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Artificial Intelligence and Big Data Adoption in MSMEs: A Systematic Literature Review

Ledyana Ayu Pratiwi[1*], Subandi Subandi[2], Yuda Padriyadi[3], Eka Travilta Oktaria[4]
Universitas Mitra Indonesia, Bandar Lampung, Indonesia[1,2,3,4]
ledyanaayupratiwi2024.student@umitra.ac.id[1*], subandi2024.student@umitra.ac.id[2],
yudapadriyadi2024.student@umitra.ac.id[3], ekatravilta@umitra.ac.id[4]

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Abstract

Purpose: This study systematically reviews the literature on Artificial Intelligence (AI) and Big Data Analytics (BDA) adoption in Micro, Small, and Medium Enterprises (MSMEs), focusing on adoption drivers, organizational and dynamic capabilities, and performance outcomes.

Research Methodology: A Systematic Literature Review (SLR) following PRISMA guidelines was conducted. Data were sourced from Scopus and Semantic Scholar for peer-reviewed journal articles published between 2015 and 2025. Based on predefined criteria, 33 articles were selected and analyzed using thematic analysis to identify the dominant themes, theoretical perspectives, and research gaps.

Results: The review shows that MSMEs' AI and BDA adoption is driven by technological readiness, managerial support, and environmental pressures. Crucially, neither AI nor BDA directly enhances firm performance. Their performance impact is indirect and occurs through the development of dynamic capabilities, particularly data-driven decision-making, organizational learning, and adaptability. These capabilities enable MSMEs to convert technology adoption into meaningful performance outcomes. However, prior studies are fragmented, often treating AI and BDA separately and focusing primarily on short-term performance effects.

Conclusions: This review confirms that AI and BDA influence MSME performance solely through dynamic capabilities. Thus, integrating technology adoption theories with the dynamic capability perspective is essential to explain their role in sustainable performance and in digital transformation.

Limitations: This study was limited to English-language journal articles indexed in selected databases.

Contribution: This study offers a holistic framework that integrates technology adoption and dynamic capability perspectives for AI and BDA adoption in MSMEs.

Keywords: *Artificial Intelligence, Big Data Analytics, Digital Transformation, Dynamic Capabilities, MSMEs*

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1. Introduction

In today's digital era, the adoption of intelligent technologies, such as Artificial Intelligence (AI) and Big Data Analytics (BDA), has become a key factor in increasing the competitiveness of organizations

across various industrial sectors (Jagatheesaperumal et al., 2022). These technologies enable organizations to process massive volumes of data, improve decision-making accuracy, and optimize business processes in real time, thus providing strategic opportunities for business growth and innovation (Ayinaddis, 2025). The use of AI and BDA also drives a paradigm shift from intuition-based management to data-driven decision making. Thus, organizations that can adopt these technologies tend to have a more sustainable competitive advantage.

However, the potential of AI and Big Data is not only relevant for large companies; the Micro, Small, and Medium Enterprises (MSMEs) sector also faces similar competitive pressures in an increasingly digitalized market (Hossain et al., 2024). MSMEs worldwide face challenges such as limited resources, limited data access, and global competitive pressures, which require them to seek technological solutions to improve operational efficiency and respond to changing market demands (Suarantalla, 2025). Digitalization is a strategic path for MSMEs to survive and thrive in dynamic business environments. Therefore, adopting intelligent technology is a strategic necessity and no longer just an option. Despite this, numerous studies indicate that the rate of AI adoption among MSMEs remains low, especially when compared with large companies (Zong & Guan, 2024). Recent research reveals that among the key factors differentiating adoption capabilities are technology readiness, managerial support, and resource readiness, including the technical skills of workers in small organizations (technology readiness and skills and competencies) (Ayinaddis, 2025). This indicates a significant digital divide between MSMEs and large companies. Without strategic intervention, this gap has the potential to weaken MSMEs' competitive position of MSMEs in the long term.

A recent systematic literature review by Ayinaddis (2025) revealed that AI has become a strategic priority in modern business, but the understanding of its adoption dynamics differs significantly between large enterprises and MSMEs. This study categorizes critical elements in AI adoption, such as data requirements, management support, and competitive pressures, indicating that MSMEs require different approaches to implement AI technology. Differences in organizational contexts require more flexible and contextual adoption models for MSMEs. This emphasizes that technology adoption strategies cannot be generalized across companies. Big Data Analytics (BDA) has also been identified as a crucial strategic asset for MSMEs, as its ability to process and analyze big data can help small businesses address market challenges and enhance their competitiveness (Johnson & Acemoglu, 2023). A systematic review of the impact of Big Data on MSME performance shows that BDA contributes to increased operational efficiency, revenue growth, and faster market response, although its adoption still faces several barriers (Kgakatsi et al., 2024). These benefits demonstrate that BDA has significant potential as a driver of MSME transformations. However, this potential can only be realized if MSMEs have adequate analytical capabilities.

However, numerous studies have highlighted that the adoption of AI and Big Data technologies in MSMEs is still constrained by structural issues, such as financial constraints for technological infrastructure investment, low organizational information technology capabilities, and a lack of managerial support in understanding the potential of digital technologies (Thayyib et al., 2023). This prevents many MSMEs from harnessing the full potential of these technologies for innovation and competitive growth. These structural barriers are often systemic and interrelated. Consequently, the technology adoption process in MSMEs tends to be slow and unsustainable. In addition to these internal limitations, other studies have shown that the human resource gap in MSMEs is a major obstacle. MSMEs often lack personnel with the technical competencies necessary to implement and maintain AI systems or manage Big Data practices, resulting in delayed or suboptimal adoption of these technologies (Kgakatsi et al., 2024). This limitation reinforces MSMEs' dependence on external parties in the digitalization process. Without internal capability development, technology adoption may become unsustainable.

