Artificial Intelligence in SMEs: Enhancing Business Functions Through Technologies and Applications

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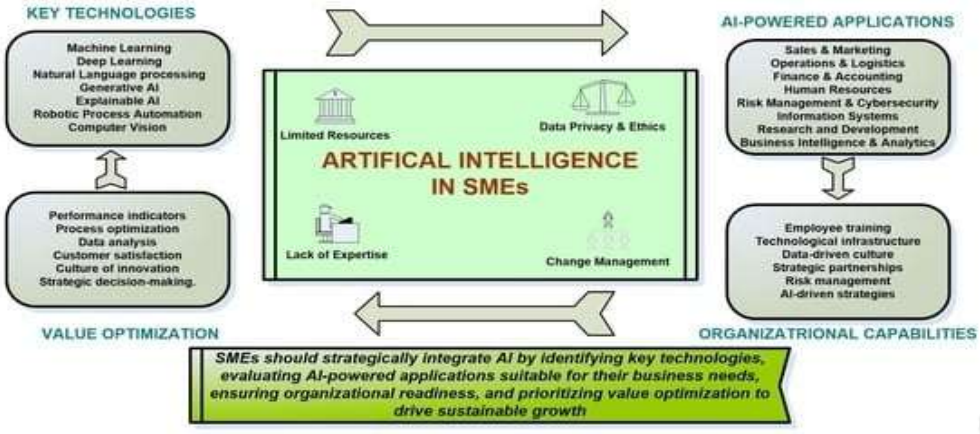
ABSTRACT

Artificial intelligence (AI) has significant potential to transform small- and medium-sized enterprises (SMEs), yet its adoption is often hindered by challenges such as limited financial and human resources. This study addresses this issue by investigating the core AI technologies adopted by SMEs, their broad range of applications across business functions, and the strategies required for successful implementation. Through a systematic literature review of 50 studies published between 2016 and 2025, we identify prominent AI technologies, including machine learning, natural language processing, and generative AI, and their applications in enhancing efficiency, decision-making, and innovation across sales and marketing, operations and logistics, finance and other business functions. The findings emphasize the importance of workforce training, robust technological infrastructure, data-driven cultures, and strategic partnerships for SMEs. Furthermore, the review highlights methods for measuring and optimizing AI's value, such as tracking key performance indicators and improving customer satisfaction. While acknowledging challenges like financial constraints and ethical considerations, this research provides practical guidance for SMEs to effectively leverage AI for sustainable growth and provides a foundation for future studies to explore customized AI strategies for diverse SME contexts.

Keywords: Artificial Intelligence; **SME**; **AI-powered technologies**

INTRODUCTION:



In recent years, artificial intelligence (AI) has emerged as a key driver in reshaping the landscape of business operations across a wide range of sectors [1]. Unlike their larger counterparts, small- and medium-sized enterprises (SMEs) often operate with limited financial and human resources, technical skill shortages, organizational resistance to change, and concerns related to data integration, security, and privacy [2], which makes the strategic adoption of AI both a significant opportunity and a formidable challenge [3], shaping how SMEs adopt and utilize AI in distinct ways. These constraints uniquely shape their AI usage. In general, AI technologies have the potential to greatly improve

operational efficiency, product development, customer engagement, and competitive advantage for SMEs [2]. In contrast to larger enterprises that may invest in long-term, large-scale AI initiatives, SMEs often prioritize solutions that offer rapid returns on investment and are easier to implement.

This paper aims to explore the core AI technologies driving adoption among SMEs and examine their diverse applications that contribute to enhanced productivity, improved decision-making, and innovation. Beyond identifying these technologies and applications, the study also focuses on how SMEs can develop the necessary organizational capabilities and infrastructure to successfully overcome the challenges associated with AI adoption. By addressing critical barriers such as limited expertise, financial constraints, and organizational resistance, this research seeks to provide practical strategies that empower SMEs to effectively integrate AI into their operations. Furthermore, the paper investigates methods for measuring and optimizing the value generated by AI adoption, offering insights into how SMEs can maximize their return on investment and continuously refine their AI strategies for sustained growth and competitive advantage.

