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The AI Revolution and Its Impact on SMEs in Asia: A Bibliometric Analysis Towards a Digital Future

Jia Qi Cheong[1]*, Chong Shyue Chuan[2], Abdul Rahim Bin Ridzuan[3]

[1] *Faculty of Business and Management, University of Teknologi MARA (Uitm) Sri Iskandar, Perak & Centre for Economic Development and Policy (CEPD), Universti Malaysia Sabah, Malaysia & Malaysian Inbound Tourism Association (MITA), Malaysia*

[2] *Tunku Abdul Rahman University of Management and Technology (TAR UMT), Kuala Lumpur, Malaysia*
[3] *Institute for Big Data Analytics and Artificial Intelligence (IBDAAI), Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia & Centre for Economic Development and Policy (CEDP), Universiti Malaysia Sabah*

Abstract: The rapid evolution of artificial intelligence (AI) is transforming business landscapes worldwide, with small and medium-sized enterprises (SMEs) in Asia facing both unprecedented opportunities and challenges. This study conducts a bibliometric analysis to explore the scientific literature on AI adoption and its implications for SMEs across the Asian region. Using data retrieved from the Scopus database between 2010 and 2024, the analysis employs VOSviewer and Bibliometrix to map publication trends, citation networks, research hotspots, and collaborative patterns. The findings reveal a steady increase in scholarly attention, with a notable surge after 2018, reflecting heightened awareness of AI's role in driving digital transformation. Key thematic clusters include AI-driven innovation, digital entrepreneurship, big data analytics, and policy frameworks supporting SME competitiveness. Results also highlight strong research contributions from China, India, and Malaysia, alongside emerging collaborative networks across Asia and beyond. This study contributes by identifying knowledge gaps, emphasizing the need for cross-disciplinary research, and providing insights for policymakers, entrepreneurs, and academics on leveraging AI for sustainable SME growth. By synthesizing existing scholarship, the paper underscores AI's strategic significance in shaping a resilient and digitally inclusive future for SMEs in Asia

Keywords: *Artificial Intelligence (AI), Small and Medium-sized Enterprises (SMEs), Asia, Digital Transformation, Bibliometric Analysis*

1. Introduction

The Fourth Industrial Revolution, marked by the convergence of advanced technologies such as artificial intelligence (AI), big data analytics, the Internet of Things (IoT), and blockchain, is fundamentally transforming the global business environment. Among these technologies, AI has emerged as a pivotal driver of digital transformation, offering new opportunities for value creation, operational efficiency, and strategic innovation across industries (Dwivedi et al., 2021; Paschen, Pitt, & Kietzmann, 2020). Recent projections by McKinsey Global Institute (2021) estimate that AI technologies could contribute up to $13 trillion in additional global economic activity by 2030, enhancing global GDP by approximately 1.2% annually.

While large multinational corporations have traditionally led AI adoption, small and medium-sized enterprises (SMEs)—which constitute approximately 97% of businesses and nearly 50% of employment in Asia (ADB, 2020; ERIA/OECD, 2024)—are increasingly recognizing the strategic importance of AI integration. SMEs are leveraging AI capabilities to enhance competitiveness, strengthen resilience, and stimulate innovation in an evolving digital economy (Chatterjee et al., 2021).

Nevertheless, SMEs in Asia encounter specific challenges in embracing AI technologies. Although AI holds significant potential to automate routine operations, optimize decision-making processes, and enable new business

models (Rana et al., 2021), SMEs often grapple with resource constraints, insufficient digital infrastructure, cybersecurity risks, and shortages of digitally skilled talent (Mariano et al., 2020; Bawack et al., 2021; Di Vaio et al., 2022). Despite these obstacles, the proliferation of cloud-based AI services, low-code/no-code development platforms, and supportive government initiatives, such as Singapore's "National AI Strategy 2.0" and South Korea's "Digital New Deal," are facilitating AI adoption among SMEs (Smart Nation Singapore, 2023).

Despite growing interest, academic understanding of AI adoption among Asian SMEs remains fragmented. Much of the existing research has focused either on large corporations or Western contexts, leading to a critical gap in the literature regarding the unique trajectories of AI integration among SMEs within Asia's diverse economic and institutional landscapes.

Several notable research gaps emerge from the existing literature on AI adoption among SMEs. First, there is a geographical imbalance: the majority of research has concentrated on developed Western economies, with significantly fewer studies examining the dynamic and diverse contexts of Asian SMEs (Wamba-Taguimdje et al., 2020). This underrepresentation limits the development of region-specific theoretical frameworks and practical strategies.

Second, sectoral gaps are evident. While industries such as manufacturing and retail have received considerable scholarly attention, other critical sectors for many Asian economies, including agriculture, healthcare, and tourism, remain underexplored. Third, methodological limitations persist. A heavy reliance on qualitative case studies and conceptual papers is observed, whereas large-scale empirical investigations and comparative analyses across different Asian economies are scarce.

Furthermore, few studies provide integrated models that contextualize the specific enablers and barriers of AI adoption among SMEs, particularly models that incorporate considerations of resource limitations, cultural diversity, and regulatory environments unique to Asia. Finally, a significant policy and practice gap remains: limited empirical research links national digital strategies and innovation policies to tangible outcomes for SMEs in the region. Addressing these research gaps is crucial for developing actionable insights that support the sustainable digital transformation of SMEs across Asia.

Figure 1 outlines the key thematic dimensions shaping the intersection between AI and SMEs in Asia. These dimensions include digital transformation (innovation, efficiency, and growth), limited resources (infrastructure and skills), and the Asian context (economic development). Additionally, the diagram highlights the role of bibliometric analysis in identifying research trends and themes, as well as the opportunities, consequences, and challenges that emerge from AI adoption. Together, these dimensions provide a conceptual framework for analyzing how SMEs navigate digital transformation in resource-constrained and context-specific environments.