This phenomenon is exacerbated by the lack of empirical research on how MSMEs simultaneously address the challenges of implementing AI and Big Data. Much of the literature still examines the two technologies separately, for example, focusing only on AI or BDA, thus lacking a comprehensive

overview of the challenges, opportunities, and best practices in the MSME context (Kgakatsi et al., 2024). This partial approach limits a holistic understanding of MSME digital transformation. In practice, AI and Big Data are interdependent and integrated. In contrast, several studies have shown that the combination of AI and Big Data has significant potential to accelerate digital transformation in MSMEs through the creation of predictive models, more sophisticated customer segmentation, and business process automation (Ma & Chang, 2025). However, while these strategic benefits are recognized in the literature, empirical evidence explaining how MSMEs implement this combination of technologies remains limited (Kgakatsi et al., 2024). This limited empirical evidence hinders the development of research-based and practical guidance. Consequently, many MSMEs lack a clear reference point for integrating AI and Big Data.

This raises the question of how MSMEs can balance the need for innovation with their limited resources, especially in the context of Industry 4.0 development. Systematic research exploring the strategic, organizational, and technical aspects of the adoption of AI and Big Data in MSMEs is needed to provide a more holistic picture (Ayinaddis, 2025). A systematic approach allows for more structured and comprehensive knowledge mapping. Furthermore, the study results can inform strategic decision-making by practitioners and policymakers. Furthermore, existing literature reviews have not sufficiently explored the cohesion between AI and Big Data approaches and theoretical frameworks such as Technology Organization Environment (TOE) or Diffusion of Innovation (DOI), which are often used to explain technology adoption in the context of small and medium-sized organizations. Integrating these theories can help us understand the interaction of technological, organizational, and environmental factors in the adoption process (Sánchez et al., 2025). This lack of theoretical integration has led to a conceptual fragmentation in the literature. Therefore, research based on systematic literature reviews is essential to bridge this gap.

Furthermore, limited empirical research in developing countries is a significant issue. Most Big Data studies in the context of MSMEs still focus on developed countries, while the literature on the adoption of advanced technologies in MSMEs in developing countries with underdeveloped digital infrastructure remains underrepresented. This opens up opportunities for more contextualized research to understand the adoption of these technologies within the framework of local economic development in Brazil. Thus, the need for more comprehensive research on the adoption of Artificial Intelligence and Big Data in MSMEs, including the challenges, drivers, and impacts on organizational performance, has become an urgent and strategic research area. Systematic research, such as the one proposed, serves not only to map trends in existing empirical findings but also to identify research gaps that can form the basis for further studies and practical policies.

Despite the growing body of literature on AI and Big Data Analytics in MSMEs, several critical research gaps remain. First, existing studies largely examine AI and BDA in isolation, offering limited insights into their integrated adoption and combined strategic value for MSMEs. Second, empirical evidence explaining how these technologies translate into performance outcomes is still inconclusive, as many studies report indirect or inconsistent effects without clearly identifying underlying mechanisms such as dynamic capabilities. Third, the literature remains fragmented in terms of theoretical grounding, with limited integration between technology adoption frameworks and capability-based perspectives. Finally, research focusing on MSMEs in developing countries is underrepresented, leaving contextual factors related to resource constraints and digital infrastructure insufficiently explored. Addressing these gaps is essential for advancing a more holistic and theory-driven understanding of AI and BDA adoption in MSMEs.

2. Literature Review and Hypothesis Development

2.1 Artificial Intelligence (AI) and Big Data in SME Context

Artificial Intelligence (AI) refers to the capability of digital systems to perform cognitive functions analogous to human learning, reasoning, and complex decision-making (Ayinaddis, 2025). Systematic reviews have demonstrated that AI is increasingly adopted across diverse organizational types as a strategic technology that enhances productivity and operational efficiency (Budianto et al., 2022). However, understanding AI adoption dynamics in Micro, Small, and Medium Enterprises (MSMEs)

remains limited and fragmented compared to large corporations. Big Data Analytics (BDA), which encompasses the collection, processing, and analysis of large-volume datasets to generate actionable insights, has been identified as a primary driver of performance improvement and competitive advantage (Kgakatsi et al., 2024).

Systematic literature reviews indicate that BDA enhances decision-making, accelerates market responsiveness, and increases revenue for MSMEs, although significant barriers persist. AI and BDA function not only as operational tools but also as strategic assets underpinning competitive superiority. Nevertheless, MSMEs frequently encounter digital readiness gaps and infrastructure deficiencies that impede the effective adoption of these technologies. Factors, including constrained budgets and limited internal technological capabilities, constitute the primary obstacles in their digital transformation trajectories.

While large enterprises typically possess dedicated R&D departments and substantial data infrastructure that enable systematic AI/BDA implementation, MSMEs exhibit heterogeneous adoption patterns characterized by opportunistic, low-cost solutions and heavy reliance on vendor-supplied technologies. Furthermore, large organizations leverage AI primarily for predictive analytics and process automation, whereas MSMEs predominantly utilize AI for customer engagement and basic operational efficiencies, a divergence attributable to differential resource endowments and strategic orientations.

