Journal of Accounting, Finance, Economics, and Social Sciences
Vol 11, No 1, January - June 2026, pp. 39-52
Received: Apr 2026 | Revised: May 2026 | Accepted: Jun 2026
DOI: https://doi.org/10.62458/jafess11g-g4
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Artificial intelligence and big data for operational decision-making: A systematic review of trends and governance frameworks (2020–2025)

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ABSTRACT

Purpose: *This systematic literature review examines how integrating Artificial Intelligence (AI) and Big Data Analytics (BDA) transforms organizational operational decision-making.*

Methodology*: Following PRISMA guidelines, a systematic search of the Scopus database initially retrieved 341 records. After removing duplicates, applying timeframe filters, and conducting title/abstract and full-text screening, 15 peer-reviewed studies (2020–2025) were included in the final synthesis.*

Findings*: The review identifies three themes: (1) intelligent decision augmentation through real-time analytics and predictive models; (2) infrastructure, skills, and governance requirements; and (3) sectoral transformation and ethical implications. AI and BDA improve decision accuracy, forecasting precision, and transparency while reducing reliance on human intuition.*

Implications*: The findings highlight the need for synergy among AI systems, human judgment, and institutional controls, providing managers and policymakers with practical benchmarks to assess organizational readiness and to design governance frameworks that balance innovation with accountability. These insights are especially relevant to developing economies such as Cambodia, where the Cambodia Digital Economy and Society Policy Framework (2021–2035) explicitly prioritizes data-driven digital transformation across government and business sectors.*

Originality*: This research offers a contemporary synthesis of AI and Big Data applications for operational decision-making across diverse industries, with explicit attention to governance frameworks, an area underrepresented in prior reviews.*

Limitations and directions for future research*: Adoption success depends on the quality of infrastructure, organizational readiness, and governance robustness. Future research should investigate strategies to strengthen organizational preparedness and develop governance frameworks that address privacy, algorithmic bias, and accountability.*

Keywords*: Artificial intelligence; Big Data analytics; operational decision-making; algorithmic governance; data-driven optimization*.

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Publisher: CamEd Business School
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Recommended Citation

Gubran, N. M., & Groda, S. P. (2026). Artificial intelligence and big data for operational decision-making: A systematic review of trends and governance frameworks (2020–2025). *Journal of Accounting, Finance, Economics, and Social Sciences, 11*(1), 39 – 52. https://doi.org/10.62458/jafess11g-g4

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INTRODUCTION

In today's complex and fast-evolving business environment, organizations face major operational decision-making challenges stemming from digital disruption, data overload, infrastructure limitations, and resistance to change. Organizations are producing large volumes of data from diverse sources, requiring sophisticated analytics to extract valuable insights and highlighting the urgency of data-informed strategies in high-pressure operations (Paramesha et al., 2024). In the Nigerian oil sector, Eteyen (2024) reports that Artificial Intelligence (AI) and big data significantly enhance decision-making, predictive maintenance, inventory management, and risk mitigation, although these benefits are often hindered by inadequate infrastructure, a shortage of skilled personnel, and organizational resistance to change. These technological challenges underscore the need to improve operational decision-making to enhance performance, reduce costs, and achieve long-term strategic goals.

The integration of AI and Big Data plays a transformative role in this regard. Eboigbe et al. (2023) affirm that the convergence of AI technologies, including machine learning (ML) and deep learning, with BI systems enhances data visualization and supports more informed decision-making, especially when coupled with real-time analytics and automation. Across the reviewed literature, the case for integrating AI and Big Data into operational decision-making rests on a consistent set of reported gains: faster, more accurate decisions, reduced reliance on intuition, and greater capacity to anticipate rather than merely react to operational conditions. This pattern recurs across sectors of markedly different character. In manufacturing, cognitive systems that integrate AI-driven algorithms with Internet of Things (IoT) networks are reported to increase precision in complex operational processes and reduce process variability (Lăzăroiu et al., 2022). In customer-facing operations, Big Data analytics is credited with streamlining workflows and improving resource allocation (Brown et al., 2024). Taken together, these findings converge on one conclusion rather than a set of isolated claims: the value of AI and Big Data lies in their cumulative effect on organizational speed, precision, and foresight. This effect is substantial enough that, with over 112,906 related publications to date, it is increasingly treated as a strategic necessity rather than an optional enhancement.

