R. Kumari, S. P. Dash, S. Mohanty, and S. Pandey, "A socio technical framework for integrating industry 4.0 and green hrm through ai for sustainable circular economy transitions," *Circular Economy and Sustainability*, vol. 6, no. 2, p. 196, 2026.
- [9] C. Lukita, N. Lutfiani, A. R. S. Panjaitan, U. Rahardja, M. L. Huzaifah *et al.*, "Harnessing the power of random forest in predicting startup partnership success," in *2023 Eighth International Conference on Informatics and Computing (ICIC)*. IEEE, 2023, pp. 1–6.
- [10] S. Siripipatthanakul, P. Phuangsuwan, P. Limna, Muthmainnha, S. Siripipattanakul, C. N. Vui, and P. Jaipong, "Artificial intelligence (ai) influencing sustainable governance: Governance adopting ai," in *International Conference on Data Analytics & Management*. Springer, 2024, pp. 551–568.
- [11] S. Rahman, S. Adeel, M. Ali, S. Bajaba, and H. Latan, "Power of green capabilities and artificial intelligence (ai): Understanding how and when green innovation promotes sustainability," *Business Strategy and the Environment*, vol. 35, no. 2, pp. 2502–2525, 2026.

- [12] E. Susetyono, D. S. Priyarsono, A. Sukmawati, and P. Nurhayati, "Improving risk management maturity in ultra micro soe holding companies," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 8, no. 1, pp. 310–324, 2026.
- [13] M. S. Shabbir, "Corporate sustainability reimaged: A bibliometric–systematic literature review of governance, technology, and stakeholder-driven strategies for sdg impact," *Business Strategy and the Environment*, vol. 34, no. 7, pp. 9203–9222, 2025.
- [14] P. Selvakumar, V. Uprikar, S. Chavan, P. B. Deshmukh, P. Kalshett, and S. Gorde, "Systematic literature review methodology and systems," *Innovative Approaches to Social Research Challenges*, pp. 17–42, 2026.
- [15] N. H. Farhansyah and H. Fabroyir, "Entrepreneurial applications of augmented reality in product placement on shelves," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 8, no. 1, pp. 185–198, 2026.
- [16] A. De Cassai, B. Dost, S. Tulgar, and A. Boscolo, "Methodological standards for conducting high-quality systematic reviews," *Biology*, vol. 14, no. 8, p. 973, 2025.
- [17] S. Ghazal Masri and M. El-Fadel, "Governance of digital transformation for sustainable development: aligning digital innovation with the sustainable development goals," *Frontiers in Sustainable Cities*, vol. 8, p. 1743552, 2026.
- [18] I. Sembiring, B. K. Aji, and T. I. Bayu, "Consortium blockchain framework for secure digital medical record innovation," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 8, no. 1, pp. 138–151, 2026.
- [19] R. M. Jia and C. Stern, "The inclusion or exclusion of studies based on critical appraisal results in jbi qualitative systematic reviews: An analysis of practices," *Research Synthesis Methods*, vol. 17, no. 2, pp. 277–292, 2026.
- [20] M. Á. Montañés-Del Río, V. Rodríguez-Cornejo, P. I. Rodríguez-Castro, and J. Herrera-Madueño, "The implementation of corporate social responsibility policies in the tourism industry and sustainable development goals: A review of progress, challenges, and opportunities," *Sustainability*, vol. 17, no. 13, p. 6044, 2025.
- [21] H. A. Azies, "Ai-based models for identifying underdeveloped villages in indonesia's rural development," *The Journal of Indonesia Sustainable Development Planning*, vol. 5, no. 3, pp. 192–202, 2024.
- [22] A. Bressane, M. V. de Castro, L. M. Nomura, and H. Ewbank, "Corporate environmental intelligence as an emerging governance framework in digital sustainability: A scoping review," *Environmental Development*, p. 101467, 2026.
- [23] V. El Ardelya, J. Taylor, and J. Wolfson, "Exploration of artificial intelligence in creative fields: Generative art, music, and design," *International Journal of Cyber and IT Service Management (IJCITSM)*, vol. 4, no. 1, pp. 40–46, 2024.
- [24] A. Florek-Paszkowska and A. Ujwary-Gil, "The digital-sustainability ecosystem: A conceptual framework for digital transformation and sustainable innovation," *Journal of Entrepreneurship, Management and Innovation*, vol. 21, no. 2, pp. 116–137, 2025.
- [25] M. M. Hassan and A. R. Ahmad, "Systematic literature review on the sustainability of higher education institutions (heis): Dimensions, practices and research gaps," *Cogent Education*, vol. 12, no. 1, p. 2549789, 2025.
