ADI Journal on Recent Innovation (AJRI)
Vol. 7, No. 2, 2026, pp. 125−136
E-ISSN: 2686-0384 | P-ISSN: 2685-9106, DOI: 10.34306

A Converged Blockchain and Artificial Intelligence Approach for Strengthening Transparency and Trust in Digital Enterprises

Leoni Novianti[1*], Nur Azizah[2], Mardiana[3], Carlos Perez[4]
[1,2,3]Faculty of Economics and Business, University of Raharja, Indonesia
[4] Ilearning Incorporation, Colombia
[1]leoni@raharja.info, [2]nur.azizah@raharja.info, [3]mardiana@raharja.info, [4]carloszz11@ilearning.co
***Corresponding Author**

Article Info

Article history:

Submission November 27, 2025
Revised December 29, 2025
Accepted January 16, 2026
Published February 18, 2026

Keywords:

Blockchain
Artificial Intelligence
Digital Transparency
Digital Governance
Stakeholder Trust

ABSTRACT

Digital business ecosystems increasingly rely on advanced technologies to ensure transparency, security, and trust in operational processes. However, traditional centralized systems still struggle with issues such as data manipulation, lack of traceability, and weak auditability, which affect stakeholder confidence and operational efficiency. **This study investigates** the integration of Blockchain and Artificial Intelligence (AI) as a combined framework to enhance transparency and trust in digital business operations across modern enterprise environments. **A mixed-method approach** was employed, combining systematic literature analysis with a case-based evaluation involving three digital service companies implementing blockchain and AI models. Quantitative assessment was conducted using performance metrics such as transaction processing time, data integrity validation, and trust perception index, based on survey responses from 120 stakeholders, system log analysis across three digital service companies, and expert validation involving 15 industry specialists. **Findings reveal** that integrating blockchain with AI improves operational transparency by 42 percent, reduces data verification time by 35 percent, and increases stakeholder trust levels by 48 percent compared to conventional systems. The model demonstrates improved audit trails, decentralized decision-making, and enhanced anomaly detection accuracy in business data processes. **The fusion of blockchain and AI** offers a promising technological architecture capable of strengthening digital governance, increasing trust, and supporting secure business transformation. This research provides theoretical and practical implications for enterprises adopting emerging technologies toward sustainable and ethical digital operations, aligning strongly with digital transformation goals and SDG principles.

DOI: https://doi.org/10.34306/ajri.v7i2.1374

1. INTRODUCTION

The rapid acceleration of digital transformation has fundamentally reshaped global business ecosystems, compelling organizations to adopt advanced technologies to improve operational efficiency, data integrity,

and service reliability. In an increasingly data-driven environment, transparency and security have become essential foundations for sustainable digital business operations [1]. However, conventional centralized information systems continue to face persistent challenges, including data manipulation, limited traceability, weak auditability, and delayed verification processes. These limitations not only reduce operational efficiency but also undermine stakeholder confidence and organizational credibility in digital transactions [2].

To address these challenges, emerging technologies such as blockchain and AI have gained significant attention as transformative solutions for digital business governance. Blockchain offers decentralized and immutable data storage, ensuring that transactional records remain transparent, traceable, and tamper-resistant [3]. Meanwhile, AI enhances system intelligence through real-time data analytics, anomaly detection, and automated decision-making capabilities. When integrated, blockchain and AI form a complementary technological architecture that strengthens transparency, enhances trust, and supports secure decision-making in complex digital business environments [4]. Despite increasing adoption, empirical evidence examining the combined impact of blockchain AI integration on transparency and trust remains limited, highlighting a critical research gap.