The subsequent sections of this paper are organized as follows: First, the paper continues with the methodology to clearly and systematically describe how the research was conducted. Thus, the paper provides an overview of the core AI technologies pertinent to SMEs and the various business applications of AI that are currently transforming SME operations. Following this, the paper discusses the organizational and infrastructural strategies SMEs can employ to address the challenges of AI implementation. The study then explores approaches for evaluating and optimizing the impact of AI across business functions. Finally, the paper concludes by highlighting its originality and contributions, presenting its research limitations, and suggesting future directions.

METHODOLOGY

This study conducts a systematic literature review (SLR) following the foundational guidelines proposed by, aiming to evaluate the adoption of artificial intelligence in SMEs

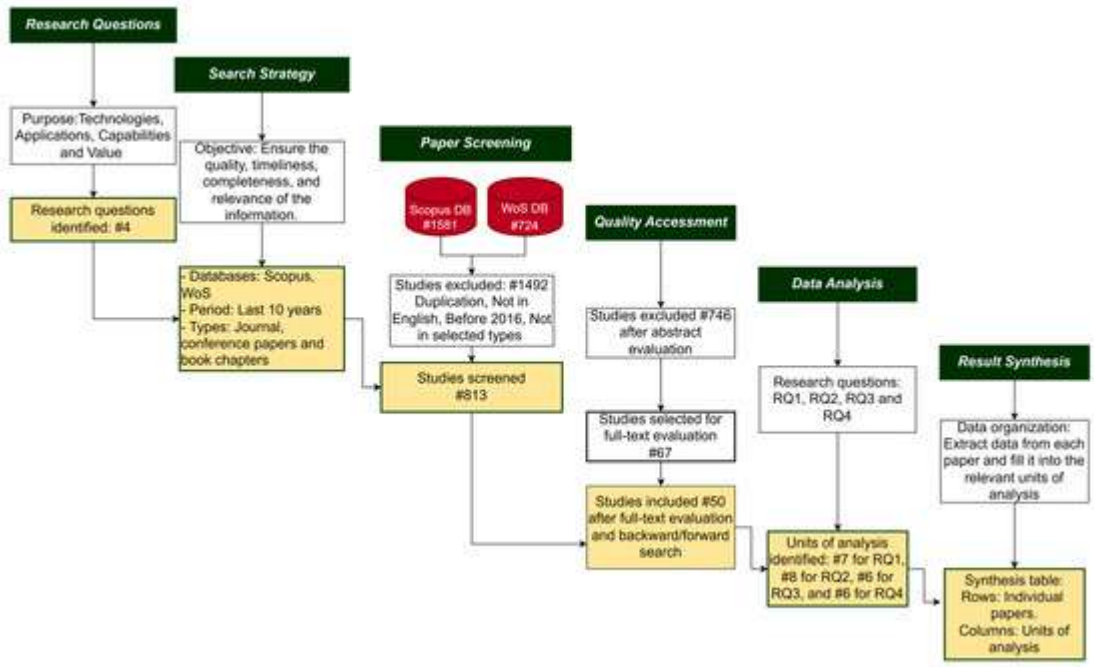


Figure 1. The SLR process.

The review specifically investigates key AI technologies, their applications, organizational capabilities required for successful implementation, and methods for optimizing the value derived from AI adoption. A detailed overview of the SLR process is provided in **Figure 1**, while the PRISMA flow diagram is included in **Appendix A**.

Defining the Research Questions (RQs)

The research questions guiding this study were developed through an iterative process of initial scoping and refinement, grounded in the principles of Service Science, Management, and Engineering (SSME). SSME represents the interdisciplinary application of scientific, managerial, and engineering approaches to the design and implementation of complex service systems [5]. Our inquiry began with a broad interest in how SMEs adopt AI. An initial review of the literature, focused on technology adoption and its role across various business functions, helped shape the early formulation of research questions. These preliminary questions were then refined through iterative literature searches and thematic analysis based on the perspective of service science, ensuring alignment with key scholarly discussions and the identification of underexplored areas.

