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Challenges and opportunities in AI and digital transformation for SMEs: A cross-continental perspective

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Abstract

This study examines the impact of AI and digital transformation on Small and Medium-sized Enterprises (SMEs) across continents. As AI and digital technologies increasingly reshape global business landscapes, SMEs face unique challenges and opportunities distinct from those of larger corporations. This research systematically reviews existing literature, guided by the PRISMA framework, to identify the barriers and enablers of AI adoption in SMEs across these diverse regions.

The study identifies key challenges, including limited financial resources, lack of skilled personnel, data security concerns, and organizational resistance to change. These barriers vary across continents; for instance, African SMEs often struggle with the high costs of AI implementation and lack of resources and expertise, while European SMEs face stringent regulatory challenges and a lack of infrastructure and finances. In contrast, Asian SMEs, particularly in developing countries, grapple with sustainability and sustainable regulatory and cultural barriers. However, it's important to note that the potential of AI to enhance operations and customer engagement is a universally recognized benefit. Europe emphasizes risk management and automation, while Africa and Asia highlight cost reduction, market expansion, and scalability, reflecting their unique regional priorities and challenges.

The study concludes that while AI adoption presents considerable growth potential for SMEs globally, the path to realizing these opportunities is shaped by regional contexts. The research underscores the need for tailored policy interventions, capacity-building initiatives, and cross-border collaborations to support SMEs in overcoming these barriers and fully leveraging AI technologies. This work contributes to understanding digital transformation in SMEs, providing practical insights for policymakers, industry leaders, and academics interested in the intersection of AI and business strategy across different continents.

Keywords: Artificial Intelligence; Digital Transformation; Digital Technologies; Technology Innovation; Small Medium Enterprises

1. Introduction

The rapid advancement of Artificial Intelligence (AI) and digital transformation has sparked a global revolution, fundamentally reshaping how businesses operate, compete, and grow (Kraus et al., 2021). While large corporations

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often possess the resources to adapt to these technological changes swiftly, Small and Medium-sized Enterprises (SMEs) encounter a distinct set of challenges and opportunities in their quest to leverage these innovations (Costa et al., 2023). SMEs, which constitute the backbone of many economies, are often more resource-constrained and face unique barriers to adopting AI and digital technologies (Idrawati et al., 2020). Nevertheless, the potential for these enterprises to harness AI and digital transformation is immense, offering avenues for enhanced competitiveness, efficiency, and growth (Kraus et al., 2021).

This study, titled 'Challenges and Opportunities in AI and Digital Transformation for SMEs: A Cross-Continental Perspective,' seeks to provide a comprehensive analysis of how AI and digital transformation are impacting SMEs across different continents. The focus is identifying the unique challenges and opportunities these enterprises encounter in various regions. To achieve this, the study will examine four key geographical regions: Europe, Asia, and Africa. These regions have been selected due to their diverse economic landscapes, varying levels of technological adoption, and distinct cultural contexts, all of which significantly influence the integration of AI and digital technologies within SMEs.

The research will address several critical questions, including:

- What are the primary challenges faced by SMEs in adopting AI and digital transformation across different continents?
- What opportunities do AI and digital transformation present for SMEs in these regions?
- What are the differences in the challenges and opportunities across continents?

By addressing these questions, the study aims to capture a broad spectrum of experiences and insights, reflecting both the global and local dynamics of AI and digital transformation. The ultimate objective is to provide actionable recommendations for SMEs, policymakers, and industry stakeholders, enabling them to navigate the complexities of digital transformation and fully realize the benefits of AI. Through this cross-continental analysis, the study will contribute to a deeper understanding of the global landscape of AI and digital transformation, offering a nuanced perspective on how SMEs can thrive in a rapidly evolving technological environment.

2. Overview of AI and Digital Transformation in SMEs

Artificial Intelligence (AI) and digital transformation have emerged as pivotal forces in modern business innovation, profoundly influencing how organizations operate, make decisions, and interact with customers (Oyekunle, 2024). Small and Medium-sized Enterprises (SMEs), which constitute the backbone of many economies worldwide, increasingly acknowledge these technologies' transformative potential. For SMEs, AI and digital transformation offer pathways to enhance competitiveness, improve efficiency, and unlock new growth opportunities (Radicic & Petković, 2023). However, the journey toward adopting these technologies is fraught with unique challenges and opportunities that differ significantly from those encountered by larger corporations.