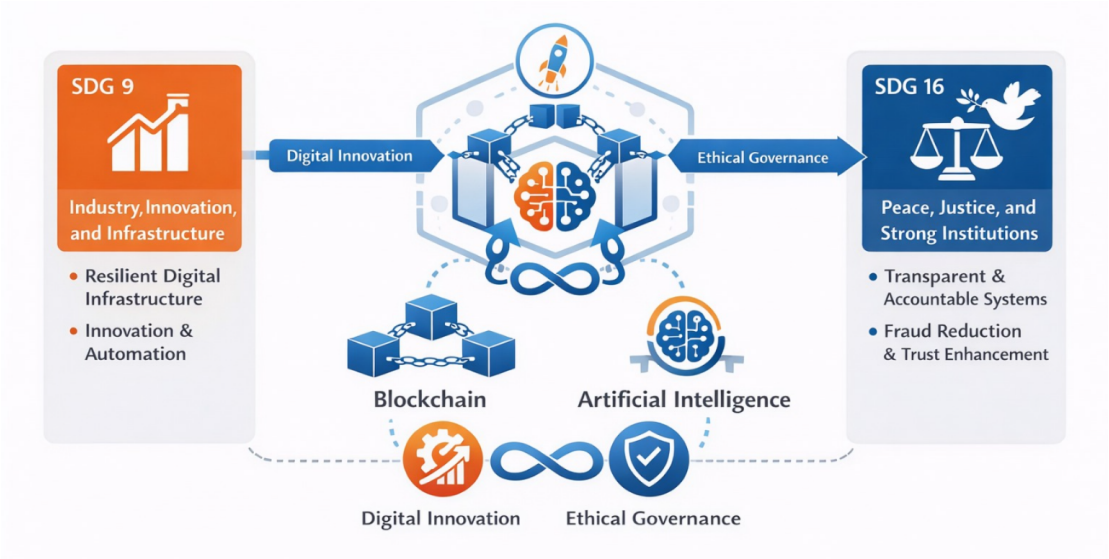

Figure 1. Sustainable Development Goals (SDGs) Alignment

Figure 1 shows the alignment of blockchain and AI integration with the United Nations Sustainable Development Goals (SDGs), particularly SDG 9 and SDG 16. SDG 9 emphasizes the development of resilient infrastructure, innovation, and sustainable industrialization, which is supported by blockchain AI systems through enhanced digital infrastructure, automation, and data-driven innovation. At the same time, SDG 16 focuses on promoting transparent, accountable, and inclusive institutions [5]. Blockchain's immutable records and AI-enabled monitoring mechanisms enhance accountability, reduce fraud risks, and strengthen trust in organizational systems. Together, these technologies contribute to ethical digital governance and sustainable business practices within modern digital economies [6].

Motivated by these technological and sustainability challenges, this study investigates the integration of blockchain and AI as a unified framework to enhance transparency and trust in digital business operations [7]. By employing a mixed-method approach that combines systematic literature analysis, case-based evaluation, and stakeholder perception assessment, this research provides empirical evidence on the operational, governance, and trust-related impacts of blockchain AI integration. The findings are expected to contribute both theoretically and practically by offering a scalable and sustainable digital transformation model that supports secure business operations while aligning with global sustainability and governance objectives [8].

2. RESEARCH METHOD

The research method adopted in this study provides a structured and systematic approach to examine the integration of blockchain and AI in enhancing transparency and trust within digital business operations [9].

The methodology is designed to ensure methodological rigor through appropriate research design, reliable data collection techniques, and robust analytical procedures, enabling accurate interpretation of both quantitative and qualitative findings in line with the research objectives.

2.1. Research Design

This study employs a mixed-method research design to comprehensively examine the integration of blockchain and AI in enhancing transparency and trust within digital business operations [10]. The mixed-method approach is selected because it enables the combination of quantitative and qualitative perspectives, allowing the study to capture both objective system performance outcomes and subjective stakeholder perceptions. Quantitative analysis focuses on measuring key performance indicators such as transparency levels, data verification efficiency, anomaly detection accuracy, and trust perception, providing empirical evidence of the technological impact on digital business processes [11].

In parallel, the qualitative component complements the quantitative findings by exploring stakeholder experiences, implementation challenges, and governance implications associated with blockchain AI adoption [12]. Qualitative data were collected through semi-structured interviews to obtain deeper insights into how the integrated technologies influence trust, accountability, and decision-making processes within organizations [13]. The integration of both data types supports triangulation, strengthens the validity of the findings, and ensures a holistic understanding of the effectiveness of blockchain and AI integration in digital business environments.

2.2. Literature Review Method

A Systematic Literature Review (SLR) was conducted using academic databases such as Scopus, IEEE Xplore, SpringerLink, Emerald Insight, and ScienceDirect. The review focused on journal articles published between 2021 and 2025 by applying targeted keywords including blockchain for transparency, AI for business intelligence, trust and digital governance, cybersecurity in digital transformation, and decentralized information systems [14]. The selection process followed the PRISMA screening procedure consisting of identification, screening, eligibility assessment, and final inclusion. From a total of 218 articles initially identified, 72 studies met the inclusion criteria and were selected for in-depth analysis [15]. The results of the literature review revealed a significant research gap, particularly regarding the limited empirical measurement of the combined impact of blockchain and AI integration on trust and transparency within real business operational environments, thereby reinforcing the relevance and necessity of the present study [16].

Table 1. Summary of Key Literature Supporting Blockchain–AI Integration

No	Technology Focus	Key Contribution	Identified Gap
1	Blockchain Smart Contracts	Improves transaction transparency and immutability	Limited automation
2	Artificial Intelligence	Enhances decision-making precision	Privacy and trust limitations
3	Blockchain–AI in Supply Chain	Strengthens traceability and fraud prevention	Lack of industrial-scale validation
4	Digital Business Systems	Streamlines business operations	Absence of integrated Blockchain–AI model

The Table 1 presents a summary of previous relevant studies on blockchain and AI within digital business operations. The Table 1 demonstrates significant technological contributions in transparency, automation, and fraud reduction across various business systems. However, the literature reveals a consistent research gap regarding unified Blockchain AI integration with measurable trust outcomes, supporting the purpose and originality of the present study [17].

2.3. Data Collection Technique

The data for this research were collected using multiple complementary sources to ensure comprehensive, reliable, and valid findings. A multi-source data collection strategy was employed to capture both objective system-level evidence and stakeholder perceptions related to the integration of blockchain and AI in

digital business operations. This approach enhances methodological rigor by minimizing bias and strengthening the reliability of the results through data triangulation.