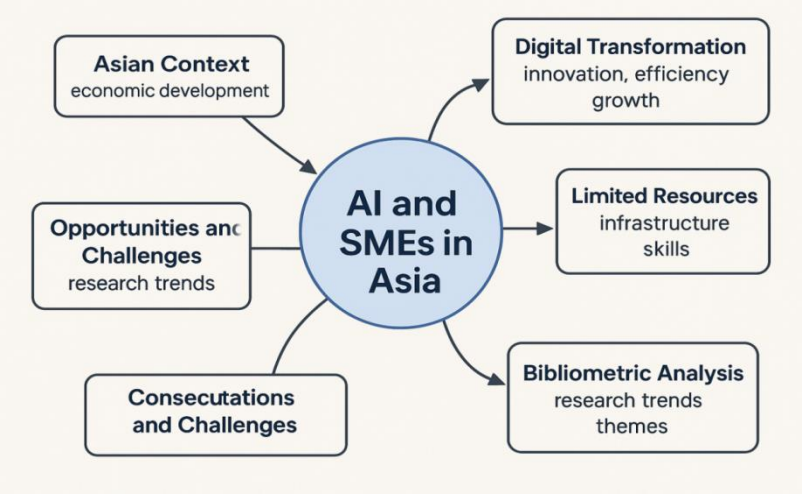

Figure 1: Key Conceptual Themes Surrounding AI and SMEs in Asia

Figure 1 *Main thematic dimensions influencing AI adoption in SMEs in Asia, including digital transformation, limited resources, regional context, research trends, and bibliometric perspectives.*

1.1 Study Objectives and Significance

This study aims to address the identified research gaps by conducting a comprehensive bibliometric analysis of scholarly research on AI adoption among SMEs in Asia. Specifically, the study seeks to examine the growth and distribution of research outputs, identify the most influential authors, journals, institutions, and countries, and uncover dominant research themes, knowledge gaps, and potential future research directions through advanced keyword co-occurrence and thematic mapping techniques.

By offering a structured and data-driven overview of the research landscape, this study contributes to both academic knowledge and practical understanding. Academically, it enhances the conceptualization of AI adoption among SMEs within Asia's diverse economic contexts. Practically, it provides policymakers, technology providers, and SME leaders with actionable insights to navigate digital transformation strategies more effectively.

Given the strategic importance of SMEs in promoting inclusive economic development and technological innovation, particularly within Asia, the findings of this study hold significant relevance. By systematically synthesizing the extant body of knowledge, the study not only bridges critical research gaps but also lays a foundation for future empirical and theoretical advancements in the field.

The remainder of this paper is organized as follows. Section 2 presents a comprehensive literature review, highlighting key theories, empirical findings, and conceptual frameworks related to AI adoption among SMEs in Asia. Section 3 describes the methodology employed for the bibliometric analysis, including data sources, selection criteria, and analytical techniques. Section 4 presents the results of the bibliometric study, covering publication trends, authorship and institutional patterns, collaboration networks, and thematic evolution. Section 5 discusses the key findings, identifies persisting research gaps, and proposes an agenda for future research. Finally, Section 6 concludes the study by summarizing its main contributions, theoretical implications, and practical recommendations for stakeholders involved in the digital transformation of SMEs in Asia.

2. Literature Review

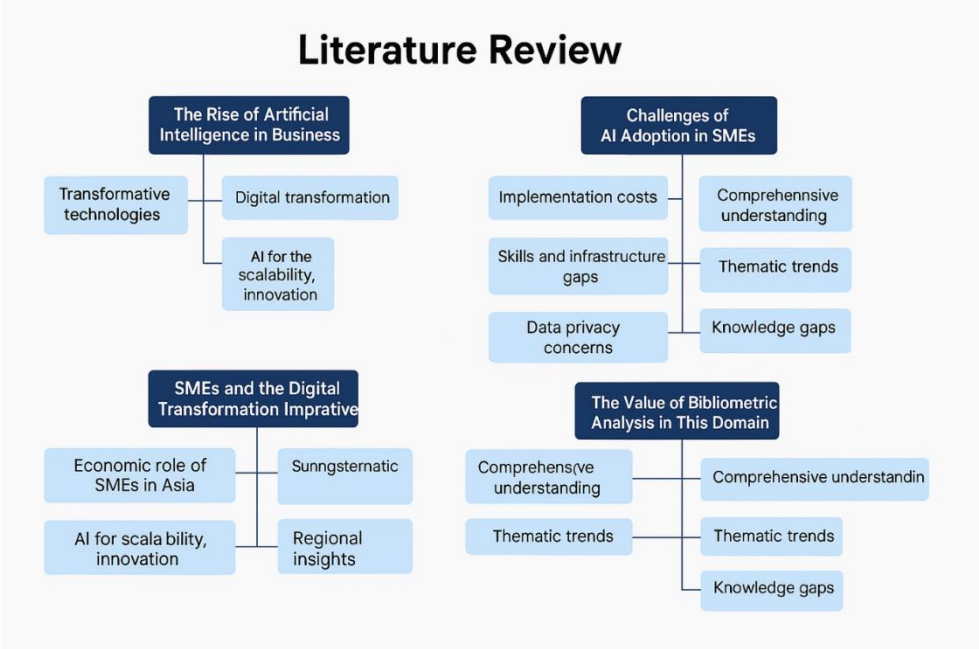

Figure 2: Structured Overview of the Literature Review on AI and SMEs

This figure 2 visual representation categorizes the literature review into four main areas: the rise of AI in business, SME digital transformation, challenges of AI adoption, and the value of bibliometric analysis.

2.1. The Rise of Artificial Intelligence in Business

Artificial intelligence (AI) has emerged as a transformative force that is reshaping modern business paradigms. It is no longer perceived merely as a back-end automation tool but as a strategic asset that redefines how organizations generate, deliver, and capture value. Shrestha et al. (2019) emphasize that AI's influence extends to organizational decision-making structures, enabling adaptive and decentralized processes. However, their conceptual lens is largely firm-agnostic and underrepresents how such strategic reconfigurations manifest differently in SMEs compared to large, formally structured corporations.