2.1. Defining AI and Digital Transformation

AI refers to creating and implementing systems and algorithms capable of performing tasks that usually require human intelligence, such as learning, reasoning, problem-solving, and decision-making (Xu et al., 2021). AI can be harnessed in various ways to drive SMEs' business value. For example, AI can automate routine processes, allowing employees to focus on more strategic tasks (Nawaz & Shabir, 2024). It can analyze vast datasets to uncover insights that inform business decisions, helping SMEs make more informed and timely choices. Additionally, AI can personalize customer interactions by predicting preferences and behaviors, thereby enhancing customer satisfaction and loyalty (Christian et al., 2023). In supply chain management, AI can optimize operations by predicting demand, managing inventory, and reducing costs.

Digital transformation, meanwhile, involves the integration of digital technologies into every aspect of a business (Krauss et al., 2021). It is not merely about adopting new tools but encompasses a broader shift in organizational culture, processes, and business models (Omol, 2023). Digital transformation includes many technologies, such as cloud computing, the Internet of Things (IoT), big data analytics, and mobile platforms (Chan, 2024). For SMEs, digital transformation can mean adopting cloud-based solutions that allow for scalable and flexible operations, leveraging big data analytics to gain deeper insights into market trends, or using IoT to monitor and optimize production processes in real time (Tripathi, 2023).

2.2. The Role of AI and Digital Transformation in SMEs

The adoption of AI and digital transformation is becoming increasingly essential for SMEs to remain competitive and survive in an ever-evolving marketplace. These technologies provide SMEs with the tools to streamline operations, reduce costs, and enhance customer satisfaction (Okafor et al., 2023). For instance, AI-driven automation can help SMEs optimize workflows by minimizing the need to provide SMEs with the tools to streamline operations, allowing resources to be allocated to higher-value tasks. This can be particularly beneficial for SMEs with limited human resources, enabling them to achieve more with less.

Furthermore, AI empowers SMEs to make data-driven decisions by analyzing large volumes of data to extract actionable insights (Ochuba et al., 2024). Previously, such insights were often inaccessible to SMEs due to the high costs associated with data analysis. Now, AI makes it possible for even small businesses to harness the power of data, enabling them to better understand customer needs, anticipate market trends, and make informed strategic decisions (Nwachukwu & Affen, 2023).

Digital transformation, on the other hand, represents a broader organizational shift. It often requires SMEs to rethink traditional business models and adopt a more agile, customer-centric approach (Vial, 2019). For example, cloud computing enables SMEs to scale their operations efficiently without significant upfront investments in IT infrastructure (Mhlongo et al., 2024). This flexibility allows SMEs to respond quickly to market changes, expand their offerings, and reach new customer segments.

E-commerce platforms are another key aspect of digital transformation, enabling SMEs to access global markets. By leveraging online platforms, even the smallest businesses can compete globally, reaching customers far beyond their local markets (Purnomo, 2023). Digital marketing tools further enhance this capability by allowing SMEs to target and engage customers precisely, improving marketing campaigns' effectiveness and driving sales growth (Ijomah et al., 2024).

AI and digital transformation present numerous opportunities for SMEs globally, yet the journey is fraught with challenges. These challenges vary across continents and are shaped by regional differences in infrastructure, skills, regulatory environments, and cultural attitudes. Understanding these variations is essential for developing tailored strategies that maximize opportunities and effectively address region-specific obstacles.

3. Methodology

This study relies heavily on a systematic review of existing literature and secondary data, guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Extension. PRISMA ensures that the methodology is robust and replicable, enhancing the reliability and validity of the study's findings (Page et al., 2021).

3.1. Database Selection

The first step in the research process involves the selection of appropriate academic databases to source relevant literature. The key databases chosen for this study include Google Scholar, IEEE Xplore, Scopus, and JSTOR. These platforms are well-known for their extensive collections of scholarly articles, conference papers, and reports, providing access to high-quality, peer-reviewed research. The selection of these databases is crucial for capturing a comprehensive range of studies on AI and digital transformation in SMEs. Each database offers unique strengths; for instance, IEEE Xplore is particularly strong in engineering and technology-related content, while Scopus provides a broad overview of multidisciplinary research. Google Scholar, with its extensive coverage, ensures that even grey literature and less prominent publications are considered. JSTOR, emphasizing historical and theoretical perspectives, adds depth to the analysis.