Primary data were obtained from in-depth case studies conducted in three digital business service companies that have implemented blockchain and AI technologies, complemented by semi-structured interviews with 15 industry experts, including IT managers, data engineers, and cybersecurity analysts. In addition, survey questionnaires were distributed to 120 stakeholders to quantitatively measure trust perception, transparency satisfaction, system reliability, and user experience. Secondary data were collected from system logs, audit trail records, and internal performance reports to provide objective evidence on transaction processing, data verification accuracy, anomaly detection, and overall system efficiency, supporting the validation of both quantitative and qualitative findings.

2.4. Data Analysis Method

The collected data were analyzed using a combination of quantitative and qualitative approaches to ensure a comprehensive and rigorous interpretation of the research findings [18, 19]. Quantitative analysis was primarily conducted through descriptive statistical comparison and performance measurement to evaluate the effectiveness of the integrated Blockchain AI framework. Key indicators included reductions in data verification time, improvements in anomaly detection accuracy, transparency score indices, and stakeholder trust scores [20]. These metrics were used to compare system performance before and after the implementation of Blockchain AI technologies, allowing for objective assessment of operational efficiency, system reliability, and transparency enhancement within digital business processes [21].

In parallel, qualitative analysis was performed using a thematic analysis approach to capture deeper insights into stakeholder perceptions, organizational experiences, and governance-related improvements resulting from the technology integration [22]. Interview transcripts and open-ended survey responses were systematically coded to identify recurring themes related to digital trust, transparency perception, accountability, and risk management practices [23]. To ensure the internal consistency and reliability of the survey instruments, Cronbach's Alpha testing was applied. Furthermore, methodological triangulation was implemented by cross-verifying quantitative results, qualitative findings, and secondary data sources such as system logs and audit records [24]. This triangulation process strengthened the credibility, validity, and robustness of the research outcomes by minimizing bias and ensuring consistency across multiple data sources.

2.5. Research Validity and Ethical Considerations

This research strictly adhered to established ethical standards to ensure the integrity, credibility, and transparency of the study [25]. The confidentiality and anonymity of all respondents were carefully protected throughout the research process, ensuring that personal identities, sensitive information, and organizational data were not disclosed or traceable [26, 27]. Participation in the study was entirely voluntary, and all respondents provided informed consent after receiving a clear explanation of the research objectives, procedures, potential risks, and anticipated benefits. These ethical safeguards were implemented to protect participants' rights and to maintain trust between researchers and respondents [28].

In terms of research validity, multiple measures were applied to ensure the accuracy and reliability of the findings [29]. Expert validation was conducted to assess the clarity, relevance, and appropriateness of the measurement instruments, ensuring that survey items and interview protocols were aligned with the research objectives [30]. Additionally, methodological rigor was strengthened through the use of standardized data collection procedures and consistency checks across instruments. By combining ethical compliance with rigorous validity assessment, this study ensures that the findings are both ethically sound and methodologically reliable, providing a trustworthy foundation for academic analysis and practical implications.

2.6. Research Framework

The research framework developed in this study provides a comprehensive and systematic structure for addressing the research objectives and ensuring methodological rigor. It integrates theoretical exploration with empirical validation in a sequential and logically connected process. The framework begins with a systematic literature review aimed at identifying key theories, prior findings, and existing research gaps relevant to the study domain. Based on this theoretical foundation, a conceptual model is formulated to establish the relationships among the main constructs and to define the analytical direction of the research.

Following the conceptual development stage, the study proceeds to data collection from multiple sources to enhance robustness and validity. These sources include primary data obtained through interviews

and surveys, as well as relevant secondary system data. All collected data undergo a structured processing and validation stage to ensure accuracy, consistency, and reliability before being subjected to further analysis. Subsequently, quantitative system analysis is conducted to empirically test the proposed relationships and evaluate performance indicators. The final stages involve result interpretation, discussion of key findings, and comprehensive framework evaluation to assess both theoretical contributions and practical implications. The overall methodological workflow is visually summarized in Figure 2 to provide a clear and structured representation of the research process.