The growing traction of AI in business is fueled by the exponential availability of data, increasing computational capacities, and advancements in machine learning algorithms. Brynjolfsson and McElheran (2016) report a strong correlation between data-driven decision-making and productivity gains, particularly in sectors characterized by rapid change. Yet, their empirical base skews toward large U.S. corporations, limiting its transferability to SMEs in emerging economies where data maturity and infrastructure remain uneven. Nonetheless, the proliferation of AI-as-a-Service (AIaaS) platforms has significantly lowered entry barriers, allowing even digitally immature firms to leverage AI for specific tasks such as customer analytics and supply chain optimization. This aligns with findings from Al-Qudah (2022), who illustrated in the UAE context how AI adoption—even in smaller firms—yields strategic benefits when aligned with firm-specific priorities.

A growing body of literature underscores a transition from algorithm-centric development to organizationally embedded AI practices. Dwivedi et al. (2021) advocate a multidisciplinary approach that factors in governance, ethics, and organizational readiness. While comprehensive, their framework is implicitly tailored for institutions with robust organizational capacity. SMEs, especially those in developing Asia, often operate in reactive modes with informal planning structures, which calls for more localized models of AI integration. Supporting this shift, Enholm et al. (2022) emphasize the value-based realization of AI in business, particularly through contextual application of predictive technologies.

Paschen, Pitt, and Kietzmann (2020) introduce a typology of AI innovations ranging from enhancement to transformation, noting that modular AI applications allow adaptation across different organizational scales. However, their innovation model presumes a baseline level of digital literacy and strategic foresight, both of which may be lacking in resource-constrained SMEs. This concern is particularly pressing in less digitized economies, where AI adoption may exacerbate digital divides rather than close them.

Ethical and trust-related concerns also remain paramount. Siau and Wang (2018) caution that building trust in AI systems—particularly in small enterprises with limited governance mechanisms—requires not just regulatory oversight but ethical leadership and transparent data practices. Yet, operationalizing such ethical imperatives remains under-theorized, particularly for SMEs that lack formal compliance systems.

In summary, AI's business transformation potential is undeniable, but its implementation is not monolithic. While the literature captures broad strategic and technological trajectories, it often lacks specificity regarding SMEs' constraints, especially in heterogeneous and developing regions. Future research should thus disaggregate the AI adoption narrative to reflect contextual differences in organizational size, sector, and geography.

2.2. SME Digital Transformation and Technology Readiness

Digital transformation is increasingly essential for SMEs seeking to remain viable in a hypercompetitive and technology-driven global market. However, SMEs often face structural and systemic barriers that impede their digital evolution. Mittal et al. (2018) argue that digital transformation entails a holistic reconfiguration of business models, not just incremental technology upgrades. Their maturity model, while useful, is calibrated for SMEs in industrialized economies and does not account for the informal sector or fragmented digital ecosystems found in much of Asia.

Technology readiness—encompassing infrastructure, digital skills, and strategic alignment—is a critical determinant of whether SMEs can adopt transformative technologies like AI. Tarutė and Gatautis (2014) find that SMEs typically trail larger firms in all readiness dimensions, especially in emerging markets. This gap is

compounded by institutional challenges such as underdeveloped ICT infrastructure and limited policy support. The Asia SME Monitor by the Asian Development Bank (2021) corroborates this, reporting vast disparities in digital readiness across Asian subregions, particularly between urban and rural areas.

Leadership and organizational culture also play pivotal roles. Chatterjee, Rana, and Dwivedi (2021) apply the technology–organization–environment (TOE) framework to argue that internal commitment can compensate for external constraints. However, their empirical evidence from Indian firms reveals a bias toward more formally structured SMEs, whereas in much of Asia, micro-enterprises dominate, often with top-down decision-making and informal governance. Naeem (2020) also shows how internal communication tools, such as social media, facilitate organizational change, particularly in SMEs undergoing digital transformation.

Meanwhile, cloud computing and AI-as-a-Service platforms offer scalable solutions that mitigate some of these readiness gaps. Maroufkhani, Ismail, and Ghobakhloo (2020) suggest that such platforms allow SMEs to bypass the need for deep internal technical expertise. Yet, the case study design of their study limits generalizability. Broader, cross-country investigations are needed to validate the conditions under which such technologies translate into meaningful performance gains.

Digital skills deficits persist as a major barrier to SME transformation. Scuotto et al. (2017) underscore the importance of both intra- and inter-organizational knowledge-sharing networks in building digital capability. Yet, many SMEs—especially in Asia—operate in competitive silos without formal collaboration ecosystems. Similarly, Vial (2019) and Nambisan, Wright, and Feldman (2019) point out that digital transformation is a socio-technical process requiring synchronized change in technology, strategy, and culture—an alignment rarely found in informal or early-stage SMEs.

Capability-based perspectives provide further nuance. Li et al. (2017) examine how entrepreneurial orientation and absorptive capacity shape SME readiness for digital change. Their study is particularly relevant for understanding heterogeneous outcomes across SMEs in Asia, where strategic capabilities vary widely. However, the lack of longitudinal data makes it difficult to assess the sustainability of digital gains. Additionally, Sestino et al. (2020) highlight that IoT and big data are increasingly enabling digitalization strategies even among resource-constrained firms.

Lastly, while the COVID-19 pandemic acted as a forcing function for digital adoption (Papadopoulos et al., 2020), many SMEs still lack post-pandemic strategies for sustained transformation. Bharadwaj et al. (2013) advocate for digital business strategies that integrate IT as a core organizational function. For SMEs, however, such integration is aspirational rather than operational due to structural constraints and financial limitations.