- [26] A. A. Abdulmuhsin, H. D. Hussein, H. AL-Abrow, R. Masa'deh, and A. F. Alkhwalidi, "Impact of artificial intelligence and knowledge management on proactive green innovation: the moderating role of trust and sustainability," *Asia-Pacific Journal of Business Administration*, vol. 17, no. 3, pp. 765–795, 2025.
- [27] D. Bennet, L. Maria, Y. P. A. Sanjaya, and A. R. A. Zahra, "Blockchain technology: Revolutionizing transactions in the digital age," *ADI Journal on Recent Innovation (AJRI)*, vol. 5, no. 2, pp. 192–199, 2024.

- [28] D. W. S. Rahayu, B. Septiawan, A. D. S. Hamidah, and R. F. Terizla, "Tourism expectation as moderator of promotion objectives and promotion mix on tourist interest," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 8, no. 1, pp. 166–176, 2026.
- [29] O. Marmouzi, I. Oumaira, and M. Ajana El Khaddar, "A systematic review of green and sustainable ai: Taxonomy, metrics, challenges, and open research directions," *Sustainability*, vol. 18, no. 8, p. 4115, 2026.
- [30] D. Wuisan and T. Handra, "Maximizing online marketing strategy with digital advertising. startupreneur business digital (sabda journal), 2 (1), 22–30," 2023.
- [31] D. Danang, H. Haryani, Q. Aini, F. A. Ramahdan, and J. Edwards, "Empowering digital literacy through blockchain based alphasign for secure and sustainable e-governance," *ADI Pengabdian Kepada Masyarakat*, vol. 6, no. 1, pp. 87–97, 2025.
- [32] S. A. Hosseini Tabaghdehi and Ö. Ayaz, "Ai ethics in action: a circular model for transparency, accountability and inclusivity," *Journal of Managerial Psychology*, 2025.
- [33] M. Rodriguez, A. Rizky, Y. I. Tanjung, S. Sumliyah *et al.*, "Optimizing e-learning platforms through adaptive learning for diverse demographics," *Jurnal MENTARI: Manajemen, Pendidikan dan Teknologi Informasi*, vol. 4, no. 1, pp. 30–39, 2025.
- [34] M. Alamandi, "Sustainable innovation management: Balancing economic growth and environmental responsibility," *Sustainability*, vol. 17, no. 10, p. 4362, 2025.
- [35] D. Bennet, S. A. Anjani, O. P. Daeli, D. Martono, C. S. Bangun *et al.*, "Predictive analysis of startup ecosystems: Integration of technology acceptance models with random forest techniques," *Journal of Computer Science and Technology Application*, vol. 1, no. 1, pp. 70–79, 2024.
- [36] K. Zhang and X. Hao, "Corporate social responsibility as the pathway towards sustainability: A state-of-the-art review in asia economics," *Discover Sustainability*, vol. 5, no. 1, p. 348, 2024.
- [37] U. Rahardja, M. Miftah, M. Rakhmansyah, and J. Zanubiya, "Revolutionizing financial services with big data and fintech: A scalable approach to innovation," *ADI Journal on Recent Innovation (AJRI)*, vol. 6, no. 2, pp. 118–129, 2025.
- [38] M. Rojahn and M. Grum, "Green ai: A systematic review and meta-analysis of its definitions, lifecycle models, hardware and measurement attempts," *arXiv preprint arXiv:2511.07090*, 2025.
- [39] K. Mazhar, S. S. Mazhar, F. S. Khan, D. AlSaleh, A. Mazhar, S. Imam, and A. Smerat, "Ethical explainable artificial intelligence for green innovation: a systematic review and meta-analysis of transparency, fairness, and accountability in sustainable technologies," *The Artificial Intelligence Review*, vol. 59, no. 9, p. 186, 2026.
- [40] G. Pangilinan, S. Audiah, M. Shauqy, and O. Wahyudi, "Entrepreneurial marketing mindset as a determining factor for digital startup success. startupreneur business digital (sabda journal), 4 (1), 34-46," 2024.
- [41] R. K. Opoku, "Championing green sustainability in manufacturing of a developing economy: implications for sustainable performance through eco-regulatory compliance," *International Journal of Productivity and Performance Management*, vol. 74, no. 7, pp. 2442–2470, 2025.
- [42] G. T. Sulistyantoro, A. Khaq, M. Z. K. Khan, A. Amin, and A.-A.-M. Hussain, "Shaping artificial intelligence governance and risk management in the public sector: Regulatory insights," *Lex Publica*, vol. 11, no. 1, pp. 161–181, Jun. 2024. [Online]. Available: <https://garuda.kemdiktisaintek.go.id/documents/detail/4698515>