2.2 Technology Adoption Theory: TOE and DOI

To conceptualize AI and BDA adoption by MSMEs, the literature predominantly employs the Technology Organization Environment (TOE) framework, which examines three principal dimensions: technological, organizational, and environmental determinants of adoption. TOE has achieved widespread application in MSME technology adoption research owing to its capacity to explain the interactions between internal and external factors shaping adoption decisions (Sánchez et al., 2025). Multiple studies have integrated the Diffusion of Innovations (DOI) theory with TOE to capture the perceptual attributes of technology adoption, such as relative advantage, compatibility, complexity, trialability, and observability, which influence how business owners perceive and accept novel technologies within operational contexts. This integration illuminates how individual-level cognitive evaluations mediate the organizational adoption process (Sánchez et al., 2025).

Empirical investigations grounded in the TOE–DOI framework consistently demonstrate that technological factors (system compatibility, complexity, relative advantage), organizational factors (management support, resource readiness, firm size, technological competence), and environmental factors (competitive pressure, regulatory support, vendor partnerships) collectively and interactively facilitate or constrain AI adoption in MSMEs.

Comparative Theoretical Synthesis: The TOE framework emphasizes structural and contextual determinants at the organizational level, whereas DOI contributes to perceptual and innovation-specific attributes at the individual decision-maker level. Recent scholarship has critiqued TOE for its relative inattention to temporal dynamics, while DOI has been challenged for insufficient consideration of external environmental constraints. Consequently, contemporary studies increasingly adopt integrated TOE-DOI models supplemented by Dynamic Capabilities theory to address both adoption determinants and post-adoption performance outcomes a theoretical triangulation that remains underutilized in MSME-specific AI research

2.3 Factor Drivers and Barriers AI Adoption in MSMEs

Systematic literature reviews have identified multiple internal and external factors influencing AI adoption of AI. Internal determinants include technological readiness, organizational digital capabilities, top management support, firm size, and innovation culture. External determinants include market competition intensity, government policy support, vendor ecosystem maturity and infrastructure availability (Ayinaddis, 2025; Sánchez et al., 2025).

In the context of AI adoption, recurrent technical obstacles include the requirements for substantial training datasets, inadequate analytical capabilities, algorithmic bias concerns, and integration complexity with legacy systems. These challenges are particularly pronounced among MSMEs, which frequently encounter difficulties in accessing the requisite big data infrastructure for advanced AI initiatives (Ayinaddis, 2025). Digital skills deficits are a major barrier to adoption. MSMEs typically lack personnel with adequate technical competencies, necessitating reliance on external consultants or vendor arrangements that substantially increase technology adoption costs. Comparative evidence indicates that skill shortages are more acute in MSMEs than in large firms, where internal training programs and specialized recruitment are more feasible.

Empirical studies consistently identify top management support and digital leadership commitment as significant success factors in digital transformation. Smaller organizations exhibiting pro-digital leadership demonstrate a greater capacity to overcome initial implementation obstacles and effectively integrate novel technologies (Sánchez et al., 2025). This finding converges with research on large enterprises, although the effect magnitude appears to be amplified in MSME contexts because of flatter organizational structures and direct owner-manager involvement.

While large corporations confront challenges related to legacy system migration and change management complexity, MSMEs face more fundamental constraints: absolute resource limitations, the absence of dedicated IT functions, and vulnerability to implementation failures. Conversely, MSMEs exhibit advantages in adoption speed and flexibility owing to simpler organizational structures and shorter decision chains, a paradoxical dynamic wherein resource poverty simultaneously constrains and enables agile responses.

2.4 Dynamic Capabilities Support Theory and Organizational Adaptation

Dynamic capabilities theory and organizational adaptation perspectives posit that an organization's capacity to sense environmental shifts, seize emerging opportunities, and reconfigure resource bases is critical for the successful adoption of disruptive technologies such as AI and BDA (Khan & Hung, 2025). This meta-capability encompasses continuous organizational learning, strategic flexibility, and innovation in internal processes. The literature proposes that dynamic capabilities amplify the positive impact of technology adoption on organizational performance through three pathways: sensing capabilities enable the early identification of relevant AI applications, seizing capabilities facilitate effective resource allocation to AI initiatives, and reconfiguring capabilities support the organizational restructuring necessary for AI integration.

Emerging evidence suggests that dynamic capabilities in MSMEs operate through mechanisms distinct from those in large enterprises. MSMEs typically exhibit informal sensing processes embedded in owner-manager networks, rather than formal environmental scanning units. Resource reconfiguration occurs through adaptive improvisation, rather than systematic restructuring. These differences suggest that existing dynamic capability frameworks, primarily developed through large firm studies, require contextualization for MSME applications. Dynamic capabilities theory complements the TOE-DOI framework by addressing a critical gap: post-adoption performance heterogeneity. While TOE-DOI explains adoption determinants, dynamic capabilities explain why some adopters achieve superior performance outcomes from identical technologies. This integration advances the understanding of both adoption antecedents and consequences, a theoretical synthesis that remains insufficiently examined in MSME digital transformation research.