In conclusion, SME digital readiness is a multifaceted construct shaped by infrastructure, skills, leadership, and institutional support. While the literature provides valuable theoretical and empirical foundations, there remains a critical need for regionalized and sector-specific research. Context-sensitive frameworks are essential to design realistic and implementable digital transformation pathways for SMEs across diverse Asian economies.

2.3. Challenges of AI Adoption in SMEs

The adoption of Artificial Intelligence (AI) in Small and Medium-sized Enterprises (SMEs) is fraught with multifaceted challenges that span financial, technical, organizational, and cultural domains. Financial constraints are a primary barrier; SMEs often lack the capital required for AI investments, which include procuring advanced technologies and hiring specialized personnel. Kamalaldin et al. (2020) highlight that the transformation of provider-customer relationships through digital servitization necessitates substantial investment, which may be prohibitive for resource-constrained SMEs.

Technical challenges, particularly the scarcity of digital talent, further impede AI adoption. Mikalef et al. (2018) emphasize that the development of big data analytics capabilities is contingent upon access to skilled professionals, a resource often scarce in SMEs due to budgetary and geographical limitations. This scarcity hampers the ability of SMEs to leverage AI effectively. Yasmin et al. (2020) further assert that without a structured

approach to capability building, big data analytics and AI are unlikely to yield substantial performance improvements in SMEs.

Organizational resistance to change also plays a significant role. Verma and Bhattacharyya (2017) found that in emerging economies like India, the perceived strategic value of big data analytics influences adoption decisions. However, many SMEs exhibit reluctance due to the complexity of AI technologies and the disruption they may cause to established workflows.

Data-related issues, including fragmented systems and lack of governance frameworks, pose additional hurdles. Maroufkhani et al. (2022) conducted a systematic literature review revealing that SMEs often struggle with big data analytics adoption due to inadequate data infrastructure and governance, which are critical for AI implementation.

Institutional support mechanisms are often insufficient to address these challenges. Wamba-Taguimdje et al. (2020) discuss the influence of AI on firm performance, noting that without robust support structures, SMEs may find it difficult to realize the benefits of AI-based transformation projects.

The COVID-19 pandemic has further complicated the landscape. Soto-Acosta (2020) observes that the pandemic has accelerated digital transformation, yet SMEs may struggle to keep pace due to existing constraints. This rapid shift underscores the need for targeted support to facilitate AI adoption in SMEs.

2.4. AI and SMEs in Asia: Regional Insights

AI adoption among SMEs in Asia exhibits significant regional disparities, influenced by varying levels of infrastructure, policy support, and organizational readiness. In Malaysia, Lada et al. (2023) identify top management commitment and organizational readiness as critical factors influencing AI adoption among SMEs. Their study suggests that enhancing these internal capabilities can significantly impact the successful integration of AI technologies.

Ayinaddis (2025) provides a comprehensive bibliometric analysis, revealing that AI adoption dynamics differ between SMEs and large firms, with SMEs facing unique hurdles such as limited resources and technological readiness. The study emphasizes the need for targeted frameworks and policies to support SMEs in overcoming these barriers. Sector-specific challenges also emerge. Maroufkhani et al. (2020) examine big data analytics adoption among SMEs, highlighting that factors such as complexity, uncertainty, and external support significantly influence adoption decisions. These findings underscore the importance of contextualizing AI adoption strategies to sector-specific needs.

The pandemic has acted as a catalyst for digital transformation. Soto-Acosta (2020) notes that the COVID-19 crisis has accelerated the shift towards digital technologies, presenting both opportunities and challenges for SMEs in adopting AI. This acceleration necessitates agile responses from SMEs to adapt to the rapidly changing technological landscape. Cultural factors also play a role in AI adoption. Verma and Bhattacharyya (2017) discuss how perceptions of strategic value influence the adoption of big data analytics in Indian firms, suggesting that cultural attitudes towards technology can significantly impact adoption rates. Environmental considerations are increasingly relevant. Arfanuzzaman (2021) explores how AI and big data can contribute to achieving Sustainable Development Goals in South Asia, indicating that AI adoption in SMEs can have broader societal and environmental benefits.

2.5. The Value of Bibliometric Analysis in This Domain

Bibliometric analysis has gained prominence as a method to map scholarly developments, particularly in rapidly evolving domains like AI and SMEs. As Donthu et al. (2021) argue, bibliometric methods allow for objective measurement of scientific output and thematic evolution. However, their study emphasizes general principles and would benefit from more context-specific applications, such as SMEs in Asia.

Bibliometric tools have also been used to trace the diffusion of AI across business functions. For instance, Ayinaddis (2025) employed keyword co-occurrence and thematic evolution mapping to analyze shifts in SME-

AI research, revealing a growing focus on personalization and predictive analytics. While insightful, these findings rely heavily on English-language databases, risking exclusion of region-specific scholarship from non-English sources.

Furthermore, co-citation and authorship analysis help identify intellectual structures within the field. Di Vaio et al. (2022) used these methods to isolate research clusters in public sector AI, providing a replicable template for the SME context. Still, few studies have fully mapped the Asian AI–SME research network, presenting an opportunity for future inquiries. Bibliometric studies also inform publication strategies by identifying impactful journals and authors. Bawack et al. (2022) found that Technological Forecasting and Social Change and Journal of Business Research frequently publish high-impact articles in this domain. However, such analyses often overlook practitioner journals that influence policy and SME strategy.

Ultimately, bibliometric approaches offer a structured pathway to uncover research gaps and inform evidence-based policymaking. Dwivedi et al. (2023) advocate for deeper integration of bibliometric tools in both academic and governmental AI roadmaps, especially in under-researched regions. In summary, bibliometric analysis serves as a valuable tool for understanding the evolving landscape of AI adoption in SMEs. By identifying research trends, gaps, and influential works, it aids in shaping future research agendas and policy frameworks tailored to the unique challenges and opportunities within this domain.