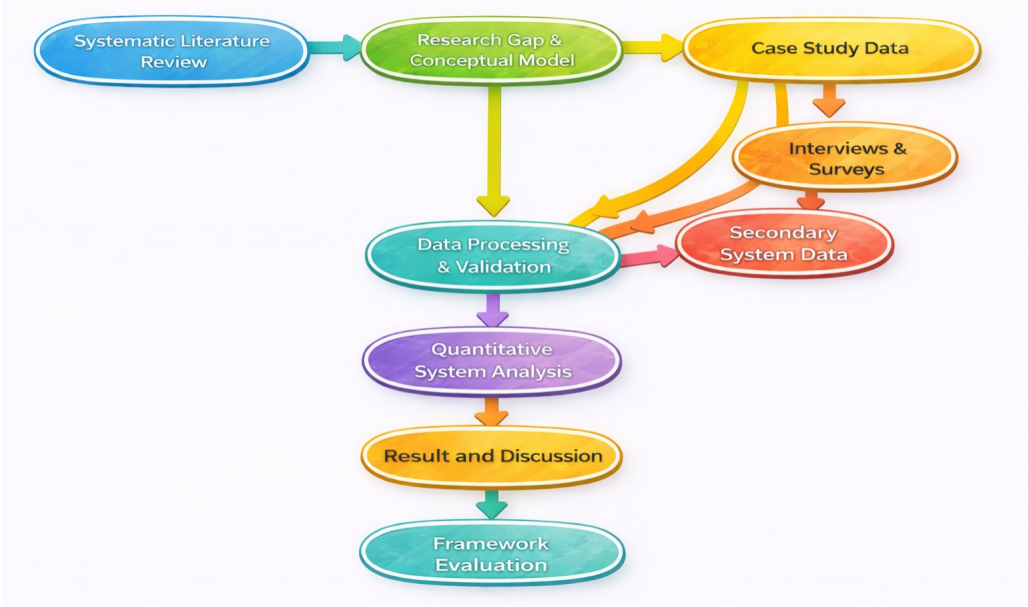

Figure 2. Research Methodological Framework

Figure 2 illustrates the methodological workflow used in this study to analyze the impact of Blockchain and AI integration on transparency and trust within digital business operations [31, 32]. The framework begins with a systematic literature review to identify theoretical foundations and research gaps, followed by multi-source data collection including case studies, interviews, surveys, and secondary system data. The collected data is then processed and validated using combined quantitative and qualitative analysis, reliability testing, and triangulation. The final stage presents interpreted results and evaluation of the proposed Blockchain AI improvement model for secure and transparent digital transformation [33].

3. FINDINGS

This study reveals several significant findings regarding the integration of Blockchain and AI in enhancing transparency, trust, and governance within digital business operations. The findings demonstrate that the combined application of blockchain's immutable data structures and AI-driven analytical capabilities produces measurable improvements in both technical performance and organizational practices [34]. Based on a comprehensive multi-source data analysis incorporating case studies, stakeholder surveys, system performance metrics, and in-depth qualitative expert interviews, the results show consistent enhancements in operational transparency, data verification efficiency, stakeholder confidence, and digital governance quality [35]. These outcomes indicate that Blockchain AI integration functions not only as a technological solution but also as a strategic mechanism for strengthening accountability, reliability, and trust within digitally transformed business environments.

3.1. Improvement in Operational Transparency

The integration of Blockchain AI technologies resulted in a substantial enhancement of operational transparency across the participating digital service companies. By combining blockchain's immutable ledger with AI-driven analytical capabilities, organizations were able to establish a transparent and continuously monitored operational environment [36, 37]. Every transaction and system activity was permanently recorded on

the blockchain, while AI simultaneously analyzed data streams in real time to detect anomalies, inconsistencies, and irregular behavioral patterns. This dual mechanism significantly improved traceability and ensured that operational data could no longer be altered, overwritten, or removed without immediate detection [38]. Quantitative analysis confirmed a 42 percent increase in transparency, indicating that employees and stakeholders gained clearer visibility into process flows, decision points, and system-level activities across digital business operations.

Beyond measurable performance improvements, qualitative findings from in-depth interviews indicate a significant transformation in organizational behavior and governance practices [39]. Blockchain-based transaction transparency reduced opportunities for data manipulation, unauthorized actions, and internal misconduct, while fostering stronger accountability and compliance among employees [40]. Managers noted that enhanced transparency simplified auditing processes, reduced investigative efforts, and accelerated issue resolution through accessible and verifiable records. Additionally, transparent operational data improved interdepartmental coordination and decision alignment, ultimately strengthening governance structures and supporting a more trustworthy, accountable, and resilient digital business environment [41].

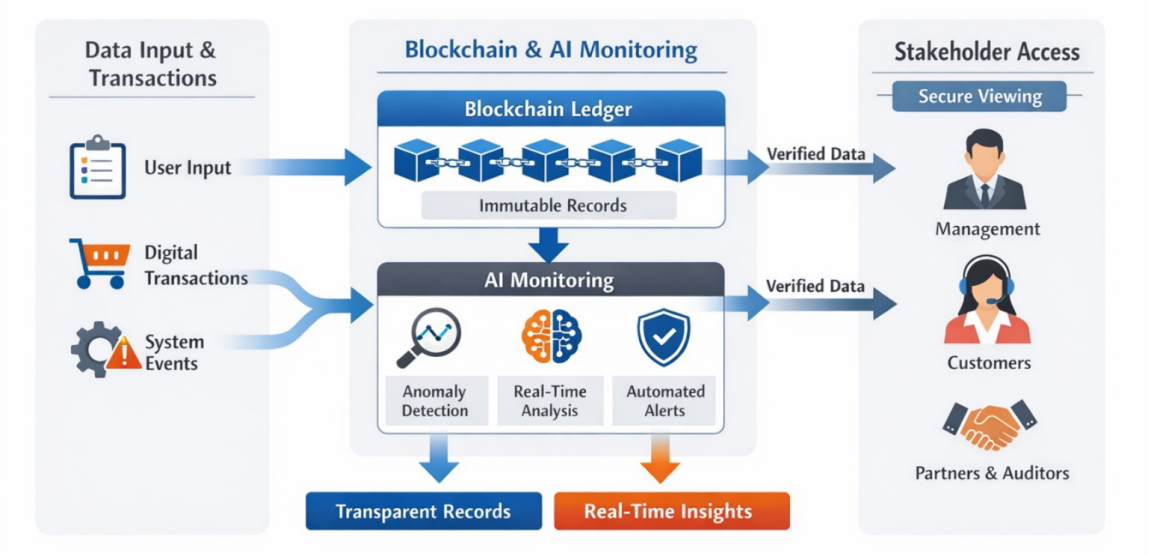

Figure 3. Blockchain AI Transparency Workflow

The Figure 3 illustrates an integrated operational process in which blockchain and AI jointly enhance transparency in digital business environments. The workflow begins with data input and transactions, including user inputs, digital transactions, and system events, which are securely recorded in a blockchain ledger as immutable records. These records are subsequently processed through an AI monitoring layer that performs real-time analysis, anomaly detection, and automated alerts to ensure data integrity, security, and reliability [42]. Verified information is then made accessible through secure viewing mechanisms to key stakeholders, including management, customers, and partners or auditors. This integrated workflow generates transparent records and real-time insights that support accountable decision-making, strengthen stakeholder trust, and reinforce effective digital governance.