Artificial Intelligence and Big Data have evolved considerably over the past decade, and their convergence, rather than their individual development, now defines their operational relevance. AI has progressed from static, rule-based automation toward systems capable of autonomous sensing, learning, and decision-making (Chen et al., 2019; Güngör, 2022; Tariq et al., 2021; Zincir-Heywood et al., 2023). Big Data has undergone a parallel shift, evolving from an operational byproduct into a strategic asset whose defining properties-volume, velocity, variety, and value - now allow organizations to model non-linear and latent relationships that traditional methods could not capture (Tse et al., 2024). What distinguishes the recent literature is less the capability of either technology alone than their integration: natural-language interfaces such as NL2SQL are reported to extend data-driven decision-making beyond technical specialists (Xiao & Xu, 2024), while sector-specific applications, from dynamic budgeting (Chang, 2025) to financial restructuring at China National Petroleum Corporation (Li et al., 2024) to predictive maintenance (Li et al., 2025), point to a consistent pattern: AI supplies analytical intelligence, Big Data supplies scale, and neither delivers transformative value in isolation.

The implementation of AI and Big Data in operational decision-making faces significant challenges that cluster around three interrelated dimensions rather than isolated issues. Technical constraints, chiefly inadequate infrastructure and a shortage of skilled personnel (Eteyen, 2024), are often compounded by unresolved data governance concerns, including data security, digital inequality, and algorithmic bias (Hardianto et al., 2025). A comparison of these accounts shows that technical and governance barriers are rarely addressed together within the same study, despite their evident interdependence. A third, less examined dimension is organizational resistance, which Almanasra (2024) attributes to workforce readiness rather than to technology itself, suggesting that adoption failures may stem as much from change-management gaps as from infrastructural ones.

Despite the breadth of the reviewed evidence, three gaps recur across the literature. First, much of the research treats AI adoption generically, with limited attention to sector-specific constraints (Tse et al., 2024); even single-industry studies, such as those on cognitive manufacturing, acknowledge that comprehensive insight into real-world implementation remains limited (Lăzăroiu et al., 2022). Second, governance considerations are addressed unevenly, with a tendency toward fragmented treatment of

scalability, data quality, and ethical concerns rather than integrated frameworks (Bena et al., 2025). Third, cross-sectoral comparisons are rare, leaving open the question of whether findings from one industry generalize to another. These gaps motivate the present review's methodological choice: a systematic synthesis, following PRISMA guidelines, is well suited to identifying such patterns across a fragmented evidence base and to assessing the overall maturity of the field (Satyani & Febriyantoro, 2024).

Although much of the reviewed literature focuses on advanced or large emerging economies, similar dynamics are unfolding in Southeast Asia. Cambodia's Royal Government has pursued a structured digital transformation agenda since 2021 through its Digital Economy and Society Policy Framework (2021–2035), which positions data-driven decision-making and AI adoption as strategic priorities for the public and private sectors (Royal Government of Cambodia, 2021). Empirical evidence supports this policy direction: Ly (2025) found that digital transformation significantly mediates the relationship between organizational leadership and sustainable development outcomes in Cambodia's public sector, highlighting both the strategic value and the implementation complexity of data-driven initiatives in the local context. However, local enterprises, particularly SMEs, remain largely in the early stages of digital and AI adoption, facing infrastructure gaps, workforce skill shortages, and underdeveloped data governance practices. This gap between national policy ambition and organizational readiness requires synthesizing global evidence on AI–Big Data integration and governance to inform Cambodia's digital transformation trajectory.

To guide this systematic review, the following research questions (RQs) were formulated:

RQ1: How do AI and Big Data technologies improve the accuracy, speed, and transparency of operational decision-making across sectors?

RQ2: What organizational, infrastructural, and governance-related challenges hinder the effective adoption of these technologies?

RQ3: What roles do human-AI synergy and institutional governance play in ensuring responsible and sustainable operational decision-making?

The first research question was prioritized because the efficiency and accuracy gains associated with AI and Big Data are the most consistently documented outcomes in the reviewed literature, providing the empirical foundation for the remaining questions. For the second research question, a review limited to reported benefits alone would present an incomplete account of the field; several studies explicitly identify infrastructural and organizational constraints as decisive factors in adoption outcomes, warranting a dedicated line of inquiry. The third research question was necessary because governance is foregrounded in the study's title. This question substantiates that framing empirically, addressing the oversight and accountability dimension that distinguishes this review from prior technology-adoption literature.

RESEARCH METHODOLOGY

This research employs a Systematic Literature Review (SLR) to identify, evaluate, and synthesize peer-reviewed articles on the use of artificial intelligence and big data to enhance operational decision-making. An SLR examines existing research through a transparent, reproducible process, enabling comprehensive integration of relevant literature and providing a robust foundation for generating evidence and drawing conclusions (Perera, 2024). This approach aligns with contemporary review practices that use literature synthesis to accelerate theoretical development and inform future research, particularly in the exploration of emerging technologies.