The finalized research questions are as follows:

- RQ1 (Technologies): What are the most effective AI technologies currently adopted by SMEs?
- RQ2 (Applications): How do SMEs apply AI to enhance specific business functions?
- RQ3 (Capabilities): What organizational capabilities and infrastructure do SMEs need to overcome challenges in AI adoption?
- RQ4 (Value): How do SMEs measure and optimize the value generated from AI adoption?

RQ1 and RQ2 address core technological and functional aspects of AI adoption in SMEs. RQ1 aligns with the engineering component of SSME, focusing on the technologies themselves, while RQ2 draws on the science component, examining how these technologies are operationalized across various business activities. RQ3 and RQ4 correspond to the management component of SSME, exploring the strategic and organizational elements essential to successful AI implementation. These questions respond to a recognized gap in the literature concerning how SMEs can build the internal capacity to support AI adoption and evaluate its return on investment. Together, these four research questions provide a comprehensive and structured framework for understanding the adoption of AI in SMEs, thereby providing practical insights for both academic researchers and industry practitioners.

Developing the Search Strategy

In this step, specific criteria and tools were established to systematically identify relevant publications:

- Databases: Scopus and Web of Science (WoS) were chosen because they are comprehensive, multidisciplinary, and reputable databases containing high-quality academic literature.
- Search Expression and Keywords: A carefully constructed search expression was created using specific keywords related to SMEs and AI, including their synonyms and subfields (e.g., “small and medium enterprises”, “SMEs”, “AI”, “machine learning”, “deep learning”, “data analytics”). These keywords were combined logically using Boolean operators (“AND”, “OR”) to precisely locate relevant literature.
- Search Limitations: The search was limited to:
- Document types: journal articles, conference papers, and book chapters.
- Language: English.
- Timeframe: Publications between 2016 and 2025, capturing the period of rapid advancements in AI adoption by SMEs.

Identifying and Screening Papers

This step involved identifying and screening relevant literature from the chosen databases:

- Identification: Initially, 2305 papers were identified (1581 from Scopus, 724 from Web of Science—WoS). These papers were exported into reference management software (EndNote 21) for easier handling.
- Removing Duplicates and Screening: Duplicates were removed, and papers were screened based on inclusion criteria:

- Relevance to SMEs.
- Relevance to AI adoption and applications.
- Publication date range (2016–2025).
- Language and document type criteria.

After applying these criteria, 813 papers remained for further quality assessment.

Conducting the Quality Assessment

This step involved rigorously assessing the quality and relevance of the remaining papers:

- Title and Abstract Evaluation: The titles and abstracts of the remaining 813 papers were carefully reviewed. In the first screening step, 416 papers were excluded for not directly addressing the research objectives. This left 397 papers for further relevance assessment. Following our search protocol, all three authors independently evaluated the remaining articles in EndNote, assigning relevance scores on a scale from 1 (low) to 5 (high), based on how well each paper aligned with the research objectives. Papers that received low scores (1–2) from at least two reviewers were excluded due to limited thematic alignment, methodological shortcomings, or insufficient focus on specific business functions. Ultimately, 67 highly relevant and methodologically robust studies were selected for full-text quality assessment, while 330 were excluded at this stage.
- Full-text Evaluation: The remaining 67 papers underwent a comprehensive full-text assessment aligned with the research questions. Reviewers independently evaluated each study, and their results were then compared. In cases of disagreement, the reviewers engaged in structured discussions to clarify interpretations and refine the application of inclusion criteria. Discrepancies were resolved through the joint re-examination of the relevant papers, with both reviewers revisiting the specific criteria in question and collaboratively reaching a consensus.
- Final Selection: After this comprehensive evaluation, the 50 most relevant and representative papers were selected for inclusion in the systematic literature review.