3.2. Keyword Identification

A specific set of keywords is identified to ensure a focused and relevant literature search. These keywords include terms such as 'AI in SMEs,' 'Digital Transformation,' 'SMEs Challenges,' and 'Opportunities in Digital Transformation'; selecting these keywords is strategic and aimed at capturing a comprehensive range of studies related to the topic. The keywords cover technological aspects and focus on the geographical and contextual differences central to the study's cross-continental perspective. The keyword search is performed across all selected databases to identify studies aligning with the research objectives, ensuring the literature review is broad and deep.

3.3. Screening and Selection

The screening and selection process follows the PRISMA guidelines, ensuring a systematic and transparent approach (Page et al., 2021). Initially, search results are screened by reviewing titles and abstracts to exclude irrelevant studies. This step is crucial in narrowing down the vast number of potential studies to those most relevant to the research questions. Studies that pass this initial screening are then subjected to a full-text review to confirm their relevance and alignment with the research objectives. The inclusion criteria are limited to studies published within the last five years, in English, and directly relevant to the topic. This ensures the research reflects the most current developments in AI and digital transformation for SMEs, providing timely and applicable insights in a rapidly evolving field.

3.4. Data Extraction and Synthesis

Once the relevant studies have been identified, data is systematically extracted, focusing on key themes such as challenges, opportunities, and regional differences. The data extraction process is meticulous, ensuring that all relevant information is captured. The extracted data is then synthesized to comprehensively analyze the impact of AI and digital transformation on SMEs across different continents. This synthesis identifies patterns, trends, and gaps in the existing literature, contributing to a deeper understanding of the subject matter.

4. Results: Summary of selected Literature

Eight articles were reviewed, representing countries from Europe (Sweden, Finland, Germany), Africa (Nigeria and other Sub-Saharan African Countries), and Asia (Saudi Arabia, Malaysia). This indicates multiple continents across different regions. Among the studies, 37.5% used quantitative research methods, 37.5% employed literature reviews, and 25% utilized qualitative research methods. The articles were published between 2021 and 2024, indicating that latest publications were used.

Table 1 General Information on Selected Journals

Authors	Baeze & Igbekele, 2021	Moilanen & Laatikainen, 2023	Ochuba et al., 2024	Uwagaba, 2023	Badghish & Soomro, 2024	Lada et al., 2023	Okoye et al., 2023	Ulrich, 2021
Country	Sweden	Finland	Nigeria	Sub-Sahara African countries	Saudi Arabia	Malaysia	-	Germany
Continent	Europe	Europe	Africa	Africa	Asia	Asia	Africa	Europe
Research Method	Qualitative	Qualitative	Literature Review	Literature Review	Quantitative	Quantitative	Literature review	Quantitative
Data collection	Interview	Interview	-	-	Survey	Survey	-	Survey
Challenges	Lack of AI Strategies Lack of skilled employee Lack of accurate data Lack of technologi	Lack of Infrastructure Financial constraint Regulatory concerns Ethical issues	Resources constraint Limited Budget HR investment	Resources constraint Lack of expertise Lack of awareness	Issue of Sustainability Complexity Lack of organizational support	Financial Constraint Regulatory concern Lack of technical expertise	-	Lack of competence Data problems Lack of infrastructure Financial barrier

	cal infrastructure	Market dimension	Capability Quick turnover	Cultural barrier Regulation barrier		Data accessibility Cultural barrier		Lack of support from management Issue with regulation Cybersecurity
Opportunities	-	-	-	-		Enhances operation Scalability and growth Improve customer engagement	Cost reduction Enhance operation decision Improved customer engagement innovation and product development Market expansion		Improved risk management Automation of process Efficiency of process Accelerate process Saving of cost New product development

4.1. Thematic Categorization

Two themes were recognized in terms of the study research questions.