Based on the SLR, a systematic search was conducted across reputable academic databases, including Scopus. The search strategy combined key terms and synonyms to ensure comprehensive coverage while maintaining specificity. Search strings included: “artificial intelligence in operational decision-making,” “big data and decision support,” “machine learning in business decisions,” “AI-based decision support systems,” and “big data analytics in business.” This strategy ensured the inclusion of the most relevant studies within the scope of the research. Additionally, content analysis was used to identify recurring patterns and dominant trends in literature. This combined analytical approach aims to provide a coherent overview of the current state of knowledge, uncover research gaps, and suggest future directions for studies in this domain.

Inclusion Criteria: The search for articles was refined using the following criteria:

- Articles must be peer-reviewed and published

between 2020 and 2025.

- The focus must be on the use of AI and big data in operational decision-making, particularly in healthcare, finance, and business management.
- Articles must be in English and have accessible full texts.

Exclusion criteria: Articles were excluded based on the following criteria:

- Studies not relevant to the topic.
- Non-peer-reviewed sources, including books and commentaries.
- Studies published before 2020 or in a language other than English.

Figure 1 presents the PRISMA flow diagram illustrating the systematic study selection process.

Figure 1: PRISMA Flow - Data Process (2025)

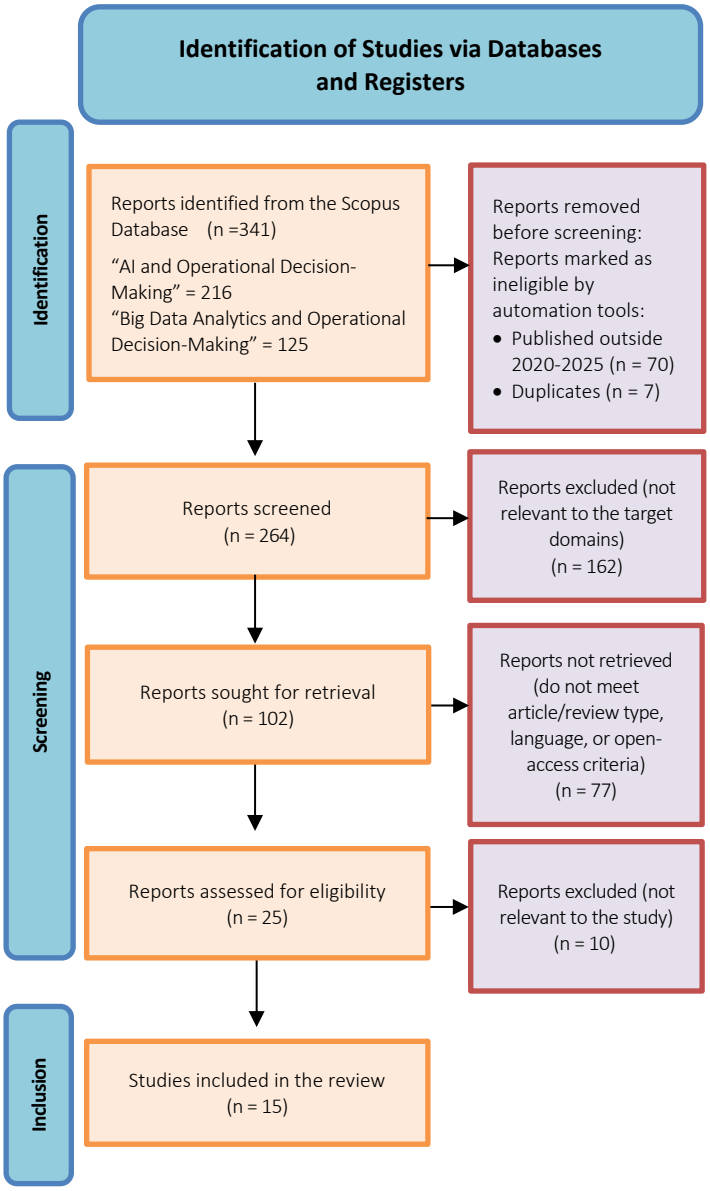


Figure 1 presents the PRISMA flow diagram illustrating the systematic study selection process. The initial search in the Scopus database using four search-term combinations yielded 341 reports. After excluding reports published outside the 2020–2025 timeframe and removing duplicates (n = 77), 264 reports remained for screening. After screening for relevance to the target domains (financial, healthcare, and business management), 162 reports were excluded, leaving 102 reports to be retrieved. Of these, 77 were further excluded for not meeting article/review type, language, or open-access criteria, leaving 25 reports for full-text eligibility assessment. After excluding 10 additional reports based on full-text relevance, 15 peer-reviewed studies were included in the final qualitative synthesis.