3. Research Methodology

This study uses a Systematic Literature Review (SLR) approach to comprehensively identify, evaluate, and synthesize relevant scientific literature on the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in MSMEs. The SLR approach was chosen because it can provide a structured, transparent, and replicable knowledge mapping and is widely recommended in management and information systems studies to examine rapidly evolving and multidisciplinary topics (Kitchenham et al., 2007; Tranfield et al., 2003).

The SLR process in this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and reduce literature selection bias (Page et al., 2021). The PRISMA steps applied included identification, screening, eligibility assessment, and inclusion of relevant articles. This approach is widely used in systematic reviews related to technology adoption and digital transformation because it provides a systematic and scientifically sound framework.

The research data sources were obtained from reputable international scientific databases, namely Scopus and Semantic Literature Search, which were selected because of their high-quality journal coverage and rigorous selection process. The literature search was conducted using a combination of keywords such as "Artificial Intelligence," "Big Data Analytics," "MSMEs," "SMEs, " AND, OR "digital Artificial transformation" combined with Boolean operators (AND, OR) to ensure the accessibility of relevant literature.

The inclusion criteria for this study were: peer-reviewed journal articles, publications between 2015 and 2025, English-language articles, and studies explicitly addressing the adoption of AI, Big Data, or both in the context of MSMEs. Proceedings, books, editorials, and studies not directly relevant to the MSME context were excluded from the analysis. This selection approach aligns with SLR practices in the fields of strategic management and information systems (Denyer and Tranfield, 2009).

Following the selection process, the articles meeting the criteria were analyzed using thematic analysis to identify key patterns, dominant themes, and conceptual relationships within the literature. This analysis included grouping themes such as drivers of adoption, barriers to implementation, theoretical frameworks used (TOE, DOI, dynamic capabilities), and the impact of AI and BDA adoption on MSME performance. Thematic analysis is widely used in SLR because of its ability to synthesize qualitative and quantitative findings in an integrative manner (Braun & Clarke, 2006).

To enhance the validity and reliability of the study results, we implemented a cross-checking process and discussions among researchers during the coding and classification stages of themes. This approach aims to minimize subjectivity in interpretation and increase the consistency of findings, as recommended in systematic review methodology (Snyder, 2019). Therefore, the results of this study are expected to provide a comprehensive, systematic, and credible overview of the development of research on the adoption of AI and Big Data in MSMEs.

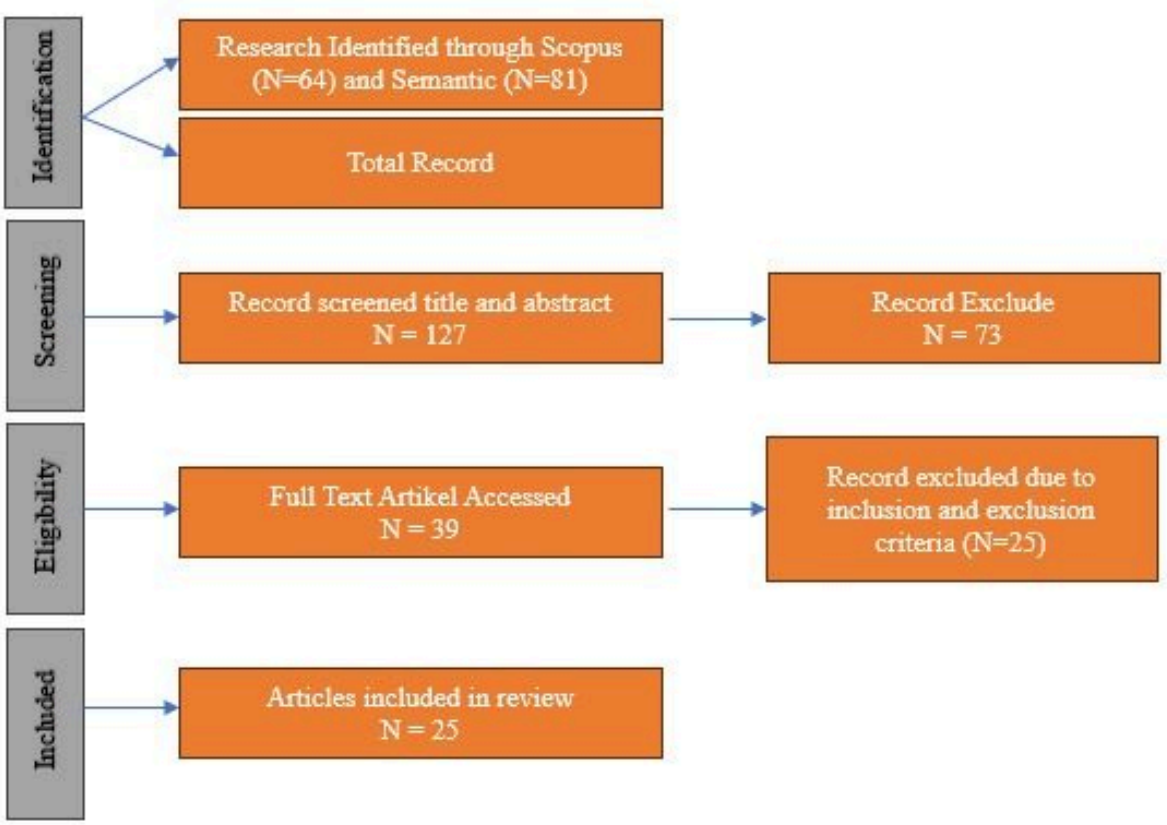

Figure 1. Prism model

Figure 1 shows the prism model of this study. The study selection process followed the PRISMA framework. A total of 145 records were identified from Scopus (N = 64) and Semantic Scholar (N = 81). After title and abstract screening, 127 records were assessed, with 73 articles excluded due to irrelevance. Subsequently, 39 full-text articles were evaluated based on the inclusion and exclusion criteria, resulting in 25 excluded articles. Finally, 25 peer-reviewed articles were included in the systematic literature review and analyzed to identify key themes, trends, challenges, and implications of digital Human Resource Management (HRM) in MSMEs.