2.6. Conceptual Frameworks Linking AI and SME Performance

The influence of Artificial Intelligence (AI) on SME performance has been conceptualized through various theoretical lenses, notably the **Resource-Based View (RBV)**, **Dynamic Capabilities (DC)**, and the **Technology-Organization-Environment (TOE)** framework. These models emphasize that the impact of AI goes beyond adoption; it depends critically on the strategic integration of AI technologies with internal firm capabilities and external environmental factors. Rialti et al. (2020) argue that SMEs must develop dynamic capabilities to convert big data and AI investments into performance gains, particularly under conditions of rapid technological change. However, their review, while comprehensive, is predominantly Western-centric and lacks sectoral and regional contextualization relevant to SMEs in Asia. This limits its direct applicability to developing economies where institutional and infrastructural gaps prevail.

In the Asian SME context, the TOE framework is particularly useful as it explicitly accounts for technological readiness, organizational culture, and external environmental pressures—factors often cited as barriers to AI adoption (Queiroz & Wamba, 2021). Their empirical work emphasizes how firms with strong IT resources and leadership commitment are more agile and capable of aligning AI tools with business processes. Yet, their study also underrepresents smaller firms that may not possess advanced IT infrastructures, suggesting the need for more SME-specific TOE models that capture their limited resource base and informal management structures.

Some scholars also highlight the significance of **strategic alignment** between AI capabilities and business objectives. In a bibliometric review, Ciasullo et al. (2023) underscore the role of absorptive capacity and organizational learning as mediators between digital technology investment and performance outcomes. This is particularly relevant for SMEs, which must often repurpose existing resources to implement AI solutions. However, the literature still lacks longitudinal studies that examine how this strategic alignment evolves over time, especially in turbulent or post-crisis environments like those following the COVID-19 pandemic.

A promising development is the integration of **open innovation and ecosystem-based models** into conceptual frameworks. Sacavém, et al(2025) propose that SMEs benefit not only from internal capabilities but also from external partnerships via digital platforms that foster co-creation and rapid experimentation. While insightful, the model assumes the existence of supportive institutional frameworks, which may not hold in regions with limited policy support or digital infrastructure—common conditions in many parts of Asia.

Critically, much of the current conceptual work focuses on potential rather than realized outcomes. Empirical validation across diverse SME sectors and countries remains limited. As Soto-Acosta (2020) points out, performance outcomes from AI investments are often ambiguous without clearly defined metrics, and SMEs may

struggle to measure ROI due to fragmented data and short planning horizons. Hence, conceptual frameworks must increasingly incorporate **measurable performance indicators** and **feedback loops** to ensure practical utility.

In conclusion, while theoretical frameworks such as RBV, DC, and TOE provide valuable perspectives on how AI may enhance SME performance, they require adaptation to local contexts and sectoral dynamics, especially in Asia. Future research should integrate these models with grounded, context-sensitive insights, incorporating real-world constraints and enablers that shape AI implementation in SMEs.

2.7. Synthesis and Research Gaps

The existing literature provides valuable insights into the transformative potential of AI for SMEs, especially when viewed through frameworks such as the Resource-Based View (RBV), Technology-Organization-Environment (TOE), and Dynamic Capabilities (DC). However, a synthesis across the reviewed works reveals several significant research gaps that constrain a holistic understanding of how AI impacts SME performance in the Asian context.

First, while there is a growing volume of empirical studies on AI adoption among SMEs, many are disproportionately focused on developed Western economies (Mariani & Borghi, 2019; Rialti et al., 2019). This geographic skewness limits the transferability of findings to Asian SMEs, which often operate under unique institutional constraints, informal structures, and infrastructural limitations. Contextual variables such as regulatory frameworks, digital literacy, and regional support ecosystems are either underexplored or generalized across vastly different countries.

Second, although conceptual frameworks such as RBV and TOE are frequently applied, there remains a disconnect between theory and practice. For example, models often assume that SMEs have sufficient absorptive capacity to exploit AI technologies (Ciasullo et al., 2023), yet this assumption is rarely tested in longitudinal field studies that track how capabilities evolve over time. Moreover, dynamic capabilities—such as innovation ambidexterity or organizational agility—are often cited as mediators in the AI-performance link, but operationalizing these concepts in empirical studies remains a challenge (Queiroz & Wamba, 2021).

Third, the literature pays insufficient attention to sector-specific dynamics. For instance, the barriers and opportunities for AI adoption in manufacturing SMEs may differ substantially from those in services or agriculture. Studies often adopt a generalized view of SMEs, overlooking the heterogeneity within the sector. As highlighted by Sacavém, et al(2025) digital platform usage differs not only across industries but also based on firm size, age, and leadership orientation. More nuanced, industry-specific investigations are therefore needed.

Fourth, while digital transformation is a recurring theme, the measurement of AI-driven performance outcomes is inconsistent and often vague. Metrics such as productivity, cost reduction, or innovation output are frequently mentioned but rarely standardized across studies (Soto-Acosta, 2020). The lack of clear key performance indicators (KPIs) hinders comparative research and weakens the policy relevance of academic findings.

Finally, there is a noticeable scarcity of studies employing mixed methods or longitudinal designs. Most research relies on cross-sectional survey data, which fails to capture the iterative and evolving nature of AI adoption. Furthermore, few studies explore unintended consequences or risks—such as job displacement, ethical dilemmas, or cybersecurity vulnerabilities—especially in relation to SMEs with limited safeguards and resources.

To address these gaps, future research should prioritize (1) geographically and culturally diverse case studies from Asia, (2) longitudinal tracking of AI implementation processes in SMEs, (3) development of sector-specific frameworks, and (4) standardization of AI impact metrics aligned with SME realities. A more nuanced and contextualized understanding of how AI empowers SMEs will significantly improve both theoretical development and practical guidance.