This study is based exclusively on synthesizing previously published, peer-reviewed literature. Therefore, the study did not involve human participants, animals, or identifiable personal data, and it did not require approval from an institutional ethics review board. Nevertheless, the review was conducted in accordance with the PRISMA reporting guidelines and adhered to principles of transparency and methodological rigor. A predefined search strategy, explicit inclusion and exclusion criteria, and a reproducible study selection process were applied using the Scopus database to minimize selection bias and enhance the transparency and reproducibility of the review.

RESULTS AND DISCUSSION

Study Results

This systematic literature review analyzed 15 peer-reviewed articles published between 2020 and 2025 to assess how Artificial Intelligence and Big Data Analytics might be used to improve operational decision-making. The review identified three common themes: (1) Intelligent Decision Augmentation, (2) Navigating Implementation Barriers, and (3) Sectoral Transformation Through AI. All analyzed studies show that AI and Big Data can help make evidence-based, predictive decisions more quickly across different organizational settings (Table 1).

These three themes align directly with the review's guiding questions. Intelligent Decision Augmentation addresses RQ1 by demonstrating how AI and Big Data improve the accuracy, speed, and transparency of operational decision-making. Navigating Implementation

Barriers addresses RQ2 by documenting the organizational, infrastructural and governance-related obstacles that constrain adoption. Sectoral Transformation Through AI, together with the human oversight and governance considerations discussed in the following sections, addresses RQ3 by illustrating how responsible and sustainable integration varies across industry contexts.

Table 1: Synthesis of Previous Studies

No	Authors	Title	Methodology	Result	Finding
1	Ortega-Calvo, A. S., Morcillo-Jimenez, R., Fernandez-Basso, C., Gutiérrez-Batista, K., Vila, M., & Martin-Bautista, M. J. (Ortega-Calvo et al., 2023)	AIMDP: An Artificial Intelligence Modern Data Platform. Use case for Spanish national health service data silo	Case Study	The platform successfully integrated heterogeneous, siloed hospital datasets, enabled non-expert users to conduct analytical workflows, and produced meaningful analytical outputs while preserving data security and governance.	An AI-enabled modern data platform can effectively overcome healthcare data silos, support large-scale data exploitation by non-specialists, and provide a scalable, secure infrastructure for operational data analysis and decision support.
2	Danna, T., & Tian, G. (Tong & Tian, 2023)	Intelligent financial decision support system based on big data	Case Study	The intelligent financial decision support system, incorporating big data, can track data in real time, enhance decision-making accuracy, present key financial indicators, and analyze financial changes in the background. It greatly saves time on analysis and increases the number of financial statements received. The system offers both visual and numerical financial analysis results, enabling effective access to data and resolution of problems. It leads to better implementation of financial strategies, better management, reduced time for report generation, and improved decision-making.	The application of big data and AI to financial decision support systems can greatly enhance automation, performance, analytic insight, and managerial control in enterprise financial management, increasing the utility and timeliness of operational and strategic decision-making.
3	Wani, A. A. (Wani, 2025)	Ten quick tips for improving estimated time of arrival predictions using machine learning in logistics and transportation systems	Narrative /Literature Review	Integrating machine learning with real-time traffic, behavioral, weather, and feedback data substantially improves ETA accuracy, robustness, and operational responsiveness, while reducing long-tail errors, latency, and bias in	Effective ETA prediction requires a holistic, adaptive framework that integrates spatiotemporal modeling, real-time data fusion, behavioral analytics, probabilistic uncertainty handling, and bias auditing, enabling more reliable, equitable,