4. Results and Discussions

Table 1. Summary of AI and big data analytics research in MSMEs

No	Author(s)	Context / Country	Theory / Framework	Key Findings
1	Aftab et al. (2025)	Italian SMEs	RBV, Dynamic Capabilities	Digital leadership indirectly enhances performance through BDA capabilities, green innovation, and AI readiness.
2	Ardito et al. (2024)	European SMEs	RBV	AI adoption increases revenue growth through decision-making quality and process automation, which is supported by BDA and IoT.
3	Ayinaddis (2025)	SMEs & large firms (global)	TOE, Bibliometric review	AI adoption drivers differ significantly between SMEs and large firms; MSMEs require contextual adoption models.
4	Behl et al. (2022)	MSME service firms (COVID-19)	RBV, Dynamic Capabilities	BDA capability mediates the relationship between digital investment and sustainable competitive advantage.

No	Author(s)	Context / Country	Theory / Framework	Key Findings
5	Diouf et al. (2025)	SMEs (Developing countries)	Sustainability-based framework	Integrated BDA adoption supports sustainable development but requires capability alignment.
6	Escolano et al. (2025)	Philippine SMEs	TOE	Technological readiness, management support, and competition significantly affect BDA adoption intentions.
7	Hayajneh et al. (2022)	SMEs	Capability-based view	Business analytics capability mediates the effect of analytics skills on innovation performance.
8	He et al. (2025)	SMEs (HR context)	RBV	AI and BDA enhance HR performance through knowledge sharing and organizational innovativeness.
9	Hossain et al. (2024)	Textile SMEs, Bangladesh	TOE	Organizational readiness and managerial support are key determinants of AI–BDA adoption in the healthcare sector.
10	Yesuf and Fields (2025)	SMEs (global)	Bibliometric analysis	Digital transformation studies have emphasized AI and BDA as emerging strategic enablers.
11	Jagatheesaperumal et al. (2022)	Industry 4.0	Technology ecosystem view	AI–Big Data integration drives automation, predictive analytics, and smart operations.
12	Johnson et al. (2021)	SMEs & industry	Workforce capability framework	AI and Big Data improve operational efficiency and decision quality through data-driven skills.
13	Kgakatsi et al. (2024)	SMEs (global)	Systematic review	BDA indirectly improves SME performance, and adoption barriers remain dominant.
14	Khan and Hung (2025)	E-commerce SMEs	TOE–TAM integration	Perceived usefulness and organizational readiness drive BDA–AI adoption in the banking sector.
15	Ma and Chang (2025)	SMEs supply chains	Dynamic capability	AI and BDA enhance agility and digital supply chain transformation through their integration.
16	Makhdoom et al. (2025)	SMEs (Green SCM)	Mediated–moderated model	AI-powered BDA capabilities mediate green innovation and sustainable performance.
17	Mathani et al. (2024)	Jordanian SMEs	TOE	Technological and organizational factors significantly influence the adoption of AI–BDA.
18	Motjolopane and Chanza (2023)	SMEs (Africa)	Readiness framework	Digital readiness is a prerequisite for AI and BDA adoption in resource-constrained SMEs.
19	Parra-Sánchez and Talero-Sarmiento (2024)	SMEs (global)	Scientometric analysis	Research on SME digital transformation is fragmented and short-term.

No	Author(s)	Context / Country	Theory / Framework	Key Findings
20	Sánchez et al. (2025)	SMEs (survey-based)	TOE–DOI	Adoption is driven by relative advantage, compatibility and environmental pressure.
21	Santos and Sant'Anna (2024)	SMEs (Sustainability)	Industry 4.0 framework	Although AI and BDA support sustainable practices, they lack long-term empirical validation.
22	Shrivastava and Riaz (2023)	UAE SMEs	Environmental uncertainty	AI–BDA adoption improves resilience in unpredictable conditions.
23	Suarantalla (2025)	MSMEs (Marketing)	Digital capability	AI supports digital marketing performance when it is aligned with data analytics capabilities.
24	Thayyib et al. (2023)	Multi-sector review	Bibliometric review	AI–BDA research is dominated by a technical focus and lacks organizational integration.
25	Venkatesh et al. (2025)	MSMEs	Dynamic capabilities	Analytical capabilities enable the sensing, seizing, and reconfiguration of processes.
26	Y. Wu et al. (2025)	SMEs (Green SCM)	Dynamic capability	Data-driven practices mediate the impact of fintech and AI on sustainable performance.
27	Zong et al. (2025a)	Creative industry SMEs	Value-chain innovation	AI–Big Data integration supports innovation and international marketing performance.
28	Zong and Guan (2024)	Industry 4.0	Knowledge-based view	AI-driven analytics can transform innovation and operational efficiency.
29	Snyder (2019)	Methodological	Review methodology	Literature reviews support theory-building and gap identification.
30	Tranfield et al. (2003)	Management research	Systematic review	Systematic reviews provide evidence-based management insights.
31	Denyer and Tranfield (2009)	Review methodology	Systematic synthesis	A structured SLR improves rigor and theoretical integration.
32	Kitchenham et al. (2007)	Evidence-based research	Empirical validation	This emphasizes the need for empirical grounding in technology research.
33	Page et al. (2021)	PRISMA	Review reporting	It ensures transparency and rigor in systematic reviews.