Extracting and Analyzing Data

The SLR process resulted in the selection of 50 relevant articles. While all 50 articles contributed to providing a comprehensive understanding of AI in SMEs, 27 of these articles provided the primary data and evidence for answering the four research questions (RQ1-4). The remaining 23 articles served to provide context, justify the methodology, or support the discussion of findings. For instance, some articles were used to establish the background and significance of the research problem, while others informed the development of the search strategy and inclusion/exclusion criteria. Although the 23 articles might have allowed for the formulation of additional research questions, the current study focused on the four core RQs to maintain a clear and manageable scope. The selected 50 papers were systematically analyzed to identify the relevant units of analysis and to synthesize insights related to the four research questions based on these units of analysis. The elements within each research question were defined based on a thematic analysis of the reviewed literature. For example, the AI technologies identified in RQ1 (Machine Learning, Deep Learning, NLP, etc.) represent the technologies most frequently discussed in the context of AI adoption by SMEs. While pre-existing classifications of AI techniques and business functions informed our analysis, the specific elements included were determined by their prevalence and relevance within the 50 reviewed articles. For instance, Machine Learning was commonly discussed in relation to credit scoring and sales forecasting, and NLP was frequently applied to customer service and chatbot development.

It is important to note that some potentially relevant aspects were not as prominent in the reviewed literature. For example, while the role of the Chief Executive Officer (CEO) in digital transformation and the challenges of workforce expertise are crucial for AI adoption in SMEs, these themes were not extensively addressed in the selected articles. Similarly, while predictive maintenance is a significant AI application, it was less frequently discussed than other applications within operations and logistics, such as inventory optimization. These underrepresented areas represent important avenues for future research.

- AI Technologies: Machine Learning (ML), Deep Learning (DL), Natural Language processing (NLP), Generative AI (GenAI), Explainable AI (XAI), Robotic Process Automation (RPA), and Computer Vision (CV) [6].
- AI-Powered Business Applications: Sales and Marketing (SM), Operations and Logistics (OL), Finance and Accounting (FA), Human Resources (HR), Risk Management and Cybersecurity (RC), Information Systems (IS), Research and Development (RD), Business Intelligence and Analytics (BIA) [7].
- Organizational Capabilities: Employee training, technological infrastructure, data-driven culture, strategic partnerships, risk management, and AI-driven strategies.
- Value Optimization: Methods for measuring AI's impact, such as performance indicators, process optimization, customer satisfaction, culture of innovation, and strategic decision-making.

Summarizing and Reporting Results

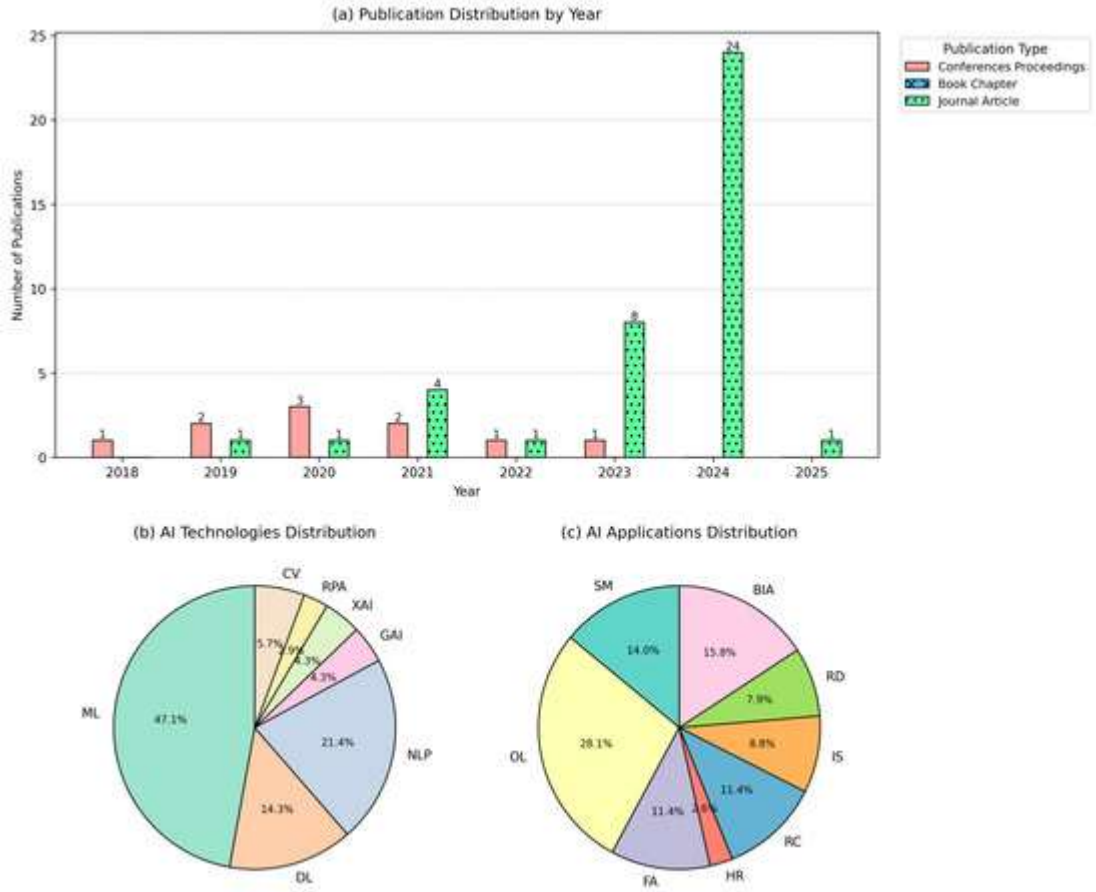
The insights gained from analyzing these papers were summarized, structured, and clearly presented to address each research question. **Table 1** presents the summary of selected papers related to AI technologies and AI-powered business applications in SMEs.