				logistics and transportation systems.	and operationally efficient decision-making in modern logistics networks.
4	Hou, T. (Hou, 2022)	Research on management efficiency and dynamic relationship in intelligent management of tourism engineering based on industry 4.0	Empirical (quantitative)	The proposed model achieved higher data utilization, improved topology classification performance, increased stability of management efficiency indicators, and higher data accuracy compared to traditional static data analysis models.	Integrating big data and convolutional neural networks into tourism engineering management enables more efficient, accurate, and dynamic analysis of management performance and relationships, thereby enhancing intelligent operational management under Industry 4.0 conditions.
5	Lukić, I., Köhler, M., Krpić, Z., & Švarcmajer, M. (Lukić et al., 2025)	Advancing smart city sustainability through Artificial Intelligence, Digital Twin and Blockchain Solutions	Mixed-Methods	The pilot implementation achieved approximately a 15% reduction in operational costs, a 12% reduction in fuel consumption, and around a 10% reduction in CO_2 emissions, along with improved recycling rates and citizen participation through participatory governance modules.	Integrating AI-driven analytics, digital twins, and blockchain into a unified platform significantly enhances operational efficiency, transparency, sustainability, and data-driven decision-making across Smart City and public service contexts.
6	Pesqueira, A., De Bem Machado, A., Bolog, S., Pereira, R., & Sousa, M. J. (Pesqueira et al., 2024)	Exploring the impact of EU tendering operations on future AI governance and standards in pharmaceuticals	Mixed-Methods	Comparative case study of four pharmaceutical companies combined with semi-structured interviews (53 experts) and a Delphi method to reach expert consensus on AI governance dimensions.	AI-enabled companies showed higher operational efficiency, faster tender processing, improved data analysis, and stronger stakeholder engagement compared to non-AI companies, but also faced increased governance, ethical, and regulatory challenges.
7	Pisoni, G. & Molnár, B. (Pisoni & Molnár, 2024)	AI-based solution for sustainability tracing for companies	Literature review	Systematic literature review across four sectors (healthcare, oil and energy, IT, food), combined with a conceptual framework and information system architecture design grounded in information systems theory.	Identified sector-specific ESG criteria demonstrated how AI can automate ESG data collection and analysis, and proposed a three-step AI-enabled process and a system architecture for tracking sustainability and supporting managerial decision-making.

8	Koliousis, I., Al-Surmi, A., & Bashiri, M. (Koliousis et al., 2024)	Artificial intelligence and policy making; can small municipalities enable digital transformation?	Mixed-Methods	The model identified significant effects of distance, mobility problems, service quality, and social factors on transportation policy outcomes. The ANN accurately predicted and ranked alternative policies by cost, feasibility, and impact.	AI-based strategic decision-making frameworks can outperform human judgment in accuracy, efficiency, and applicability, enabling small municipalities to achieve effective digital transformation in public policymaking.
9	Banihabib, R., & Assadi, M (Banihabib & Assadi, 2023)	Towards a low-carbon future for offshore oil and gas industry: A smart integrated energy management system with floating wind turbines and gas turbines	Case Study	The optimized smart management system reduced operational costs by about 16.32%, natural gas consumption by about 16.42%, and carbon emissions compared with rule-based operation; it also demonstrated effective power balancing using wind, gas turbines, and hydrogen storage.	AI-enabled hybrid optimization and smart energy management can significantly improve operational efficiency and support decarbonization in offshore oil and gas microgrids, with strong potential for practical implementation in complex real-world energy systems.
10	Al-Surmi, A., Bashiri, M., & Koliousis, I. (Al-Surmi et al., 2022)	AI based decision making: combining strategies to improve operational performance	Mixed-Methods	SEM results showed that IT strategy significantly influences marketing strategy and that marketing strategy significantly improves operational performance, with marketing fully mediating the IT–performance relationship. ANN successfully predicted performance and identified optimal strategy combinations across industries.	Aligning IT and marketing strategies through an AI-enabled decision framework enhances operational performance, improves the accuracy of strategic decisions, and supports managers in selecting optimal operational strategies across industries.
11	Bahangulu, J. K., & Owusu-Berko, L. (Bahangulu & Owusu-Berko, 2025)	Algorithmic bias, data ethics, and governance: ensuring fairness, transparency and compliance in AI-Powered business analytics applications	Narrative/Conceptual Review	AI-powered business analytics systems remain vulnerable to bias stemming from skewed training data and insufficiently diverse datasets, as illustrated by real-world cases (e.g., biased hiring algorithms). These systems are subject to regulatory frameworks (GDPR, CCPA, EU AI Act) that increasingly mandate bias audits, fairness	Ensuring fairness in AI-powered business analytics requires embedding accountability and explainability directly into governance structures, rather than treating bias mitigation as an afterthought, to sustain organizational trust and ensure regulatory compliance.