3. Methodology

This study employs a bibliometric analysis to systematically explore the academic literature on the intersection of artificial intelligence (AI) and small and medium-sized enterprises (SMEs) in the Asian context. Bibliometric

methods are widely recognized for their ability to provide objective, reproducible insights into the structure, dynamics, and evolution of scientific fields. As such, this method is particularly appropriate for evaluating research output, identifying intellectual trends, and detecting collaboration patterns in the rapidly growing domain of AI and SMEs. To ensure comprehensiveness and data quality, the study draws its dataset from two premier academic databases: **Scopus** and the **Web of Science (WoS) Core Collection**. These platforms are well-regarded for their rigorous indexing policies and extensive coverage of peer-reviewed publications, thus ensuring a robust foundation for bibliometric inquiry.

The temporal scope of the analysis spans from **January 1, 2010, to December 31, 2024**. This 15-year period was selected to capture the rapid evolution and acceleration of AI technologies in the post-global financial crisis era, including their intensified relevance during and after the COVID-19 pandemic. By encompassing this period, the study reflects not only the technological advancements but also the growing policy and business interest in digital transformation among Asian SMEs. The year 2010 serves as an appropriate starting point because it marks a phase when AI began experiencing substantial theoretical and applied developments across industries, including small businesses in emerging economies.

The data collection process was conducted through a carefully structured search strategy using a combination of targeted keywords and Boolean operators. The search queries were applied to the **title**, **abstract**, and **keywords** fields of each database to maximize the precision and recall of relevant documents. The AI-related terms used in the query included "artificial intelligence," "machine learning," "deep learning," "natural language processing," and "predictive analytics." To capture literature relevant to the business size category, terms such as "small and medium enterprises," "small and medium-sized businesses," and "SMEs" were employed. To ensure geographic focus, terms such as "Asia," "Asian," and the names of major Asian countries (e.g., "China," "India," "Malaysia," "Singapore," "Indonesia," "Vietnam," and "Philippines") were included. This resulted in the following representative Boolean search string: **("artificial intelligence" OR "machine learning" OR "deep learning" OR "natural language processing" OR "predictive analytics") AND ("small and medium enterprises" OR "SMEs") AND ("Asia" OR "China" OR "India" OR "Indonesia" OR "Malaysia" OR "Singapore" OR "Vietnam")**, with filters applied for document types (articles and reviews only), language (English), and publication years (2010–2024).

Following the search, the results were exported from Scopus and WoS in BibTeX and CSV formats. Duplicate records were identified and removed using **Bibliometrix**, an R-based open-source tool for bibliometric and scientometric analysis. Additional cleaning steps included standardizing author names, institutions, and keywords to correct for inconsistencies caused by typographical variations or database-specific formatting. The dataset was further refined by excluding non-research publications such as editorials, conference proceedings, books, and non-English articles. Only peer-reviewed journal articles and review papers were retained to ensure scientific rigor and quality.

The analytical phase of the study utilized two specialized tools. First, the **Bibliometrix R package** was used to generate descriptive statistics, analyze publication trends, and conduct co-word analysis. Bibliometrix offers a comprehensive framework for science mapping and allows for longitudinal examination of keyword evolution and thematic development. Second, **VOSviewer** was employed to construct and visualize bibliometric networks, including co-authorship, co-citation, and keyword co-occurrence maps. VOSviewer is particularly effective at producing interpretable visualizations that highlight structural and relational patterns within the scholarly literature. Through these tools, the study assessed not only productivity metrics such as the most prolific authors, institutions, and countries, but also intellectual linkages and thematic clusters that characterize the research landscape.

To enhance the reliability and relevance of the results, the study adopted well-defined inclusion and exclusion criteria. Included were publications written in English, focused explicitly on AI applications or impacts on SMEs within Asian countries, and indexed in either Scopus or WoS. Excluded from the analysis were articles not directly related to SMEs or AI, those focused solely on large enterprises or regions outside Asia, and non-peer-reviewed content such as conference papers, theses, and editorials. These criteria helped maintain the thematic and

geographical relevance of the dataset while preserving the methodological rigor expected in bibliometric scholarship.

Overall, this methodology provides a systematic and replicable foundation for mapping the scholarly discourse at the confluence of AI and SME development in Asia. By leveraging high-quality data sources, applying a robust search and filtering process, and employing state-of-the-art analytical tools, the study aims to offer an insightful and data-driven overview of a rapidly emerging research frontier.

4. Results and Discussion

4.1. Publication Trends Over Time

The bibliometric analysis reveals a robust upward trend in academic publications focusing on AI and SMEs in Asia, particularly between 2010 and 2024. While early studies were sparse and exploratory, post-2015 saw a marked acceleration in output. This surge correlates with global attention on Industry 4.0, big data, and digital transformation imperatives (Dissanayake et al., 2024). The COVID-19 pandemic served as a catalyst, prompting SMEs to seek agile, technology-driven solutions to ensure continuity and resilience (Vu, 2024). These shifts reflect a broader recognition of AI as a tool for operational efficiency and strategic innovation (Ziky et al., 2025).

Bibliometric insights indicate that 2020 to 2024 represent peak periods of publication, underscoring the alignment between real-world technological shifts and scholarly attention (Dissanayake et al., 2024). The proliferation of open-access platforms and regional research funding in Asia has further facilitated the diffusion of AI-focused SME literature (Ziky et al., 2025).

4.2. Leading Countries, Institutions, and Authors

China and India lead in both quantity and impact of publications related to AI in SMEs, which aligns with their strong national AI strategies and substantial R&D investments. Key institutions include Tsinghua University, Zhejiang University, the Indian Institutes of Technology (IITs), and the National Institute of Technology, reflecting high government and academic prioritization of AI in digital transformation (Ziky et al., 2025; Dissanayake et al., 2024).

