

Creating an Artificial Intelligence (AI) Readiness Model to assist South African SMME's to Adopt AI effectively

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Abstract

The adoption of Artificial Intelligence (AI) among Small Medium and Micro Enterprises (SMME's) has gained significant momentum across various industries. South African SMME's plays a pivotal role in job creation, contributing significantly to the country's GDP, and they are a driving force behind innovation and entrepreneurship. While Artificial Intelligence (AI) is changing the landscape, altering business practices and models. South African SMME's are struggling to keep up with the evolving landscape. Scholarly work points out that there's fragmented and inconsistent understanding of AI Adoption among SMME's and large enterprises. These SMMEs continue to face challenges in the Adoption of AI due to some contributing factors such as inadequate infrastructure, financial burden and inefficient digital skills. The study aims to develop an AI Readiness model that will assist SMME's to successfully adopt AI. The study will employ a review of existing literature and develop a model that will assist successful adoption of AI to be simple and practical. The model will assist in assessing current business readiness, capacity gaps and providing a guide on how SMME's can adopt AI successfully.

Keywords

Artificial Intelligence (AI), AI Adoption, AI Readiness Model, Adoption Barriers, and SMME's

1. Introduction

According to Palade and Carutasu (2023), the integration of artificial intelligence represents a novel concept among South African small, medium, and micro enterprises. Empirical research indicates that AI adoption remains a relatively recent phenomenon for these SMMEs, in contrast to larger organizations in developed economies. Although numerous scholarly publications underscore its expanding relevance, the absence of a comprehensive AI readiness model constitutes a significant impediment to AI adoption among these enterprises, thereby hindering operational integration. Issa et al. contend that the transformative evolution of the technological landscape induced by AI has compelled a reevaluation of conventional technology adoption paradigms within SMMEs. This shift underscores the imperative for such enterprises to incorporate AI to sustain competitiveness. Palade and Carutasu further observe that, unlike other technologies, no established frameworks for AI adoption readiness presently exist. This distinctive attribute of

AI generates novel opportunities alongside substantial challenges for SMMEs. Consequently, a structured model for AI readiness and adoption is essential to facilitate seamless integration, a priority for SMMEs, where delineating barriers can inform strategies to bolster preparedness and expedite adoption. The objective of this study is to formulate a robust AI readiness model attuned to SMME-specific requirements. By adapting extant models and mitigating contextual barriers, this framework will enhance organizational capacity for AI adoption, thereby promoting innovation and competitive advantage.

1.1 Problem statements

Artificial Intelligence (AI) adoption has emerged as a fast-growing phenomenon of interest among South African SMMEs. Even though these enterprises acknowledge the transformative potential that AI possess, many enterprises remain uncertain of their readiness to adopt AI. Most existing readiness models, tailored for large firms in developed economies, where financial resources and digital infrastructure are more readily available. These models do not reflect the operational realities SMMEs in South Africa in emerging markets, where enterprises face challenges of financial constraints, lack of digital expertise, and inadequate technological infrastructure. There is a substantial gap between literature and practice: there's no tailored frameworks for these small enterprises to assess their readiness to integrate Artificial Intelligence. To bridge this gap, there is a need to develop a structured readiness model to help SMMEs overcome the challenges of adopting AI. This model will address specific barriers such as limited resources, insufficient AI expertise, and inadequate data infrastructures, thereby providing a robust framework for successful AI implementation in resource-constrained environments (Kalleparambil and Akoum, 2025).

1.2 Objectives

This study aims to address this critical gap by developing an AI readiness model specifically designed for South African SMMEs, enabling them to navigate the complexities of AI adoption more effectively (Schönberger, 2023; Hussain and Rizwan, 2024; Proietti and Magnani, 2025). This model will provide a systematic approach for evaluating an SMMEs current capabilities, identifying areas for improvement, and guiding strategic investments to optimize AI integration (Závodná, Überwimmer and Frankus, 2024). This study seeks to address the extant gaps in Artificial Intelligence adoption among South African SMMEs. By investigating barriers, readiness limitations, and the absence of bespoke frameworks, the research proffers practical recommendations. The principal objectives are delineated below:

- To identify key barriers that affects AI adoption amongst South African SMME's.
- To determine the challenges that affect AI readiness (Skills, Technology, Finance, Culture and Governance)
- To develop AI Readiness Model tailored for South African SMME's
- To provide strategies for improving AI readiness