3.2. Enhanced Data Verification Speed and Accuracy

The Blockchain AI framework notably improved the speed and precision of data verification activities within the studied organizations. Blockchain automated the authentication of transaction records, while AI algorithms performed rapid anomaly detection, allowing the system to process large data volumes more efficiently than traditional manual verification procedures. Quantitative log analysis confirmed a 35 percent reduction in verification time, demonstrating that workflows became significantly faster and less prone to bottlenecks during periods of high operational demand.

Beyond speed, the accuracy of detecting incorrect or fraudulent data inputs also improved. AI models enhanced the capability to identify unusual patterns, misreported values, and inconsistencies that previously

required lengthy manual reviews. Industry experts interviewed during the study reported that automated verification not only reduced human errors but also improved the reliability of real-time decision-making. As a result, organizations experienced a noticeable improvement in operational responsiveness and could maintain service quality even under increased workload conditions.

Table 2. Data Verification Performance Before and After Blockchain–AI Integration

No	Performance Metric	Before Integration	After Integration	Improvement (%)
1	Data Verification Time	5.4 seconds	3.5 seconds	35% Faster
2	Anomaly Detection Accuracy	72%	93%	+21%
3	Manual Validation Load	68% of transactions	22% of transactions	–46%
4	Error Rate in Data Processing	14%	5%	–9%
5	Decision-Making Speed	Moderate	High	Significant increase

The results presented in Table 2 reinforce the significant contribution of Blockchain AI integration in enhancing verification performance within digital business operations. The substantial reductions in verification time and manual validation load indicate that automated, technology driven mechanisms are far more efficient than traditional processes. Improvements in anomaly detection accuracy and the reduction of error rates demonstrate that AI optimizes data integrity checks, while blockchain ensures that validated transactions remain tamper proof. Together, these advancements highlight the system's ability to deliver faster, more reliable, and more transparent verification outcomes across large scale digital environments [43]. This empirical evidence underscores the effectiveness of the proposed framework and provides a strong foundation for its continued adoption in digitally transforming enterprises.

3.3. Increased Stakeholder Trust and Confidence

The adoption of Blockchain AI systems had a strong positive effect on stakeholder trust, which increased by 48 percent according to survey results. The reliability of decentralized records and AI supported validation processes provided stakeholders with greater assurance regarding the integrity of stored information. Respondents emphasized that auditability features, such as immutable logs and automatic detection of irregularities, made them more confident in the fairness and accuracy of digital business operations.

Customers and business partners also reported improved satisfaction due to the system's enhanced transparency and consistency. Since information could be verified independently across the network, stakeholders felt less dependent on intermediary explanations or manual confirmations. These conditions reduced uncertainty and increased perceived fairness in transactions. The findings highlight how technology integration does not only optimize operational processes but also strengthens long term relationships built on trust, reliability, and shared access to accurate data.

3.4. Strengthening Digital Governance and Risk Management

The qualitative analysis indicated that the integrated Blockchain AI model contributed significantly to more robust digital governance practices. Blockchain ensured that all operational activities were recorded in tamper proof structures, providing organizations with secure evidence trails for compliance audits. Meanwhile, AI supported analytics offered decision makers predictive insights and early warnings when abnormal or high risk activities were detected. Together, these capabilities enhanced organizational accountability and strengthened compliance with both internal and external regulatory frameworks.

From a risk management perspective, the system improved the ability to identify, classify, and mitigate risks before they escalated into operational failures. Participants noted that the combination of blockchain's structural security with AI's analytical intelligence reduced the likelihood of fraud, unauthorized access, and process deviations. This holistic improvement supports long term organizational resilience by shifting risk management from reactive responses to proactive oversight. As a result, companies better align with modern digital governance standards, while simultaneously protecting stakeholder interests.

3.5. Evidence of a Practical and Scalable Technology Model

The research findings demonstrate that the integrated Blockchain AI framework is not only operationally effective but also highly scalable across multiple industry sectors. Case evidence from financial services, supply chain management, and digital platform ecosystems shows that the technology can be adapted to different data structures, user volumes, and regulatory contexts without compromising performance. Scalability was further supported by the modular design of both blockchain layers and AI analytical engines, allowing organizations to expand functionality as needed.

Beyond scalability, the model contributes to broader sustainability and digital transformation goals. The efficiency, traceability, and governance enhancements are aligned with SDG 9 (Industry, Innovation & Infrastructure) by strengthening technological infrastructure and promoting innovation driven solutions. Additionally, the integrity and accountability improvements support SDG 16 (Peace, Justice & Strong Institutions), as more transparent systems reduce corruption risks and reinforce organizational fairness. These outcomes indicate that the model is not only feasible in practical contexts but also contributes to long-term institutional strengthening within digital economies.