Singapore, Malaysia, and Indonesia also emerge as significant contributors, bolstered by regional innovation strategies and industry-academia collaborations (Vu, 2024). Collaborative patterns among Asian institutions indicate a trend toward multidisciplinary research involving business management, computer science, and public policy—an evolution confirmed by global bibliometric studies on AI applications in business (Dissanayake et al., 2024). Notably, authors such as Dwivedi, Rana, and Maroufkhani frequently appear as influential contributors, indicating their central role in shaping research around AI, SMEs, and digital ecosystems.

4.3. Keyword Co-Occurrence Networks

The keyword co-occurrence analysis in the bibliometric mapping reveals three dominant thematic clusters that encapsulate the evolving research focus on AI applications in SMEs across Asia. The first thematic cluster centers on **AI Integration in Business Processes**, characterized by the frequent appearance of keywords such as “artificial intelligence,” “automation,” “machine learning,” and “business performance.” This cluster underscores the critical role of AI technologies in enhancing operational efficiency, streamlining workflows, and facilitating intelligent decision-making processes. Research in this domain emphasizes how AI tools are being embedded into day-to-day business functions to optimize productivity and improve overall firm performance, particularly for resource-constrained SMEs (Ziky et al., 2025; Dissanayake et al., 2024).

The second cluster focuses on **Digital Transformation and Innovation**, prominently featuring keywords like “digital transformation,” “SMEs,” “technology adoption,” and “innovation.” These terms reflect the strategic orientation of contemporary AI research, which increasingly views AI not only as a tool for automation but as a fundamental enabler of organizational renewal and innovation. The presence of these keywords points to a growing body of literature that examines how SMEs leverage AI to drive structural change, enter new markets, and create competitive advantages in rapidly evolving digital environments (Vu, 2024; Dissanayake et al., 2024).

The convergence of AI with strategic innovation processes illustrates a paradigm shift in how small firms approach growth and digital competitiveness in the post-pandemic context.

The third major thematic area, **Data Analytics and Decision Support**, is defined by the prevalence of terms such as "big data," "predictive analytics," and "decision support systems." This cluster highlights the increasing emphasis on data-driven decision-making in SME operations. The research suggests that AI-powered analytics tools are enabling firms to harness large volumes of structured and unstructured data, thus supporting more informed and agile strategic planning (Ziky et al., 2025). As SMEs adopt these capabilities, they move beyond basic data collection towards advanced data interpretation and predictive modeling, which can provide significant performance gains in areas such as customer engagement, supply chain optimization, and market forecasting.

Collectively, these three thematic clusters—AI integration in processes, digital transformation and innovation, and data-driven decision support—illustrate the multidimensional nature of AI's role in SME development. They also reflect an ongoing evolution in academic inquiry, shifting from foundational technology adoption studies toward more complex investigations into how AI enables strategic, operational, and analytic capabilities in small and medium-sized firms across Asia.

These clusters suggest a growing maturity in the research landscape, transitioning from basic exploration of adoption challenges to nuanced inquiries into AI's strategic, organizational, and societal implications. This evolution aligns with global bibliometric findings that track the sophistication of AI discourse in business literature (Dissanayake et al., 2024).

4.4. Research Clusters and Themes

The thematic evolution of AI-related literature in the context of SMEs in Asia reveals four major research clusters that chart the intellectual trajectory of the field over time. The first cluster focuses on **Adoption Barriers and Enablers**, which dominated early scholarly attention. These studies highlight the structural challenges that SMEs face, such as limited infrastructure, high implementation costs, and insufficient digital literacy among employees and managers. This foundational body of work is crucial for understanding the readiness gaps that impede AI adoption in small firms, especially in developing Asian economies (Vu, 2024; Li et al., 2017). Such insights provide a baseline for policymakers and practitioners to develop targeted interventions that support digital inclusion.

The second cluster pertains to the **Strategic Deployment of AI**, which has gained prominence in more recent literature. Here, research has moved beyond basic adoption toward examining how AI can be leveraged as a strategic asset. Scholars have analyzed how AI contributes to competitive advantage by improving supply chain responsiveness, enabling predictive maintenance, and enhancing customer analytics. This cluster reflects a broader shift in perspective—from AI as a mere operational tool to a transformative force capable of reshaping business strategy and industry dynamics (Dissanayake et al., 2024; Bharadwaj et al., 2013).

A third important thematic cluster centers on **Digital Entrepreneurship and Business Model Innovation**. Studies in this area explore how AI technologies are empowering entrepreneurs to create novel value propositions, enter underserved markets, and design adaptive business models that suit dynamic digital environments. This is particularly relevant for SMEs operating in resource-constrained settings, where AI-driven automation and analytics can offset labor shortages and support agile scaling (Papadopoulos et al., 2020; Vial, 2019). The convergence of AI with entrepreneurship signals a deeper integration of technological capabilities into the core fabric of SME innovation.

The fourth and most recent thematic cluster addresses **Ethics, Trust, and Sustainability** in AI deployment. With the increasing maturity of AI research, scholars have begun to interrogate broader concerns surrounding the responsible use of AI. Key issues include algorithmic bias, transparency, data privacy, and the long-term sustainability of AI-powered systems. Establishing trust in AI systems is now viewed as a prerequisite for widespread adoption, especially in customer-facing applications where ethical lapses can severely damage brand reputation (Siau & Wang, 2018; Ziky et al., 2025). This cluster reflects an evolving research agenda that seeks to balance innovation with social responsibility and long-term value creation.

Together, these four thematic clusters—ranging from initial adoption barriers to advanced considerations of strategy, entrepreneurship, and ethics—offer a comprehensive overview of the current research landscape. They illustrate a progression from reactive studies addressing constraints to proactive explorations of AI's transformative potential and its alignment with sustainable development goals for SMEs in Asia. This thematic progression signals a broader research maturity, echoing the transition from operational to strategic and ethical concerns in AI deployment.