4.1.1. Theme 1: Challenges in AI adoption and Digital technologies by SMEs.

Several barriers were identified when it comes to the adoption of AI and digital technologies by SMEs across the continent. These can be further grouped into five subthemes:

Sub-theme 1: Strategic and Organizational Challenges

These include a lack of AI strategy, lack of skilled employees, HR investment capability, quick turnover, lack of awareness, and cultural barriers. Baez and Igbekele (2021) reported that a lack of AI strategy leads to misaligned investments. According to Uwagaba (2023), insufficiently skilled employees also limit the development and management of AI technologies in Africa, which is also reported in Sweden by Baez and Igbekele (2021). In addition, HR investment constraints reduce the ability to train or hire talent, exacerbating issues like high employee turnover, which disrupts continuity (Ochuba et al., 2024).

Additionally, a lack of awareness about AI's potential and cultural resistance to change create reluctance to adopt these technologies, preventing SMEs from fully leveraging AI and digital tools to enhance their competitiveness and efficiency (Uwagaba, 2023; Lada et al., 2023). Another organizational barrier is a lack of organizational support, which can be a barrier to the adoption of AI and digital technologies for SMEs (Badgish & Soomro, 2024; Ulrich, 2021).

Sub-theme 2: Technical and Infrastructural Barrier

As reported in the selected articles, technical and infrastructural barriers significantly impact AI adoption in SMEs. One major issue is the lack of accurate data (Baez & Igbekele, 2021). AI systems rely on high-quality data to make effective decisions, but incomplete or inaccurate data can hinder the generation of valuable insights. Additionally, many SMEs lack the necessary technical infrastructure, including hardware, software, and IT systems, needed to implement and scale AI technologies (Baez & Igbekele, 2021; Moilanen & Laatikaien, 2022; Ochuba et al., 2024). This absence of

infrastructure limits their ability to deploy AI solutions effectively. The complexity of AI technology also poses a challenge) Badghish & Soomro, 2024). The sophisticated nature of AI can be overwhelming for SMEs, particularly those without in-house technical expertise, making it difficult for them to understand and implement these technologies. Moreover, limited access to relevant data sources restricts SMEs' ability to train AI models, reducing the effectiveness and applicability of AI solutions for their specific needs (Lada et al., 2023).

Sub-theme 3: Financial and Market Constraints

Financial constraints and market dimensions significantly impact SMEs' adoption of AI and digital technologies. Limited financial resources can restrict SMEs' ability to invest in advanced technologies, which often require substantial upfront costs and ongoing maintenance expenses (Moilanen & Latikainen, 2023; Lada et al., 2023; Ochuba et al., 2024; Ulrich, 2021). This financial barrier can prevent SMEs from leveraging AI and digital tools that could enhance their operational efficiency and competitiveness. Market dimension also plays a crucial role. SMEs operating in smaller markets may experience reduced incentives to invest in AI and digital technologies due to lower potential returns on investment. (Moilanen & Laatikainen, 2023). In contrast, businesses in larger markets may have more opportunities to scale their technological investments and achieve greater economic benefits.

Subtheme 4: Regulatory Concern

Regulatory concerns can pose significant barriers to AI adoption for SMEs, as navigating complex and evolving regulations requires substantial resources (Moilanen & Laatikainen, 2023; Uwagaba, 2023; Ulrich, 2024). SMEs may lack the expertise or capacity to ensure compliance with data protection laws, industry standards, and AI-specific regulations, leading to potential legal risks that deter investment in AI technologies.

Ethical concerns are also crucial (Lada et al., 2023). The use of AI can raise questions about fairness, bias, and transparency, which SMEs may find challenging to address. Ethical lapses can harm a company's reputation and lead to customer distrust, making SMEs cautious about integrating AI into their operations.

Cybersecurity is another major barrier. AI systems can increase the attack surface for cyber threats, and SMEs often lack robust security infrastructure (Ulrich, 2024). The fear of data breaches, intellectual property theft, and other cyber risks can discourage SMEs from adopting AI, as they may not have the resources to mitigate these threats effectively.