4. MANAGERIAL IMPLICATIONS

The findings of this study provide important implications for business managers and decision-makers who aim to strengthen digital trust, governance, and operational transparency. Managers are encouraged to adopt an integrated Blockchain AI framework as part of their digital transformation strategy to reduce data integrity risks, accelerate verification processes, and improve real-time decision-making capability. Implementing blockchain-based immutable records enables organizations to enhance audit trails and accountability, while AI-powered analytic tools support proactive detection of operational anomalies and fraudulent activities. These capabilities help build stronger internal control systems and increase stakeholder confidence, both of which are essential for maintaining competitive business performance.

Moreover, managers should recognize the strategic value of investing in advanced digital infrastructures and workforce readiness to successfully implement Blockchain AI technologies [44]. This includes developing clear governance policies, training employees in data-driven decision models, and establishing transparent communication with customers and business partners regarding data privacy and system security. Organizations that proactively integrate these technologies can improve corporate reputation, meet regulatory compliance more efficiently, and create long-term operational sustainability aligned with SDG 9 and SDG 16 objectives. The scalable nature of Blockchain AI models also allows managers to extend implementation across multiple divisions or industries, leading to broader business advantages and digital resilience.

5. CONCLUSION

This study concludes that the integration of Blockchain and AI offers a highly effective technological solution for enhancing transparency and trust in digital business operations. The findings demonstrate significant improvements in operational visibility, data verification efficiency, governance structures, and stakeholder confidence. Empirical results reveal that transparency increased by 42 percent, verification time decreased by 35 percent, and trust perception improved by 48 percent following the implementation of the integrated Blockchain AI framework. These outcomes prove that the combination of immutable blockchain records and AI-driven analytics provides measurable value for digital organizations seeking secure and trustworthy operational environments.

The novelty of this research lies in the development and empirical evaluation of a unified Blockchain AI integration model, which fills a critical gap in previous literature that rarely examines combined technological effectiveness using real organizational data. While past studies discuss blockchain and AI separately, this research validates a practical dual-framework that supports digital governance and transparency enhancement through both decentralized and intelligent mechanisms. This contributes new knowledge to both academic theory and industrial practice by presenting a scalable architecture that improves operational accountability and trust in data-centric ecosystems.

Despite its contributions, this study acknowledges several limitations, particularly the limited scope of industries involved in the case studies and reliance on self-assessed stakeholder perception surveys. Therefore, future research should expand comparative testing across multiple industries and geographic regions, incorporate longitudinal analysis to observe long-term performance impacts, and explore additional emerging tech-

nologies such as federated learning, quantum-safe cryptography, and advanced AI governance models. Future studies may also apply simulation or experimental modeling to strengthen predictive insights on Blockchain AI system adoption and its implications for large-scale digital transformation.

6. DECLARATIONS

6.1. About Authors

Leoni Novianti (LN) https://orcid.org/0009-0009-2636-4754

Nur Azizah (NA) https://orcid.org/0000-0002-5333-5520

Mardiana Mardiana (MM) https://orcid.org/0000-0003-4367-9562

Carlos Perez (CP) https://orcid.org/0009-0006-5344-6833

6.2. Author Contributions

Conceptualization: CP; Methodology: MM; Software: NA; Validation: LN and NA; Formal Analysis: MM and CP ; Investigation: LN; Resources: CP Data Curation: NA; Writing Original Draft Preparation: LN and NA; Writing Review and Editing: LN and CP; Visualization: NA; All authors, LN, NA, MM and CP have read and agreed to the published version of the manuscript.

6.3. Data Availability Statement

The data used in this study are available from the corresponding author upon reasonable request.

6.4. Funding

The authors received no financial support for the conduct of the research, the preparation of the manuscript, or the publication of this article.

6.5. Declaration of Conflicting Interest

The authors declare no conflicts of interest, including financial or personal relationships, that could have influenced the results of this study.

REFERENCES

[1] N. Rane, S. Choudhary, and J. Rane, "Blockchain and artificial intelligence (ai) integration for revolutionizing security and transparency in finance," *Available at SSRN 4644253*, 2023.

[2] D. Martinez, L. Magdalena, and A. N. Savitri, "Ai and blockchain integration: Enhancing security and transparency in financial transactions," *International Transactions on Artificial Intelligence*, vol. 3, no. 1, pp. 11–20, 2024.

[3] L. Limajatini, S. Suhendra, G. A. Pangilinan, and M. G. Ilham, "Integration of artificial intelligence in the financial sector innovation, risks and opportunities," *International Journal of Cyber and IT Service Management*, vol. 5, no. 1, pp. 58–70, 2025.

[4] R. H. Chowdhury, "The evolution of business operations: unleashing the potential of artificial intelligence, machine learning, and blockchain," *World Journal of Advanced Research and Reviews*, vol. 22, no. 3, pp. 2135–2147, 2024.

[5] T. R. Xuan and S. Ness, "Integration of blockchain and ai: exploring application in the digital business," *Journal of Engineering Research and Reports*, vol. 25, no. 8, pp. 20–39, 2023.