				assessments, and transparency reporting.	
12	Papasani, P. K., & Papasani, R. T. (Papasani & Papasani, 2025)	The role of artificial intelligence in data analytics and business intelligence solutions	Qualitative	AI improves data preprocessing speed, pattern recognition, predictive analytics, real-time insights, and personalization of BI outputs, while also highlighting challenges such as data quality issues, legacy system integration, skills gaps, and ethical risks.	AI significantly enhances the effectiveness and timeliness of data-driven decision-making in organizations, but its value depends on addressing governance, transparency, data quality, and ethical considerations.
13	Kosaraju, D. (Kosaraju, 2021)	The role of Artificial Intelligence in enhancing Big Data Analytics	Narrative/ Literature Review	AI improves data processing speed, pattern recognition, predictive analytics, real-time insights, and personalization across sectors, while also identifying challenges such as data privacy, ethical concerns, skills gaps, and system integration difficulties.	AI is a critical enabler of advanced big data analytics and data-driven decision-making, but its effective use requires robust governance, ethical frameworks, data quality management, and workforce adaptation.
14	Radha, C., Midunkumar, R., Muralibabu, S., Mr. V. Partheeban, Partheeban, V., & Praveenkumar, T. (Radha et al., 2024)	Role of Artificial Intelligence in Big Data Analytics	Narrative/ Literature Review	AI improves automated data processing, pattern recognition, predictive analytics, real-time analysis, and the accessibility of big data analytics across industries.	Integrating AI into big data analytics enhances organizational decision-making and operational efficiency, but it requires addressing data quality, ethical concerns, and skill gaps.
15	Himeur, Y., Elnour, M., Fadli, F., Meskin, N., Petri, I., Rezgui, Y., Bensaali, F., & Amira, A. (Himeur et al., 2023)	AI-big data analytics for building automation and management systems: a survey, actual challenges and future perspectives	Systematic Literature Review	AI and big data analytics enable accurate load forecasting, anomaly detection, occupancy detection, indoor environmental quality monitoring, and energy optimization in buildings, but are constrained by challenges related to data scarcity, scalability, interoperability, security, privacy, and computational cost.	AI-driven big data analytics can substantially improve the operational efficiency, reliability, and sustainability of building automation and management systems, provided that technical, organizational, and governance challenges are adequately addressed.

The evidence synthesized in this review spans a wide range of regional and sectoral contexts, including Nigeria, China, Hong Kong, and Europe, reflecting the global scale at which AI and Big Data are reshaping operational decision-making. Within this broader picture, the findings also have practical relevance for

developing economies such as Cambodia, where digital transformation is a stated national priority (Royal Government of Cambodia, 2021), yet organizational readiness remains uneven (Ly, 2025). The barriers most consistently reported across the reviewed studies are infrastructure limitations, workforce skill shortages, and fragmented data governance. These constraints are widely documented among SMEs in other developing and emerging-market contexts (Lu & Shaharudin, 2024), suggesting that Cambodian institutions are likely to encounter comparable obstacles as they begin adopting AI and Big Data tools.

Discussions

Intelligent Decision Augmentation

Artificial Intelligence and Big Data Analytics are essential for making intelligent decisions, improving predictive accuracy, enabling real-time insights, and reducing reliance on human intuition in operations. Multiple research projects confirm that applying AI and Big Data significantly enhances predictive accuracy and decision-making speed. According to Wani (2025), integrating machine learning with real-time traffic, behavioral, weather, and feedback data can significantly reduce ETA cost, improve ETA strength and responsiveness to operations, and decrease long-tail errors, latency issues, and bias in logistics and transportation systems. This indicates predictive intelligence's contribution to operational forecasting and flexibility in complex systems. Ortega-Calvo et al. (2023) discovered that an AI-powered information platform can easily break down healthcare information silos, encourage non-experts to use large volumes of information, and offer a scalable, secure framework for examining operational data and supporting decision-making. Their research highlights the importance of real-time data integration in enabling quicker, fact-based decision-making in healthcare operations. Taken together, these results highlight the importance of predictive modeling and real-time analytics, enhancing organizations' ability to anticipate trends, respond dynamically, and optimize resource allocation in unpredictable situations.

Automation is identified as an important element in improving decision transparency and reducing cognitive bias. According to Radha et al. (2024), AI enhances automated data analysis, pattern recognition, predictive analytics, real-time analysis, and the accessibility of big data analytics across industries. Similarly, as Mungara (2023) notes, AI enhances the speed of data processing, pattern recognition, predictive analytics, real-time insights, and personalization across various industries, and also highlights issues such as data privacy, ethical considerations, skills shortages, and difficulties in integrating systems. Such studies indicate that automation not only enhances the speed of analytical functions but also ensures clarity and objectivity in operational decision-making, reducing human bias by using data as a source of objectivity.

The transformative power of smart decision augmentation is further supported by evidence from several sectors. In healthcare, Ortega-Calvo et al. (2023) found that their platform succeeded by integrating heterogeneous, siloed hospital data, enabling non-expert users to execute analytical workflows and generate meaningful results without compromising data security and governance. Wani (2025) also found that spatiotemporal modeling, real-time data fusion, behavioral analytics, probabilistic uncertainty management, and bias auditing provide a holistic approach to logistics that yields more reliable, equitable, and operationally efficient decision-making. Meanwhile, in business intelligence, both Radha et al. (2024) and Mungara (2023) affirm that combining AI and Big Data improves decision-making and organizational efficiency by automating processes and enabling real-time analysis. Collectively, these results confirm that AI-based decision augmentation consistently delivers quantifiable benefits in the accuracy, efficiency, and flexibility of operations across various sectors.