Table 1. List of papers included in the literature review.

presents the distribution of AI technologies and their applications in SMEs, addressing RQ1 and RQ2. This format effectively illustrates the relationships between specific AI technologies and the business functions they serve. RQ3 and RQ4, which explore organizational capabilities and value optimization, are addressed in detail in **Section 3.3** and **Section 3.4**, respectively, as their findings are more effectively presented using descriptive text to capture the nuances of these strategic elements.

Research Findings

As presented in **Figure 2**, the distribution of the publication dates spans from 2018 to 2025. The topic has gained increasing momentum from 2023 to 2024 (33 papers). The analysis of AI technologies and their applications in SMEs reveals significant trends and insights. Concerning AI technologies, Machine Learning and NLP received the most attention, with 33 and 15 papers, respectively, indicating their widespread use in business contexts. In terms of business applications, Operations and Logistics, and Business Intelligence and Analytics garnered the highest response counts, with 32 and 18 papers, respectively, suggesting strong interest in how AI enhances these areas



AI Technologies in SMEs (RQ1)

This subsection identifies key AI technologies adopted by SMEs, including Machine Learning (SMEs are leveraging ML to enhance operations and support data-driven decision-making. *Supervised Learning* techniques like Support Vector Machines and Random Forests are used for credit scoring and financial risk prediction. *Ensemble Learning* methods such as XG Boost and Light Gradient Boosting Machine enhance sales forecasting and market predictions to support inventory management, neighborhood rough sets-based approach for SME creditworthiness assessment using big data to generate interval number rules for addressing complexities and equifinality, In general, these ML techniques enable SMEs to mitigate risks and improve business processes more effectively)

Deep Learning: DL uses multilayered neural networks to analyze and learn from large amounts of data, enabling systems to recognize patterns and make decisions with minimal human intervention. DL can empower SMEs by enhancing various business operations through advanced data analysis and automation.

NLP: NLP enables computers to understand, interpret, and respond to human language in a meaningful way. In SMEs, advanced chatbots provide 24/7 customer support, understand the user intent, and manage complex supply chains

Generative AI: Gen AI refers to AI systems designed to create content by learning patterns from large datasets. Gen AI is revolutionizing SMEs by enhancing services like marketing, customer support, and report generation through LLMs

Explainable AI: XAI refers to AI systems designed to make their decision-making processes transparent and understandable to humans and empowers SMEs by enhancing transparency and trust in AI systems

Robotic Process Automation: RPA is a technology that uses software robots to automate repetitive and structured business tasks, mimicking human actions to enhance efficiency and reduce costs. RPA empowers SMEs by automating routine tasks such as data extraction, data entry, and system logging with software robots, effectively acting as virtual assistant

Computer Vision: CV, which enables computers to interpret and understand visual information from images and videos, enhances SMEs by automating tasks such as defect detection, quality control, inventory management, and

process optimization. Affordable and portable CV systems use cameras and advanced software to help businesses maintain high standards and efficiently manage their inventory

These technologies enable SMEs to automate processes, optimize decision-making, enhance customer interactions, and drive innovation, thus improving their overall competitiveness and efficiency.