2. Literature Review

The subsequent sections of this study delve into a comprehensive literature review concerning AI adoption within the context of small and medium-sized enterprises (Proietti and Magnani, 2025). This review will critically evaluate existing theoretical frameworks and empirical studies to elucidate the specific challenges and opportunities that AI presents for SMMEs, particularly in resource-constrained environments (Motjoloane and Chanza, 2023; Weilbach, 2025). A significant body of current research often overlooks the unique challenges faced by small and medium-sized enterprises in integrating AI, focusing predominantly on larger, more resource-rich organizations (Paul, 2023). This oversight necessitates a focused examination of how AI adoption barriers, such as cost, lack of technical skills, and employee acceptance, manifest within the SMME context (Hussain and Rizwan, 2024).

2.1 Global AI Overview

Artificial Intelligence is advancing rapidly, revolutionizing business operations and fundamentally transforming organizational functions. As a subfield of computer science, AI empowers systems to perform tasks that traditionally relied exclusively on human capabilities, including learning, reasoning, and decision-making. In the contemporary technological era, AI has emerged as a pivotal driver of innovation, efficiency, and performance. Its pervasive applications span diverse sectors, enhancing predictive analytics, automating intricate processes, and facilitating advanced data interpretation (Weilbach, 2025). This technological advancement is particularly significant for Small, Medium, and Micro Enterprises seeking to enhance their competitive edge and operational resilience within an increasingly digitized global economy (Sheik, 2023).

2.2. The Landscape of AI in Developing Countries

Artificial intelligence has emerged as a driving force and transformative tool in today's technological era. It has reshaped business operations, human interactions, and information processing. Despite its potential, AI adoption in developing countries presents both opportunities and challenges. These nations often grapple with unique infrastructural, economic, and social constraints that influence the pace and nature of AI integration (Holland, 2026). While AI offers substantial benefits in streamlining operations and fostering data-driven decision-making, its implementation in these regions is often hindered by limited financial resources, a scarcity of skilled personnel, and inadequate technological infrastructure (Eyeregba et al., 2024; Yusuf et al., 2024). The lack of in-house technical expertise and high development costs further exacerbate these challenges, making AI adoption particularly complex for Small and Medium-sized Enterprises in developing nations (Vilma and Booshnam, 2025). For instance, challenges such as insufficient digital literacy, high implementation costs, and limited access to finance and technology often impede widespread AI adoption among African SMEs (Nwagbala et al., 2025).

2.2.1 An Overview of Adoption Trends

Artificial Intelligence is increasingly shaping global technological landscapes, presenting both significant challenges and opportunities in its adoption. This subsection provides an overview of AI adoption trends in developing regions compared to more advanced economies. The rapid advancement of AI has necessitated a reevaluation of traditional adoption strategies, exerting a profound impact on small, medium, and micro enterprises. As innovation accelerates, businesses face growing pressure to integrate AI to sustain competitiveness. Although relatively novel compared to other digital technologies, AI readiness can be assessed using established digital frameworks. These attributes of AI unlock new opportunities while posing distinct challenges for SMMEs. Effective AI integration thus requires developing a structured readiness framework tailored for SMMEs. Developing nations are progressively adopting AI technologies, recognizing their potential to drive economic growth, enhancing public services, and addressing key societal challenges a trend propelled by technological progress, improved connectivity, and rising awareness of AI's transformative capabilities (Aderibigbe et al., 2023). However, disparities persist in AI adoption rates and sophistication between high-income countries and low-income countries, with the latter often facing significant limitations in infrastructure, technical expertise, and financial resources (Khan et al., 2024). Consequently, developed countries with established infrastructure, abundant resources, and a skilled workforce are better positioned to harness AI's economic benefits, whereas developing nations face the risk of an exacerbated digital divide and wider economic disparities (Adigwe et al., 2024). This disparity is further complicated by the fact that despite the transformative potential of AI, small and medium-sized enterprises which form the backbone of global and developing economies face significant hurdles in its effective adoption (Delgado-Sánchez et al., 2025 and Nwagbala et al., 2025).