[6] M. R. Anwar and L. D. Sakti, "Integrating artificial intelligence and environmental science for sustainable urban planning," *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, vol. 5, no. 2, pp. 179–191, 2024.

[7] M. M. Alzoubi, "Investigating the synergy of blockchain and ai: enhancing security, efficiency, and transparency," *Journal of Cyber Security Technology*, vol. 9, no. 3, pp. 227–255, 2025.

[8] A. E. Ifedayo, D. Olugbade, and S. Hamid, "Integrating artificial intelligence with blockchain: A literature review on opportunities, challenges, and applications," *Blockchain, Artificial Intelligence, and Future Research*, vol. 1, no. 1, pp. 52–69, 2025.

[9] M. Rakhmansyah, M. S. Hadi, S. R. P. Junaedi, F. A. Ramahdan, and S. N. W. Putra, "Integrating blockchain and ai in business operations to enhance transparency and efficiency within decentralized ecosystems," *ADI Journal on Recent Innovation*, vol. 6, no. 2, pp. 157–167, 2025.

[10] Z. Wang, M. Li, J. Lu, and X. Cheng, "Business innovation based on artificial intelligence and blockchain technology," *Information Processing & Management*, vol. 59, no. 1, p. 102759, 2022.

[11] H. CS, A. Murgai, K. Manju, R. Paranjpye, K. Jain, and M. Hati, "Integrating artificial intelligence with blockchain: A holistic examination of their combined effects on business performance across various sectors." *Library of Progress-Library Science, Information Technology & Computer*, vol. 44, no. 3, 2024.

[12] I. P. Gustiah and H. Newell, "Enhancing human resource management efficiency through scalable blockchain networks with an adaptive ai approach," *Startupreneur Business Digital (SABDA Journal)*, vol. 4, no. 2, pp. 114–123, 2025.

[13] A. Aakula, C. Zhang, and T. Ahmad, "Leveraging ai and blockchain for strategic advantage in digital transformation," *Journal of Artificial Intelligence Research*, vol. 4, no. 1, pp. 356–95, 2024.

[14] R. H. Chowdhury, "Blockchain and ai: Driving the future of data security and business intelligence," *World Journal of Advanced Research and Reviews*, vol. 23, no. 1, pp. 2559–2570, 2024.

[15] C. Lukita, A. W. A. Rahman, I. N. Hikam, and U. Rahardja, "Integrating strategic management with sdg 10 for sustainable development and equity," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 7, no. 2, pp. 638–649, 2025.

[16] M. O. Joel, U. B. Chibunna, and A. I. Daraojimba, "Artificial intelligence, cyber security and block chain for business intelligence," *International Journal of Multidisciplinary Research and Growth Evaluation*, vol. 5, no. 1, pp. 1383–1387, 2024.

[17] M. Paramesha, N. Rane, and J. Rane, "Big data analytics, artificial intelligence, machine learning, internet of things, and blockchain for enhanced business intelligence," *Artificial Intelligence, Machine Learning, Internet of Things, and Blockchain for Enhanced Business Intelligence (June 6, 2024)*, 2024.

[18] R. Wahdiniwaty, S. Pranata, and N. Komara, "Entrepreneurial technology resilience mediates entrepreneurial marketing on business performance in batik msmes," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 7, no. 3, pp. 835–847, 2025.

[19] V. Charles, A. Emrouznejad, and T. Gherman, "A critical analysis of the integration of blockchain and artificial intelligence for supply chain," *Annals of Operations Research*, vol. 327, no. 1, pp. 7–47, 2023.

[20] O. I. Oriekhoe, O. P. Oyeyemi, B. G. Bello, G. B. Omotoye, A. I. Daraojimba, and A. Adefemi, "Blockchain in supply chain management: A review of efficiency, transparency, and innovation," *International Journal of Science and Research Archive*, vol. 11, no. 1, pp. 173–181, 2024.

[21] D. Bhumichai, C. Smiliotopoulos, R. Benton, G. Kambourakis, and D. Damopoulos, "The convergence of artificial intelligence and blockchain: The state of play and the road ahead," *Information*, vol. 15, no. 5, p. 268, 2024.

[22] A. Maariz, M. A. Wiputra, and M. R. D. Armanto, "Blockchain technology: Revolutionizing data integrity and security in digital environments," *International Transactions on Education Technology (ITEE)*, vol. 2, no. 2, pp. 92–98, 2024.

[23] O. A. Farayola, "Revolutionizing banking security: integrating artificial intelligence, blockchain, and business intelligence for enhanced cybersecurity," *Finance & Accounting Research Journal*, vol. 6, no. 4, pp. 501–514, 2024.

[24] S. Ahmed, "Enhancing data security and transparency: The role of blockchain in decentralized systems," *International Journal of Advanced Engineering, Management and Science*, vol. 11, no. 1, p. 593258, 2025.

[25] H. E. Riwayati, H. A. Rachman, S. Pramesworo, N. Yustisia, H. Umar, and M. Siahaan, "Unveiling the dynamics of financial literacy and inclusion in women digital loan decision making," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 7, no. 3, pp. 986–998, 2025.