Subtheme 5: Sustainability

Sustainability concerns can hinder AI adoption for SMEs due to the high energy consumption and resource use associated with AI systems, as Badgish and Somro (2024) reported in Saudi Arabia.
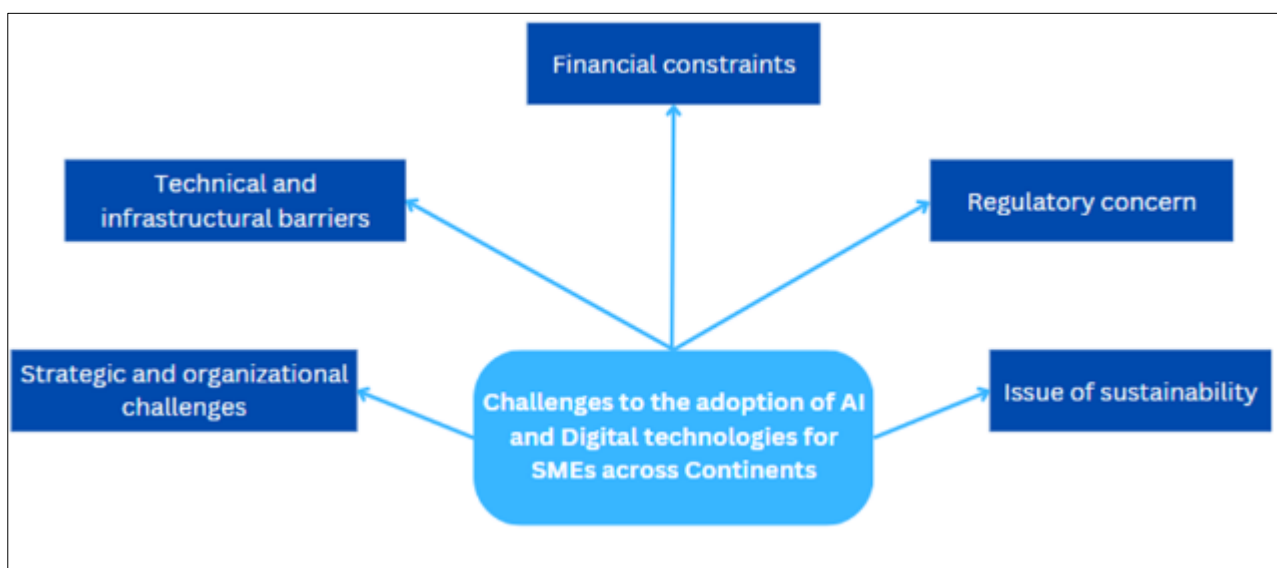

Figure 1 Summary of Theme 1

4.2. Theme 2: Opportunities for growth through digital transformation.

The various opportunities for AI and digital technologies adoption for SMEs can be grouped into three subthemes:

4.2.1. Subtheme 1: Efficiency in Operation

AI and digital technologies offer significant opportunities for enhancing operational efficiency in SMEs (Lada et al., 2023). Process automation is one of the most impactful benefits, allowing businesses to streamline repetitive tasks, reduce manual errors, and free up human resources for more strategic activities (Ulrich, 2021). This automation boosts productivity and reduces operational costs, making it a valuable asset for SMEs operating on tight budgets.

Effective risk management is another opportunity identified, leading to more efficient operations by identifying potential risks early, optimizing decision-making, and reducing the likelihood of costly disruptions or losses (Ulrich, 2021). Moreover, AI can accelerate processes by optimizing workflows and improving decision-making (Okoye et al., 2023). Advanced analytics and machine learning models can quickly analyze large volumes of data, providing insights that help businesses make informed decisions more rapidly. This acceleration of processes enables SMEs to respond more swiftly to market changes, customer needs, and competitive pressures, further enhancing their operational efficiency.

4.2.2. Subtheme 2: Scalability and Growth

AI and digital technologies also give SMEs the tools to scale and grow their operations. Scalability is a key advantage, as digital solutions can be easily expanded to accommodate business growth without significant additional investments, as reported by Lada et al. (2023) and Okoye et al. (2023). For instance, cloud-based AI platforms allow SMEs to scale their computing resources as their data and processing needs increase, ensuring they can handle larger volumes of business activity.

Additionally, AI facilitates new product development by enabling businesses to innovate and create customized solutions for their customers, as Okoye et al. (2023) highlighted. Machine learning algorithms can analyze customer behavior and preferences, guiding SMEs in developing products and services that better meet market demands. This capability drives growth and helps SMEs stay competitive in dynamic markets.

4.2.3. Subtheme 3: Improved Customer Engagement

AI and digital technologies significantly enhance customer engagement, as reported by Okoye et al. (2023) and Lada et al. (2023), offering SMEs the ability to create more personalized and responsive customer experiences. AI-powered tools can analyze customer data to understand individual preferences, allowing businesses to tailor their marketing and communication strategies accordingly.