2.2.2 AI Adoption Trends in Developing Nations

In recent years, many developing nations have begun to adopt Artificial Intelligence (AI) technologies, recognizing their potential to stimulate economic growth, improving public services, and addressing critical societal challenges. The uptake of AI in these regions is shaped by multiple factors, including rapid technological progress, expanding digital connectivity, and growing awareness of AI's transformative applications. Across sectors such as healthcare, agriculture, education, and governance, AI is being applied to enhance efficiency and drive innovation. Governments and businesses in these countries are strategically utilizing AI to confront complex issues and unlock new opportunities (Aderibigbe et al., 2023).

2.2.3 Comparison with AI Trends in Developed Countries

Although AI adoption in developing economies is gaining momentum, it is important to view these trends against the backdrop of global developments. Advanced economies, supported by strong technological infrastructures and established innovation ecosystems, have long led the way in AI research and implementation. Their progress has been shaped by substantial investment in R&D, access to highly skilled professionals, and supportive regulatory frameworks. As a result, AI has been widely integrated across industries, ranging from robotics in manufacturing to complex algorithms in finance and business analytics. The strong focus on AI-driven innovation has positioned these nations as global leaders in AI deployment. At the same time, the growing adoption of AI in developing countries highlights its potential to drive inclusive growth and development. As the gap between advanced and emerging economies narrows, developing nations have an opportunity to strategically leverage AI to address local challenges while contributing to global innovation (Aderibigbe et al., 2023).

2.3 AI adoption in South African SMMEs

Mthembu (2025) argues that Artificial Intelligence (AI) has the potential to transform Small, Medium, and Micro Enterprises (SMMEs) across Africa by enhancing efficiency, fostering innovation, and strengthening global competitiveness. Within South Africa's evolving industrial landscape, SMMEs are uniquely positioned to leverage AI in building smarter and more sustainable organizations (Mthembu, 2025). AI also offers significant promise for improving productivity and driving innovation among small and medium-sized enterprises (SMEs). However, adoption levels remain relatively low compared to other digital technologies and to larger firms, with a clear gap evident across AI applications (Sheehan et al., 2025). Despite its potential to boost productivity, AI adoption in SMEs continues to face notable obstacles. Limited financial resources, insufficient technical expertise, and concerns around data security and privacy remain major barriers. Furthermore, the high initial investment required for implementation and the need for workforce training present additional challenges for SMMEs (Dinh et al., 2025).

2.4 Technology-Organization-Environment (TOE) framework

The Technology-Organization-Environment framework offers a comprehensive lens through which to analyze the factors influencing the adoption and implementation of technological innovations within organizations (Holland, 2026). To assess the readiness of SMMEs for adopting Artificial Intelligence (AI), this study develops a theoretical framework that builds upon the Technology–Organization–Environment (TOE) model. The TOE framework is particularly relevant as it emphasizes technology acceptance at the organizational level, aligning well with the focus of this research. Beyond technology acceptance, TOE also incorporates organizational and environmental dimensions, accounting for a firm's internal resources and characteristics as well as the external business context influencing AI adoption. Since the central aim of this study is to evaluate readiness for AI integration, examining these three dimensions provides a holistic understanding of the factors shaping organizational willingness to adopt AI (Hradecky et al., 2022).

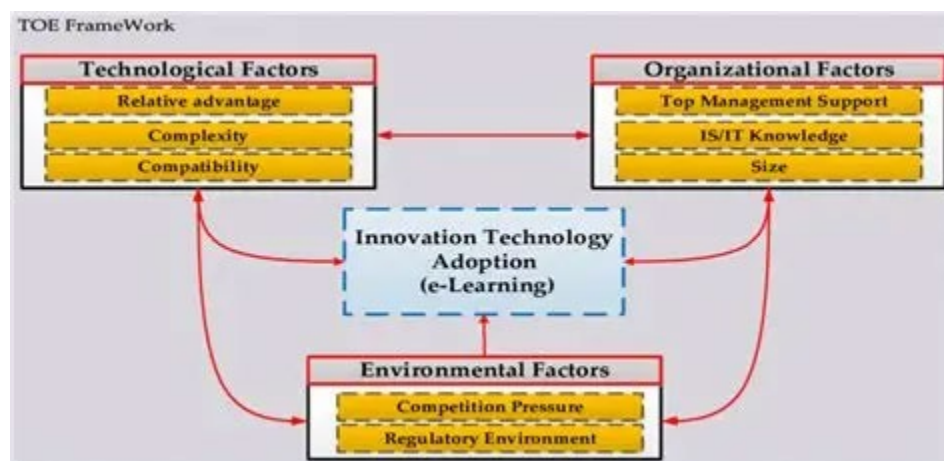


Figure 1. TOE Framework (Mousa , et al., 2020)

As depicted in Figure 1, the original TOE framework is structured around three core contexts: the technological context, comprising relative advantage, complexity, and compatibility; the organizational context, encompassing firm size, IS/IT knowledge, and top management support; and the environmental context, incorporating competitive pressure and regulatory environment (Mousa et al., 2020).