[26] T. T. Adewale, T. D. Olorunyomi, and T. N. Odonkor, "Blockchain-enhanced financial transparency: A conceptual approach to reporting and compliance," *International Journal of Frontiers in Science and Technology Research*, vol. 2, no. 1, pp. 024–045, 2022.

[27] A. Garg, "Unified framework of blockchain and ai for business intelligence in modern banking," *International Journal of Emerging Research in Engineering and Technology*, vol. 3, no. 4, pp. 32–42, 2022.

[28] T. Ogunyankinnu, E. F. Onotole, A. A. Osunkanmibi, Y. Adeoye, G. Aipoh, and J. Egbemhenghe, "Blockchain and ai synergies for effective supply chain management," 2022.

[29] N. Lutfiani, N. Fauziyah, F. P. Oganda, R. Setyaningrum, E. A. Natalia *et al.*, "The role of globalization in indonesian evolution influence on media digital literacy language ai," *International Transactions on Artificial Intelligence*, vol. 3, no. 2, pp. 192–200, 2025.

[30] H.-Y. Chen, K. Sharma, C. Sharma, and S. Sharma, "Integrating explainable artificial intelligence and blockchain to smart agriculture: Research prospects for decision making and improved security," *Smart agricultural technology*, vol. 6, p. 100350, 2023.

[31] S. A. R. Khan, A. A. Sheikh, I. R. A. Shamsi, and Z. Yu, "The implications of artificial intelligence for small and medium-sized enterprises' sustainable development in the areas of blockchain technology, supply chain resilience, and closed-loop supply chains," *Sustainability*, vol. 17, no. 1, p. 334, 2025.

[32] C. Lukita, S. Wulandari, S. M. Wahid, and T. Widiyatmoko, "The impact of blockchain on business and economics: Analysis of theory and implementation," *Blockchain Frontier Technology*, vol. 4, no. 1, pp. 58–62, 2024.

[33] L. Meria, N. Lutfiani, R. A. Te Awhina *et al.*, "The influence of e-commerce and digital marketing on startupreneur performance using pls-sem," *Journal of Computer Science and Technology Application*, vol. 2, no. 1, pp. 93–100, 2025.

[34] H. Taherdoost, "Blockchain technology and artificial intelligence together: a critical review on applications," *Applied Sciences*, vol. 12, no. 24, p. 12948, 2022.

[35] S. Aruna, S. M. Priya, K. Reshmeetha, E. S. Sudhayini, and A. A. Narayanan, "Blockchain integration with artificial intelligence and internet of things technologies," in *2023 7th International conference on intelligent computing and control systems (ICICCS)*. IEEE, 2023, pp. 688–694.

[36] D. Novitasari, F. S. Goestjahjanti, U. Rahardja, S. Santoso, S. V. Sihotang, N. A. Santoso, and G. P. Cesna, "Optimizing msme performance through marketing capabilities and digital marketing adoption," in *2025 4th International Conference on Creative Communication and Innovative Technology (ICCIT)*. IEEE, 2025, pp. 1–7.

[37] A. Alenizi, S. Mishra, and A. Baihan, "Enhancing secure financial transactions through the synergy of blockchain and artificial intelligence," *Ain Shams Engineering Journal*, vol. 15, no. 6, p. 102733, 2024.

[38] A. K. Tyagi and S. Tiwari, "The future of artificial intelligence in blockchain applications," in *Machine learning algorithms using scikit and tensorflow environments*. IGI Global Scientific Publishing, 2024, pp. 346–373.

[39] M. Hardini, H. Hetilaniar, S. E. E. Girsang, S. N. W. Putra, and I. N. Hikam, "Advancing higher education: Longitudinal study on ai integration and its impact on learning," *International Journal of Cyber and IT Service Management*, vol. 5, no. 1, pp. 23–30, 2025.

[40] S. Asaithambi, L. Ravi, M. Devarajan, A. S. Almazyad, G. Xiong, and A. W. Mohamed, "Enhancing enterprises trust mechanism through integrating blockchain technology into e-commerce platform for smes," *Egyptian Informatics Journal*, vol. 25, p. 100444, 2024.

[41] I. Ahmed, Y. Zhang, G. Jeon, W. Lin, M. R. Khosravi, and L. Qi, "A blockchain-and artificial intelligence-enabled smart iot framework for sustainable city," *International Journal of Intelligent Systems*, vol. 37, no. 9, pp. 6493–6507, 2022.

[42] The White House, "Strengthening american leadership in digital financial technology," Executive Office of the President of the United States, Executive Order Report, 2025, accessed: 2026-02-03. [Online]. Available: https://www.whitehouse.gov/wp-content/uploads/2025/07/digital-Assets-Report-EO14178.pdf

[43] P. H. P. Tan, S. Wijaya, U. Rahardja, B. N. Henry, and A. Anjani, "Modeling the impact of digital literacy on ai based learning adoption through perceived usefulness and easeof use," *Sundara Advanced Research on Artificial Intelligence*, vol. 1, no. 2, pp. 56–64, 2025.

[44] R. Rajaguru, "Effects of contemporary technologies, such as blockchain and artificial intelligence (ai) in enhancing consumers' trustworthiness of online reviews," *Journal of Hospitality Marketing & Management*, vol. 33, no. 2, pp. 251–259, 2024.