A summary of AI and Big Data Analytics research in MSMEs is presented in Table 1. The reviewed studies indicate that Artificial Intelligence (AI) and Big Data Analytics (BDA) have become strategic enablers of digital transformation, innovation, and sustainable performance in SMEs and MSMEs. The dominant theoretical perspectives include the Resource-Based View (RBV), Dynamic Capability Theory, and Technology–Organization–Environment (TOE) framework. Findings consistently show that AI–BDA adoption improves decision-making quality, operational efficiency, innovation capability, supply chain agility, and sustainability outcomes. However, successful implementation depends on technological readiness, managerial support, organizational capability, digital skills, and contextual factors. The literature also highlights that current research remains fragmented, with limited long-term empirical evidence and a need for more integrated models addressing organizational, human, and technological dimensions.

4.1 General Characteristics of AI and Big Data Research in MSMEs

A synthesis of 33 selected articles shows that research on the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in Micro, Small, and Medium Enterprises (MSMEs) has significantly increased since 2020, in line with the acceleration of global digital transformation. In terms of methodology, most studies use a quantitative survey-based approach with structural equation modeling-partial least squares (SEM-PLS) analysis techniques or structural regression to examine the relationship between technology adoption variables and organizational performance (Ardito et al., 2024; Behl et al., 2022; Mathani et al., 2024). In addition, several studies have utilized a Systematic Literature Review approach and bibliometric analysis to identify research trends, thematic patterns, and conceptual developments in AI and BDA studies in MSMEs (Ilahiane et al., 2025; Parra-Sánchez & Talero-Sarmiento, 2024). However, studies using qualitative and mixed-methods approaches are still relatively limited, especially those that deeply explore the internal dynamics of MSMEs during the process of adopting and implementing smart technology.

Geographically, the synthesized literature shows a predominance of research conducted in developed countries and certain emerging economies, such as European countries, China, and the Middle East (Shrivastava & Riaz, 2023; Zong et al., 2025b). Conversely, research on MSMEs in developing countries, particularly in Southeast Asia and Africa, remains relatively underrepresented in the international literature (Motjolopane & Chanza, 2023). This imbalance indicates a geographical bias that could potentially limit the generalizability of research findings, given the significant differences in digital infrastructure, technological readiness, and institutional support across regions. Therefore, these findings emphasize the importance of a contextual approach in the study of AI and BDA adoption in MSMEs to reflect the real conditions and specific challenges across economic environments.

From a theoretical perspective, these general research characteristics reflect the dominance of technology adoption frameworks, such as the Technology–Organization–Environment (TOE) and Diffusion of Innovation (DOI) models, in explaining AI and BDA adoption in MSMEs. The prevalence of quantitative, survey-based studies using SEM-PLS aligns with the positivist orientation of these frameworks, which emphasize measurable technological, organizational, and environmental determinants of adoption. Moreover, the geographical concentration of studies in developed and emerging economies suggests that empirical testing of TOE and DOI has largely occurred in contexts with relatively high technological readiness and institutional support. This contextual bias limits the theoretical generalizability of existing findings and highlights the need to extend adoption theories by incorporating contextual and capability-based perspectives, particularly for MSMEs in resource-constrained environments.

4.2 Theoretical Framework in AI and Big Data Adoption Studies

Literature synthesis shows that Technology–Organization–Environment (TOE) and Diffusion of Innovation (DOI) are the most dominant theoretical frameworks used to explain the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in Micro, Small, and Medium Enterprises (MSMEs) (Escolano et al., 2025; Mathani et al., 2024). The TOE framework is widely used to identify the determinants of technology adoption through three main dimensions: technological factors, such as data readiness and system complexity; organizational factors, such as top management support and human resource capabilities; and environmental factors, including competitive pressures and regulatory support. Meanwhile, DOI complements the analysis by highlighting the perceptual aspects of technology, such as relative advantage, compatibility, and complexity. However, most studies still partially use TOE and DOI and focus on the adoption decision stage without explicitly linking them to long-term strategic implications for MSMEs' performance and sustainability.

In contrast, more recent literature has begun to adopt the Resource-Based View (RBV) and Dynamic Capabilities Theory perspectives to explain how AI and BDA can transform from mere operational tools into strategic capabilities that create sustainable competitive advantages (Behl et al., 2022; Venkatesh et al., 2025; Wu et al., 2025). These perspectives emphasize the importance of an organization's ability to dynamically integrate, build, and reconfigure digital resources to respond to

changes in the business environment. However, the simultaneous integration of the technology adoption framework (TOE–DOI) and resource-based and dynamic capabilities perspectives within a single conceptual model is rare. This fragmentation indicates a theoretical gap in the literature, where the drivers of adoption and the strategic impact of AI and BDA on MSMEs' capabilities and performance tend to be studied separately, thus limiting a holistic understanding of MSME digital transformation.