CONCLUSIONS

This paper presents a comprehensive systematic literature review on the adoption and application of artificial intelligence (AI) in small- and medium-sized enterprises (SMEs), focusing on key technologies, business applications, organizational capabilities and infrastructure, and value optimization. By examining 50 representative studies, the research highlights how AI-driven technologies are transforming multiple business functions across the SME landscape. The primary contribution of this paper lies in its broad and up-to-date coverage of recent AI advancements and their practical implications for SMEs, offering a relevant and timely perspective that advances prior research in this domain.

Our review highlights the increasing adoption of machine learning and natural language processing (NLP) within SMEs, particularly in the domains of operations and logistics and business intelligence and analytics. This aligns with previous research that emphasizes the potential of these technologies to automate processes and improve decision-making. However, our analysis also reveals a persistent challenge for SMEs: the limited availability of high-quality data required for effective machine learning implementation—an issue that is notably less significant in larger enterprises. This finding underscores the importance of developing tailored solutions to address data scarcity, such as collaborative data-sharing initiatives or the application of synthetic data generation techniques.

Concerning the originality, this review distinguishes itself from existing literature such as through its extensive coverage of recent AI advancements and their specific applications in SMEs to ensure both completeness and relevance. The systematic categorization of AI technologies and their business functions provides a clear, structured framework that makes the findings accessible to both technical and non-technical stakeholders across disciplines. The incorporation of the latest studies ensures that the insights are up to date to provide a fresh perspective compared to earlier reviews. By bridging the gap between AI theory and practical implementation in SMEs, this paper stands out in its originality and utility for both academic and practitioner audiences.

The primary contribution of this study lies in its thorough classification and synthesis of AI technologies and their specific applications across different business domains in the context of SMEs. It provides valuable insights into how AI enhances business functions, and applications at the enterprise level. Additionally, this paper examines the key challenges SMEs encounter in adopting AI and presents strategic approaches to develop the necessary organizational capabilities and infrastructure to address these obstacles effectively. By offering insights into methods for measuring and optimizing the value derived from AI implementation, the study provides SMEs with practical guidance to enhance operational efficiency and achieve long-term growth.

For researchers, this study highlights the multifaceted role of AI in enhancing SME competitiveness and operational efficiency to suggest numerous avenues for future investigations into specialized AI applications and the development of tailored AI frameworks for SMEs. It underscores the need for empirical studies that validate the proposed strategies and explore AI integration across diverse industries. Practitioners and SME leaders can utilize the findings to inform strategic decision-making, prioritize AI investments, and implement best practices for AI integration. The identification of key challenges and proposed solutions serves as a practical guide for SMEs aiming to harness AI's potential while mitigating associated risks.

Despite its comprehensive approach, this study is constrained by its reliance on published literature up to 2025, which may exclude the most recent developments and real-time advancements in AI technologies. Furthermore, the focus on specific business functions may limit the generalizability of the findings across other industries.

While this review aimed to be comprehensive, it is possible that some relevant industry-specific or regionally focused studies may have been overlooked, particularly given the global diversity of SME operations. Future research should aim to broaden the scope to include a wider range of sectors to validate the proposed strategies. Moreover, exploring the long-term impacts of AI adoption on SME sustainability and growth would provide deeper insights. In addition, the particularities of AI adoption on SME can be analyzed through the lens of other studies, such as the Technology–Organization–Environment framework, Diffusion of Innovation theory, or User Acceptance Model. Moreover, integrating knowledge management with AI empowers SMEs to utilize domain expertise and customer intelligence to enable tailored solutions, personalized experiences, improved customer satisfaction, and fostering innovation, adaptability, and sustainable growth for long-term success. Finally, studying smart systems and services is crucial for applying AI effectively in SMEs to bridge the gap between cutting-edge technology and practical solutions tailored to smaller organizations.

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