Theoretical Framework

Technology-organization-environment model (TOE)

The Technology-Organization-Environment framework serves as a robust analytical lens for investigating organizational adoption and implementation of emerging technologies, with particular emphasis on technological, organizational, and environmental determinants. Central to this model are three pivotal dimensions: technological capability, organizational readiness, and external influences. The environmental context encapsulates exogenous pressures, including competitive forces, governmental regulations, and sectoral dynamics. In turn, the technological context pertains to both endogenous systems and exogenous market-available technologies. The organizational dimension, meanwhile, pertains to intrinsic firm attributes, such as scale, structure, and internal communication mechanisms.

In the context of South African small and medium-sized enterprises, the technological facets of AI adoption are modulated by elements like relative advantage, complexity, compatibility, and cost considerations. Elevated implementation expenses and paucity of technical proficiency frequently impede uptake, whereas prospective gains in innovation and decision-making engender opportunities. Moreover, congruence between AI solutions and SMEs' innovation imperatives bolsters adoption prospects. Organizational elements, encompassing firm size and corporate culture, exert considerable influence: resource-scarce smaller entities grapple with fiscal and infrastructural limitations, yet entrepreneurial and innovative cultures may propel adoption, in contrast to risk-averse dispositions that function as deterrents. Environmentally competitive imperatives may catalyze AI integration, while policy frameworks, capacity-building programs, and infrastructural advancements can either enable or constrain diffusion.

Distinguishing itself from the Technology Acceptance Model, which centers on individual-level behavioral dynamics, the TOE framework prioritizes organizational preparedness, rendering it especially apposite for SMEs. Across its triadic dimensions technology, organization, and environmental factors manifest dually as impediments and facilitators. A holistic approach to mitigating these elements holds potential to fortify AI adoption within South African SMEs. However, empirical studies have demonstrated that the specific factors within each of these three contexts can vary significantly depending on the technology and the organizational setting under investigation (Rawashdeh et al., 2022).

3. Methodology

This study adopted a conceptual research design, utilizing a systematic literature review of extant scholarship to formulate an AI Readiness Model customized for South African SMMEs. Given the core aim of devising a framework to facilitate effective AI adoption among small enterprises, the methodological approach was inherently exploratory, analytical, and oriented toward theory construction. Empirical data collection was eschewed in favor of a comprehensive synthesis of scholarly articles, industry reports, and validated digital transformation frameworks, thereby ensuring the model's foundation in established knowledge while accommodating the contextual exigencies of South African SMMEs. The process commenced with a thorough literature review encompassing barriers to AI adoption, digital readiness paradigms, investigations into SMME evolution, and optimal protocols for technological assimilation. Materials were sourced from repositories including Google Scholar, ScienceDirect, JSTOR, and IEEE Xplore. Emergent motifs encompassed infrastructural prerequisites, leadership and organizational ethos, human capital competencies, ethical/regulatory imperatives, fiscal constraints, and marketplace vicissitudes, which guided the delineation of pivotal readiness facets.

Subsequently, an integrative synthesis was employed to expose lacunae in prevailing models, notably the dearth of streamlined, pragmatic instruments for SMMEs in nascent economies. Prevailing frameworks frequently presuppose robust resources, sophisticated ICT apparatuses, and elevated digital sophistication preconditions misaligned with the typical milieu of South African SMMEs. Accordingly, international readiness constructs were juxtaposed, with salient components refined into a contextually attuned architecture. This culminated in a six-dimensional readiness model that harmonizes thoroughness with parsimony, rendering it amenable to enterprises with scant AI familiarity.