From a theoretical integration perspective, the findings suggest that TOE and DOI frameworks are particularly effective in explaining why MSMEs decide to adopt AI and BDA, whereas RBV and Dynamic Capabilities Theory are more suitable for explaining how these technologies generate strategic value after adoption. Technological readiness, managerial support, and environmental pressures identified in TOE act as antecedents that enable the accumulation of valuable digital resources, whereas DOI attributes shape managerial perceptions and adoption timing. Once adopted, AI and BDA become strategic resources whose value depends on the firm's ability to reconfigure them into dynamic capabilities, such as data-driven decision-making, organizational learning, and adaptability. This theoretical linkage indicates that adoption frameworks and capability-based theories should be viewed as complementary rather than competing lenses, providing a more coherent explanation of the transition from technology adoption to sustained performance outcomes in MSMEs.

4.3 AI and Big Data as Enablers of MSMEs' Organizational Capabilities

The majority of the literature analyzed in this study confirms that the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in MSMEs does not directly impact performance improvement but rather works indirectly by strengthening organizational capabilities. Behl et al. (2022), and Hayajneh et al. (2022) show that big data analytics capability serves as a crucial mediating mechanism in converting technology investments into sustainable competitive advantage. This capability enables MSMEs to improve the quality of information processing, decision-making accuracy, and operational efficiency of their businesses. Similarly, Ardito et al. (2024) assert that AI adoption contributes to MSME revenue growth through improved decision-making quality and process automation, ultimately strengthening business responsiveness to dynamic markets. These findings emphasize that the strategic value of AI and BDA lies in their ability to build internal capabilities, not solely in the adoption of technology.

From a dynamic capabilities perspective, AI and BDA are important enablers in strengthening MSMEs' ability to sense, seize, and adaptively reconfigure resources amid uncertain business environments (Venkatesh et al., 2025; Zong et al., 2025b). These technologies enable MSMEs to detect market changes earlier, capture business opportunities more quickly, and adjust process configurations and business models flexibly. However, the literature also emphasizes that the effectiveness of developing these capabilities is highly dependent on the readiness of human resources and the quality of digital leadership within the organization (Aftab et al., 2023; He et al., 2025). Without adequate investment in digital competency development, organizational learning, and managerial commitment, the adoption of AI and BDA risks being symbolic, not strategically integrated, and is unlikely to provide a sustainable long-term impact for MSMEs.

When interpreted through the lens of the Resource-Based View (RBV), AI and BDA can be understood as valuable but imperfectly imitable digital resources whose contribution to performance depends on their integration with firm-specific capabilities. However, RBV alone is insufficient to explain performance outcomes in the highly dynamic environments faced by MSMEs. Dynamic Capabilities Theory extends this explanation by clarifying how MSMEs transform AI and BDA into higher-order capabilities by sensing market changes, seizing opportunities, and reconfiguring resources. The empirical findings reviewed in this study align with this theoretical view, demonstrating that AI and BDA enhance performance only when embedded in organizational processes that support learning, managerial cognition, and continuous adaptation. This theoretical linkage reinforces the argument that AI and BDA function as enablers of capability development, rather than direct drivers of MSME performance.

4.4 The Impact of AI and Big Data on MSMEs Performance and Sustainability

A literature synthesis shows that the impact of adopting Artificial Intelligence (AI) and Big Data Analytics (BDA) on MSME performance is multidimensional and not limited to financial aspects alone. Several studies have confirmed that BDA contributes significantly to increased operational efficiency, decision-making accuracy, and responsiveness to market dynamics (Johnson, Jain, Brennan-Tonetta, Swartz, Silver, Paolini, Mamonov, & Hill, 2021; Kgakatsi, Galeboe, Molelekwa, & Thango, 2024). Furthermore, the integration of AI and BDA enables MSMEs to innovate along the value chain, from optimizing internal processes to developing data-driven products and services, thereby strengthening business competitiveness in a more adaptive way (Zong & Guan, 2024). These findings confirm that data-driven technology plays a key role in improving operational and innovative performance in the context of small and medium-sized enterprises.

However, recent literature has begun to highlight the role of AI-powered Big Data in supporting MSMEs' sustainability. Empirical studies have shown that the use of AI and BDA contributes to improved green supply chain performance, resource efficiency, and decision-making that is more oriented towards long-term sustainability (Makhdoom, Junejo, Sohu, Shah, Alwadi, Ejaz, & Hossain, 2025;Santos, & Sant, 2024). However, most studies still measure performance impacts from a short-term perspective and financial indicators, with limited exploration of long-term sustainable competitive advantages. Furthermore, the causal relationship between AI adoption, organizational capability development, and sustainability outcomes has rarely been empirically tested within a single integrated model, opening up opportunities for further research to develop an integrative framework that links digital transformation to MSMEs' performance and sustainability.

From a theoretical standpoint, these findings align with the Resource-Based View and Dynamic Capabilities Theory, which argue that sustainable performance outcomes arise not from technology ownership itself but from the firm's ability to strategically deploy and renew its resources over time. AI and BDA enhance MSMEs' performance and sustainability when they are transformed into dynamic capabilities that support continuous innovation, process reconfiguration, and environmentally responsible decision-making. In this context, operational efficiency and short-term financial gains reflect lower-order capability outcomes, whereas long-term sustainability and competitive advantage emerge from higher-order capabilities such as organizational learning, strategic agility, and green innovation. This theoretical interpretation helps explain why empirical evidence on direct performance effects remains mixed and underscores the importance of capability mediation in linking AI and BDA adoption to sustainable MSME performance.