Navigating Implementation Barriers

The adoption of Artificial Intelligence and Big Data Analytics in operational decision-making remains significantly hindered by technical and human restrictions. According to Eteyen (2024), organizations, especially in resource-intensive industries such as oil and gas, face inadequate infrastructure and a lack of skilled staff, which restrict the efficient use of AI and Big Data technologies. These technological deficiencies often create system integration challenges, as traditional systems cannot coexist with sophisticated analytics systems, slowing the adoption of smart decision-making. Additionally, Almanasra (2024) notes that although AI and Big Data have high potential to streamline operations, their successful adoption requires workforce preparation and cross-industry cooperation to overcome the unwillingness of decision-makers and frontline employees. Taken together, these studies affirm that digital

infrastructure disparities and human resistance remain key drivers of the complete implementation of AI-based operational intelligence.

Equally important are the ethical and governance risks of implementing technology. As Hardianto et al. (2025) emphasize, public institutions that integrate AI and Big Data must address data security, digital inequality, and algorithmic bias, aligning these efforts with regulatory requirements such as the GDPR. Bena et al. (2025) cite fragmented governance structures, limited scalability, data quality, and ethical issues as major challenges that undermine accountability and sustainability. The reviewed articles suggest developing the workforce, fostering cross-sector cooperation, and creating governing frameworks that address both technical and scalability performance. Infrastructure fortification, the empowerment of digital capabilities, and clarity in mechanisms governing data are hence inseparable from the responsible, efficient, and trustworthy adoption of AI and Big Data in operational decision-making.

Sectoral Transformation Through AI

The reviewed studies reveal that Artificial Intelligence and Big Data Analytics are driving a profound transformation across sectors by improving decision accuracy, operational efficiency, and sustainability. In the healthcare sector, Ortega-Calvo et al. (2023) show that an AI-oriented modern data platform can efficiently break down healthcare data silos, enable non-experts to use large volumes of data, and deliver a scalable, secure infrastructure for operational data analysis and decision support. This observation highlights the sector's trend toward real-time, data-driven clinical decision-making with integrated AI platforms. Similarly, Tong and Tian (2023) found that AI-based intelligent financial systems can enhance analytical accuracy, and Tse et al. (2024) discovered that the use of AI and Big Data technologies led to cost reductions and increased efficiency in the financial management model. Collectively, these studies highlight the value of AI-based analytics in enabling organizations to become more resource-efficient, forecast more effectively, and automate financial processes strategically.

Outside of the medical field and the banking industry, AI and Big Data are also transforming the manufacturing, energy, and urban management sectors by automating processes and enabling intelligent optimization. According to Lukić et al. (2025), integrating AI-driven analytics, digital twins, and blockchain into a single platform considerably improves operational efficiency, transparency, sustainability, and data-driven decision-making in smart city and public service settings. Similarly, Banihabib and Assadi (2023) showed that an AI-enabled hybrid optimization and smart energy management system reduced operational costs by approximately 16.32 percent, natural gas consumption by approximately 16.42 percent, and carbon-based emissions by a significant margin. These outcomes demonstrate that AI-based systems continue to contribute to environmental sustainability, efficiency, and intelligent governance in industrial and urban sectors. The overall evidence examined in this paper supports the idea that AI and Big Data technologies have found their way into the sector, driving data-centric transformation and creating more intelligent, cleaner, and more resilient operational ecosystems.

Economic Implications and Investment Dynamics of AI and Big Data Implementation

Implementing AI and Big Data systems requires significant upfront investment in infrastructure, cloud computing, and human resources, creating considerable short-term financial strain. According to Limani and Spahija-Gjikolli (2025), the cost of digital technology investment is also high. Although investment is critical to AI implementation in business processes, particularly in financial management, it can be an obstacle for some businesses. Nevertheless, the long-term returns are meaningful despite these initial costs. Lou et al. (2025) found that AI adoption significantly improves corporate investment efficiency. AI enhances investment efficiency by increasing information transparency and strengthening internal controls. Research also demonstrates operational savings and performance improvements. Ghayda et al. (2024) note that AI and ML patents dramatically increase ROA and operating margins, with effects that are notably delayed but beneficial, typically observed after a five-year interval. This result highlights that economic viability depends on the size and preparedness of organizations, since smaller or less-equipped companies may be unable to cover initial costs. In general, AI is a significant short-term investment; however, it is necessary to present it as a long-term strategy, as the benefits of efficiency and ROI will offset the initial investment costs.