Model elaboration prioritized lucidity, applicability, and pertinence. Dimensions were articulated drawing on literature-derived insights and calibrated to mirror prevalent SMME hurdles, including budgetary scarcities, digital proficiency deficits, regulatory adherence strictures, and volatile market exigencies. The resultant framework empowers self-evaluation via an uncomplicated ordinal scale, enabling firms to discern assets, isolate deficiencies, and devise precise remedial strategies.

In essence, the methodology anchored the AI Readiness Model in rigorous scholarship while attuning it to SMME pragmatics. Through knowledge amalgamation into a concise, operable construct, the inquiry furnishes an instrumental asset for propelling efficacious and enduring AI assimilation in small enterprises.

4. Discussion & Recommendation

4.1 How the Model Fills the Readiness Gap

The AI Readiness Model formulated for South African SMMEs seeks to address deficiencies in extant digital transformation frameworks. These frameworks predominantly prioritize larger enterprises within developed economies or concentrate narrowly on technological capabilities, thereby marginalizing smaller firms. In practice, South African SMMEs confront unique impediments including inadequate ICT infrastructure, deficits in digital skills,

constrained financial resources, and heterogeneous patterns of technology adoption that are frequently overlooked by conventional models.

- Recognizing the uneven levels of digital maturity that exist among SMMEs. Recognizing the uneven levels of digital maturity that exist among SMMEs.
- Acknowledging the regulatory and ethical obligations introduced by AI, such as compliance with POPIA.
- Incorporating market and environmental dynamics that strongly shape the competitiveness of small businesses in emerging economies.
- Emphasizing the importance of human skills and leadership, which are often overlooked in models that focus primarily on technology.

This framework evaluates readiness along six interconnected dimensions: Technological, Organizational, Human Skills, Financial, Governance/Ethical, and Environmental/Market. Through a multidimensional lens, the model delivers an all-inclusive, contextually attuned strategy that mirrors the challenges faced by South African SMMEs. Thus, it overcomes the limitations of existing frameworks while providing actionable guidance for small firms seeking to adopt AI successfully.

- Accounting for the varying degrees of digital maturity among SMMEs.
- Addressing the regulatory and ethical demands of AI, including POPIA compliance.
- Integrating market and environmental factors that critically influence small businesses' competitiveness in emerging markets
- Underscoring the vital role of human skills and leadership, often sidelined in technology-focused models.

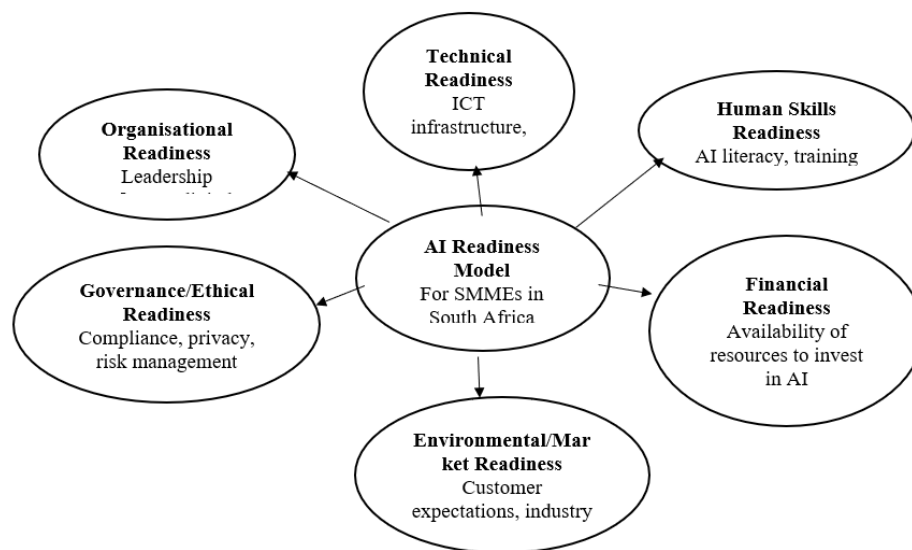


Figure 2. AI Readiness Model for SMME's in South Africa

This model aims to conceptualize the multifaceted determinants influencing the readiness of South African SMMEs to adopt and integrate artificial intelligence technologies (Figure 2). Within the South African context characterized by digital disparities, resource limitations, and heterogeneous levels of technological maturity, AI readiness ought to be conceptualized as a holistic and systemic construct, rather than a narrowly technical one. This comprehensive perspective is critical for developing targeted interventions and policies that foster sustainable AI integration,

especially given the recognized importance of SMEs as drivers of economic growth and the high failure rates they experience (Zhou et al., 2024).