4.5 Research Gap in AI and Big Data Literature in MSMEs

Based on a synthesis of 33 selected articles, this study identifies several significant gaps in the literature on the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in MSMEs. First, most studies examine AI and Big Data separately, while research integrating both technologies simultaneously is still very limited, even though they are complementary and integrated in business practice (Diouf et al., 2025). This condition results in a partial understanding of the synergy between AI and Big Data in driving MSME digital transformation. Furthermore, the literature also shows a lack of integration between technology adoption factors described through the Technology–Organization–Environment (TOE) framework with strategic outcomes such as dynamic capabilities and organizational performance in a single comprehensive conceptual model.

The next gap relates to the research context and the long-term perspective. The predominance of studies focused on developed countries limits our understanding of the dynamics of AI and BDA adoption among MSMEs in developing countries, which generally face limitations in digital infrastructure, human resources and institutional support. Furthermore, most research still positions AI and Big Data as operational tools to improve short-term efficiency, while studies that position these two technologies as strategic assets that shape dynamic capabilities and sustainable competitive advantage are still relatively rare. Therefore, these gaps underscore the urgency of conducting a Systematic Literature Review capable of synthesizing the literature in a holistic, integrative, and

theory-based manner to build a stronger conceptual foundation for future MSME research and practice.

5. Conclusions

5.1 Conclusion

This study provides a comprehensive synthesizes 33 scholarly articles examining the adoption of Artificial Intelligence (AI) and Big Data Analytics (BDA) in Micro, Small, and Medium Enterprises (MSMEs). Drawing on Technology–Organization–Environment (TOE), Diffusion of Innovation (DOI), Resource-Based View (RBV), and Dynamic Capabilities Theory, the findings demonstrate that MSMEs' AI and BDA adoption is shaped by the interaction of technological readiness, organizational support, and environmental pressures. Importantly, this review confirms that AI and BDA do not directly impact MSME performance. Instead, their strategic value materializes indirectly through the development of organizational and dynamic capabilities, particularly data-driven decision-making, organizational learning, adaptability, and the reconfiguration of resources. This finding helps reconcile inconsistencies in prior empirical studies and reinforces the argument that technology adoption frameworks alone are insufficient to explain performance outcomes without incorporating a capability-based perspective.

Overall, this study contributes theoretically by integrating technology adoption theories with the dynamic capability perspective, offering a more holistic explanation of how AI and BDA enable digital transformation and sustainable performance in MSMEs. This integrative approach advances the literature beyond fragmented, adoption-focused studies toward a capability-driven understanding of technology-enabled competition. From a practical perspective, the findings indicate that MSMEs cannot expect performance improvements solely by adopting AI and Big Data technologies. The effectiveness of these technologies depends on how well they are embedded in organizational processes, managerial practices, and learning mechanisms. MSMEs that lack digital leadership, skilled human resources, and organizational readiness risk experiencing symbolic or superficial adoption without tangible performance benefits. Therefore, AI and BDA should be viewed as strategic enablers within a broader digital transformation agenda, rather than as standalone technological solutions.

5.2 Research Limitations

This study had several limitations. First, the review included only English-language journal articles indexed in the Scopus and Semantic Scholar databases, which may have resulted in the exclusion of relevant studies published in other languages, databases, or non-journal outlets. Second, although the review covers a ten-year period, a substantial proportion of the analyzed studies employed cross-sectional research designs, limiting the ability to capture the long-term dynamics of AI and BDA adoption and their sustained impact on MSME performance. These limitations suggest that the findings should be interpreted with caution, particularly when generalizing them across different institutional and economic contexts.

5.3 Suggestions and Directions for Future Research

Based on the identified limitations and synthesis results, several directions for future research are recommended. First, future studies should move beyond examining AI and BDA adoption in isolation and investigate their integrated implementation within MSMEs. Second, empirical research should explicitly test the mediating role of dynamic capabilities in the relationship between AI and BDA adoption and performance outcomes, particularly sustainability and competitive advantage. Third, theory-driven studies integrating TOE and DOI frameworks with RBV and Dynamic Capabilities Theory within a single empirical model are needed. Longitudinal and mixed-method research designs are especially encouraged to better capture causal relationships and the evolution of digital transformation over time. [insert DOI] Finally, more empirical evidence from developing countries is required to address the contextual constraints related to digital infrastructure, resource limitations, and institutional environments. Such studies would enrich the current literature and provide more nuanced insights into how AI and Big Data can effectively support inclusive and sustainable digital transformation among MSMEs.

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Author Contributions
LAP contributed to the conceptualization of the study, formulation of research objectives, development of the review framework, execution of the systematic literature review following PRISMA guidelines, data analysis, and drafting of the original manuscript. SS was responsible for the study design, development of the search strategy, literature screening and selection, and contributed to data interpretation and discussion. YP assisted in the thematic analysis, synthesis of findings, and manuscript revision and refinement of theoretical arguments. ETO provided methodological supervision, critically reviewed and revised the manuscript for intellectual content, ensured theoretical coherence and academic rigor, and approved the final version of the manuscript. All authors reviewed and approved the final manuscript and agreed to be accountable for all aspects of the study.

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