Figure 2 Theme 2

4.3. Comparative analysis of SMEs across continents (Africa, Asia, and Europe).

4.3.1. Comparative Analysis of Challenges

In Africa, particularly Nigeria and sub-Saharan Africa, most of the challenges reported include resource constraints and the cost of adopting AI and digital technologies. Other challenges reported include a lack of expertise and awareness, regulatory barriers, and HR capability (Ochuba et al., 2024; Uwagaba, 2023). These challenges can be classified into financial, strategic, and organizational challenges and regulation concerns.

In Asia, Malaysia, and Saudi Arabia, in particular, sufficient resources were reported for Saudi Arabia, as well as the capacity to train experts and government capacity to support the adoption of AI and digital technologies for SMEs (Badghish & Soomro, 2024). Lada et al., 2023, reported financial constraints in Malaysia as a barrier. However, there was also an issue of sustainability and perception of complexity (Badghish & Soomro, 2024). Other constraints reported include regulatory concerns, data accessibility, and cultural barriers.

In Europe, barriers include a Lack of technology infrastructure, financial constraints, and regulatory concerns (Moilanen & Laatikainen, 2023). Other barriers reported include a lack of expertise, inaccurate data, and an AI strategy (Baez & Igbekele, 2021).

Comparing challenges across continents reveals notable patterns and differences. The main obstacles in Africa, particularly Nigeria and sub-Saharan Africa, include financial constraints, high costs of adopting AI, and a lack of expertise. These issues are compounded by regulatory barriers and insufficient HR capabilities, presenting significant financial, strategic, organizational, and regulatory challenges. In Asia, the situation varies by country. Saudi Arabia benefits from ample resources, effective government support, and the ability to train experts, easing the adoption of AI. However, Malaysia faces financial constraints and additional barriers related to sustainability and the perceived complexity of AI. Regulatory concerns, data accessibility, and cultural barriers also play a role.

In Europe, challenges include inadequate technology infrastructure, financial constraints, and regulatory concerns. Additionally, Europe struggles with a shortage of expertise, inaccurate data, and a lack of clear AI strategies. Financial and regulatory issues are generally common, and specific challenges like sustainability and resources vary by region.

4.3.2. Comparative analysis of opportunities

Comparing AI and digital technology adoption opportunities across continents reveals distinct regional focuses. In Africa, key opportunities include reduced costs, enhanced operational efficiency, improved customer engagement, market expansion, and innovation in product development. These benefits illustrate how AI can facilitate cost savings, drive market growth, and foster new innovations, supporting broader economic development within the region.

In Europe, the emphasis is on improved risk management, process automation, operational efficiency, process acceleration, cost savings, and new product development. AI's role here is to streamline operations, enhance risk management, and support growth through advanced automation and innovation, addressing specific challenges faced in a more mature technological landscape.

In Asia, improved customer engagement, scalability and growth, and operational efficiency are notable opportunities. AI is seen as a key enabler in enhancing customer interactions, facilitating business expansion, and optimizing operations, reflecting the region's focus on leveraging technology for growth and efficiency.

Overall, while AI's potential to enhance operations and customer engagement is recognized globally, Europe emphasizes risk management and automation. In contrast, Africa and Asia highlight cost reduction, market expansion, and scalability, reflecting their unique regional priorities and challenges.

5. Discussion and Implication

Based on the systematic review, the adoption of Artificial Intelligence (AI) and digital transformation within Small and Medium-sized Enterprises (SMEs) presents a complex landscape characterized by significant challenges and promising opportunities.

The literature consistently underscores the resource limitations faced by SMEs as a primary barrier to AI adoption. Financial constraints are particularly pronounced, as the cost of acquiring, implementing, and maintaining AI technologies is often prohibitive for smaller firms. This finding is supported by Bhalerao et al. (2022), where a lack of

resources was identified as a barrier to the adoption of AI by SMEs. This challenge is exacerbated by the lack of access to capital, which restricts the ability of SMEs to invest in the necessary infrastructure and expertise required for AI integration. Moreover, the gap in technical skills within SMEs is a recurrent theme in the literature, with many SMEs lacking the in-house capabilities to manage AI technologies effectively, also supported by Bhalerao et al. (2022). This often necessitates reliance on external consultants or third-party providers, which can introduce additional costs and operational risks.