4.5. Policy and Technology Trends

Policy environments across Asia have progressively adapted to support the integration of Artificial Intelligence (AI) within Small and Medium-sized Enterprises (SMEs), acknowledging AI's transformative potential for productivity enhancement, innovation stimulation, and economic resilience. In China, national initiatives such as those under the National Natural Science Foundation have provided extensive funding for AI-focused research, fostering a robust academic-industry ecosystem. India, under its Digital India initiative, has adopted a strategic AI roadmap that emphasizes support for SMEs through innovation hubs, incubation centers, and public-private partnerships. Similarly, Malaysia's Industry4WRD policy represents a targeted governmental effort to accelerate digital transformation in the SME sector by offering financial grants and expert advisory services (Asian Development Bank, 2021). These national strategies exemplify how state-led initiatives can serve as foundational pillars for the diffusion of AI technologies across the business landscape, particularly among resource-constrained enterprises.

These policy measures are increasingly complemented by rapid technological advancements, particularly the convergence of AI with other digital technologies such as blockchain, the Internet of Things (IoT), and cloud computing. This fusion is enabling the creation of integrated platforms that support automation, real-time data analytics, and intelligent decision-making in SMEs. Moreover, the rise of AI-as-a-Service (AIaaS) models is significantly lowering barriers to entry by offering scalable, cloud-based AI tools that eliminate the need for large capital expenditures and specialized technical expertise. This democratization of AI access is particularly impactful in developing economies, where SMEs often face structural limitations. The growing availability of user-friendly analytics platforms is empowering even micro-enterprises to leverage AI for strategic decision-making and operational efficiency. These trends reflect findings by Dissanayake et al. (2024) and Nambisan et al. (2019), who emphasize the critical importance of aligning national policy frameworks with enabling technological infrastructures. Ensuring such alignment is essential not only for inclusive AI adoption but also for fostering innovation-driven growth across Asia's diverse SME ecosystems.

5. Implications

The findings of this bibliometric study carry significant implications for Small and Medium-sized Enterprises (SMEs) across Asia. The most prominent trends—AI integration in business processes, data-driven decision-making, and digital transformation—demonstrate that adopting AI is no longer optional but essential for SMEs striving for competitiveness and sustainability in a digital economy. The rise of AI-as-a-Service (AIaaS), cloud-based analytics, and automation platforms reduces the dependency on in-house technical expertise, making AI more accessible to SMEs with limited resources (Dissanayake et al., 2024). Moreover, thematic clusters identified in the literature reveal a growing interest in strategic deployment and business model innovation, underscoring the need for SMEs to develop internal capabilities that support not just adoption but long-term integration of AI (Papadopoulos et al., 2020). For SMEs, these findings suggest a strategic imperative: embracing AI technologies aligned with their operational contexts and leveraging external support networks to overcome traditional barriers such as cost, digital literacy, and infrastructure constraints.

For policymakers, the study emphasizes the critical role of policy environments in facilitating inclusive AI adoption among SMEs. Countries that demonstrate leadership in AI research and SME support—such as China, India, and Malaysia—combine targeted financial incentives, infrastructure development, and institutional collaboration to foster AI readiness. Policies like Malaysia's Industry4WRD and India's Digital India initiative serve as effective models that integrate funding mechanisms, training programs, and innovation hubs tailored for SMEs (Asian Development Bank, 2021). Policymakers must therefore focus on creating enabling ecosystems that

bridge the technological readiness gap and promote equitable AI adoption across urban and rural enterprises. Moreover, future policies should incorporate support for ethical AI, data privacy, and cybersecurity, which are increasingly important in light of emerging concerns around trust and responsible innovation (Siau & Wang, 2018).

From a research standpoint, the bibliometric analysis uncovers several underexplored areas warranting further scholarly attention. While substantial work has been done on AI implementation and performance impact, gaps remain in understanding longitudinal effects, cross-sector variations, and the socio-cultural dimensions of AI adoption in SMEs. Research clusters have only recently begun to explore themes such as ethics, trust, and sustainability, signaling the need for deeper inquiry into responsible AI practices and their implications for SME stakeholders (Ziky et al., 2025). Furthermore, the literature shows limited empirical evidence from developing Asian economies beyond China and India, pointing to a geographic imbalance that future studies should address. Interdisciplinary research bridging information systems, business strategy, and public policy could offer more holistic insights into how AI can drive inclusive and sustainable SME development across diverse Asian contexts.

6. Conclusion

This bibliometric analysis provides a comprehensive overview of the evolving scholarly landscape at the intersection of Artificial Intelligence (AI) and Small and Medium-sized Enterprises (SMEs) in Asia. The study identifies a marked acceleration in AI-related SME research over the past decade, particularly after 2015, reflecting a growing recognition of AI's transformative potential in driving digital transformation, innovation, and competitiveness among SMEs. The analysis reveals that China, India, and several Southeast Asian nations are leading contributors, supported by strong institutional ecosystems and national policy frameworks. Co-occurrence and clustering of keywords highlight three dominant thematic areas: AI integration into business operations, digital transformation and innovation, and data-driven decision-making. Furthermore, the evolution of research themes—from foundational studies on adoption barriers to advanced explorations of strategic deployment and ethical considerations—demonstrates a maturing research agenda.

Looking forward, several directions emerge for the future of AI and SMEs in Asia. First, for SMEs to fully leverage AI's potential, there must be a concerted effort to address structural challenges such as digital infrastructure, affordability, and human capital. The increasing availability of AI-as-a-Service and cloud-based tools offers a promising pathway for overcoming these constraints. Second, national policies should focus not only on technological adoption but also on promoting responsible and inclusive AI practices, particularly in resource-constrained and rural SME contexts. Finally, future research should aim to fill existing gaps by examining longitudinal impacts of AI on SME performance, exploring cross-sectoral differences, and expanding empirical coverage beyond dominant economies such as China and India. By aligning technological innovation with supportive policies and inclusive research agendas, Asia's SMEs can be empowered to thrive in the AI-driven digital future.

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