Strategic Synergy of Human and AI

The articles analyzed indicate that the long-term success of Artificial Intelligence and Big Data Analytics

in operational decision-making depends on a harmonized relationship between human control and machine intelligence. As Bahangulu and Owusu-Berko (2025) caution, AI-powered analytics systems, despite their capacity for automated classification and pattern recognition, remain vulnerable to bias originating from skewed training data and insufficiently diverse datasets, risks that can translate into discriminatory outcomes and reputational harm if left ungoverned. Ensuring fairness in such systems, they argue, requires embedding accountability and explainability directly into governance structures rather than treating bias mitigation as an afterthought. This highlights the need for institutional controls and ethical systems to provide transparency and accountability in AI-based systems. However, Koliousis et al. (2024) found that AI-based strategic decision-making systems can be more accurate, efficient, and applicable than human judgment, while also highlighting the importance of human interpretation for contextual reasoning and responsible applications. In line with this argument, Almanasra (2024) noted that successful implementation involves workforce development and cross-sector collaboration to enhance human adaptability and technological advancements. All these discoveries attest that the combination of human judgment and AI precision promotes not only trust and fairness but also long-lasting innovation and competitive advantage in the context of digital transformation.

CONCLUSION AND RECOMMENDATIONS

This systematic literature review shows that incorporating Artificial Intelligence and Big Data Analytics has significantly transformed operational decision-making across industries, addressing the review's guiding questions about the capabilities, barriers, and governance conditions that shape this transformation. Overall, the literature confirms that these technologies improve predictive accuracy, enable real-time insights, and enhance automation, resulting in observable gains in efficiency, transparency, and strategic responsiveness. Experience in the healthcare, finance, manufacturing, and energy industries shows that AI-based analytics contribute to data democratization, reduce operational expenses, and facilitate evidence-based decisions that outperform conventional intuition-driven models. Nonetheless, this transformative potential remains conditional on organizations' ability to address technical, organizational, and governance obstacles, including inadequate infrastructure, data management limitations, and workforce adaptation challenges. These constraints resonate particularly strongly in developing economies such as Cambodia, where digital transformation is a stated priority, but organizational readiness remains uneven. Notably, the review emphasizes that the most effective systems combine algorithmic intelligence with human judgment, so that decisions remain contextual, ethical, and responsible. In general, the synthesis highlights that sustainable competitive advantage in the digital age rests on a synergistic approach to integrating AI, Big Data, and human governance structures, in which intelligent systems complement rather than substitute for human judgment.

Recommendations

The findings of this review have direct implications for how organizations structure the relationship between algorithmic systems and human decision-makers. While the reviewed literature consistently demonstrates that AI and Big Data enhance the speed, accuracy, and scope of operational decisions, it equally shows that these benefits are not automatic; they depend on how deliberately organizations manage the interface between machine output and human judgment. The following recommendations translate this synthesis into actionable steps for managers and policymakers seeking to operationalize AI-human collaboration responsibly.

Before Adoption

Assess infrastructure and workforce readiness before scaling AI tools beyond pilot projects. Premature scaling without addressing these prerequisites was identified as a primary barrier to successful adoption (Eteyen, 2024; Hardianto et al., 2025).

Distinguish high-frequency, data-rich decisions suited to AI augmentation from context-sensitive decisions that require primary human judgment. This distinction reflects the review's central finding that AI's value is most consistently demonstrated in pattern-based, high-volume decision contexts (Paramesha et al., 2024), whereas nuanced judgment remains essential elsewhere (Almanasra, 2024).

During Implementation

Require AI-generated recommendations to include a supporting evidence trail rather than a final output alone, enabling human reviewers to evaluate rather than simply accept the recommendation, consistent

with findings on the risks of unchecked reliance on algorithmic (Bena et al., 2025).

Assign human oversight to AI-assisted decisions above a defined risk threshold, reflecting evidence that responsible integration depends on preserving institutional control over automated outputs (Koliousis et al., 2024).

Ongoing Governance

Periodically audit AI outputs against actual outcomes to detect bias or accuracy drift over time, addressing the governance gaps identified as a recurring limitation in the reviewed literature (Bena et al., 2025).

Invest in workforce training that builds critical interpretation of AI outputs, not only technical operation, because skill shortages were repeatedly cited as a barrier to sustainable adoption (Eteyen, 2024).

Collectively, these recommendations operationalize the review's central conclusion: AI and Big Data generate sustainable value in operational decision-making only when deliberately paired with human oversight and institutional governance, not as an automatic outcome of adopting the technology.

Funding
The authors declared that no funding was received for the research, authorship, and publication of this article.

Conflicts of Interest
The authors declared no conflict of interest pertaining to the publication of this article.

AI Usage Disclosure
The authors declared no AI was used in the creation of this research article.

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