Another critical challenge identified is the issue of data management. AI systems rely heavily on large volumes of high-quality data to function effectively, yet SMEs often struggle with data collection, storage, and analysis. The literature points to SMEs' difficulties in implementing robust data management strategies, particularly in ensuring data privacy and compliance with regulatory frameworks. This is supported by the findings of Almashawreh et al. (2024), where employee IT knowledge and training initiatives were emphasized to help in the adoption of AI by SMEs. In order to solve the issue of data management, there will be a need for knowledge improvement through training.

This challenge is compounded by the lack of awareness and understanding of AI among SME owners and managers, leading to resistance to change and a slow pace of adoption. Cultural resistance within organizations, driven by fears of job displacement and the perceived complexity of AI technologies, further hampers the integration of AI into business processes.

5.1. Opportunities in AI Adoption for SMEs

Despite these challenges, the literature also reveals significant opportunities for SMEs that successfully navigate the complexities of AI adoption. One of the most compelling benefits is the potential for enhanced operational efficiency. AI technologies can automate routine and repetitive tasks, reducing the time and resources required for these activities and allowing SMEs to allocate their human resources to more strategic functions. This can lead to substantial cost savings and increased productivity, providing a competitive edge in a rapidly evolving market. Roy and Srivastava (2024) support this finding.

The ability of AI to facilitate data-driven decision-making is another key opportunity for SMEs. By leveraging AI-driven analytics, SMEs can gain insights into customer behavior, market trends, and operational performance that were previously inaccessible due to cost or technological limitations, as supported by Ekechi et al. (2024). This capability can inform more effective business strategies, enabling SMEs to respond more agilely to market changes and customer needs. Furthermore, the personalization of customer interactions through AI can enhance customer satisfaction and loyalty, driving revenue growth and long-term business success.

The literature also highlights the role of AI in fostering innovation within SMEs. AI can help SMEs differentiate themselves from competitors and explore new market opportunities by enabling the development of new products, services, and business models. This is particularly relevant in regions where digital transformation is rapidly advancing, such as Asia and North America. SMEs that adopt AI early can position themselves as leaders in their respective industries.

5.2. Regional and Sectoral Variations

The literature review also indicates that the challenges and opportunities associated with AI adoption vary significantly across different geographical regions and industry sectors. In developed regions such as North America and Europe, where technological infrastructure and access to capital are relatively advanced, SMEs are more likely to adopt AI and realize its benefits. In contrast, SMEs in developing regions such as Africa and parts of Asia face more pronounced barriers, including weaker digital infrastructure, lower levels of technical expertise, and more significant financial constraints.

Industry-specific factors also play a crucial role in determining the success of AI adoption. For example, SMEs in technology-intensive sectors, such as manufacturing and finance, are more likely to adopt AI technologies than those in traditional retail or agriculture sectors. This is often due to the higher perceived value of AI in optimizing complex processes and improving operational efficiency in these industries.

6. Conclusion

In conclusion, the literature review underscores the dual nature of AI adoption in SMEs, where equally compelling opportunities balance significant challenges. While resource limitations, technical skill gaps, and cultural resistance pose considerable barriers, the potential for operational efficiency, data-driven decision-making, and innovation offers

SMEs a pathway to enhanced competitiveness and growth. The success of AI adoption in SMEs will largely depend on their ability to navigate these challenges, leverage the available opportunities, and adapt to the specific regional and sectoral contexts in which they operate.

Recommendations

The study recommends developing region-specific capacity-building programs to enhance AI literacy and technical skills among SME employees, tailored to the unique needs of Africa, Europe, and Asia. Additionally, it suggests establishing flexible financial support mechanisms, such as grants and low-interest loans, to help SMEs overcome cost barriers to AI adoption. Lastly, fostering cross-continental collaborations is advised to enable SMEs from different regions to share best practices, navigate regulatory differences, and address common challenges, ultimately driving more effective AI integration across the globe.

Compliance with ethical standards

Disclosure of Conflict of interest

No conflicts of interest/competing interests in the publication of the manuscript or an institution or regarding product are mentioned in the manuscript.

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