4.2 Comparison to Existing Research Finding

AI integration, especially given the recognized importance of SMEs Existing literature on AI readiness predominantly emphasizes three core pillars: the robustness of an organization's technological infrastructure, its internal capabilities, and the proficiency of its workforce. These elements resonate extensively within the broader field of digital transformation studies. For example, Schumacher et al. delineates technological maturity and organizational preparedness as indispensable elements of Industry 4.0 readiness, demonstrating how infrastructure and internal processes underpin a firm's capacity to embrace novel technologies. Likewise, Chatterjee et al. emphasize leadership's digital orientation and employee competencies as pivotal to effective transformation, contending that human capital is equally critical as technological investments. Mikalef et al. extend this perspective by positing that superior data quality and robust analytical capabilities are prerequisites for substantive AI utilization, thereby accentuating the salience of dependable information systems.

The AI Readiness Model advanced in this study augments previous approaches by incorporating supplementary dimensions that directly address the constraints encountered by small enterprises in emerging economies. Financial readiness, in particular, accounts for the acute budgetary limitations prevalent among SMMEs, an aspect routinely sidelined in international models. Governance and ethical readiness are likewise prioritized, acknowledging the formidable challenges of POPIA compliance, responsible data stewardship, and transparency for firms with constrained legal and technical expertise.

Moreover, the model incorporates environmental and market readiness to encapsulate external dynamics such as customer expectations, competitive pressures, and fluctuating industry conditions factors that profoundly influence technology adoption in developing economies. In this manner, the model aligns with global scholarship while expanding its ambit to more faithfully represent the socio-economic, infrastructural, and regulatory context shaping South African SMMEs. This expansion differentiates the proposed framework from models that predominantly focus on developed economies, which often overlook the multifaceted barriers unique to emerging markets, such as inadequate digital infrastructure, limited financial resources, and the absence of context-appropriate regulatory frameworks (Aboelmaged, 2014; Mweha, 2026).

5. Proposed Improvements

- The AI readiness model serves dually as a theoretical framework and a practical instrument, enabling South African SMMEs to evaluate and bolster their preparedness for AI integration and adoption. Employing a five-point Likert scale, the model facilitates businesses' self-assessment of readiness levels, yielding precise insights into their capacity for AI implementation. For instance, a score of 2 in Technological Readiness or 1 in Financial Readiness signals an imperative for targeted interventions and resource allocation.
- This structured methodology empowers SMMEs to channel resources efficiently toward capacity-building endeavours. A suboptimal Technological Readiness score, for example, may necessitate enhancements in connectivity, adoption of cloud-based solutions, or refined data management practices. Correspondingly, deficiencies in Human Skills Readiness underscore the urgency of workforce training, AI literacy programmes, and digital upskilling initiatives. Emphasis on Governance and Ethical Readiness further entails strengthening data stewardship, information management protocols, and comprehension of POPIA compliance.
- Leadership commitment and organisational culture are pivotal enablers. Endorsement from senior leadership fosters a digital-oriented mindset and broadens stakeholder engagement. Moreover, synchronising AI strategies with prevailing market dynamics and environmental imperatives directs investments toward high-impact applications, such as customer service automation or predictive analytics for trend forecasting.
- Utilising the model as an iterative diagnostic tool, SMMEs can reframe AI adoption from a formidable challenge into a systematic, phased progression attuned to their operational contexts and strategic aspirations.

6. Conclusion

This study aimed to develop an AI Readiness Model tailored to the unique challenges confronting South African SMMEs, recognising that strategic AI integration and adoption can position these enterprises as pivotal drivers of competitiveness, operational efficiency, and long-term resilience. The findings demonstrate that AI readiness

constitutes a multifaceted, interdependent construct, reliant on interrelated dimensions including technological capabilities, organisational support systems, workforce competencies, financial capacity, governance maturity, and adaptability to market and environmental dynamics. Unlike extant literature, which predominantly addresses AI implementation in large organisations within developed economies, the proposed model offers a comprehensive and pragmatic framework that bridges the digital divide pervasive among SMMEs in developing contexts such as South Africa. By explicitly incorporating constraints such as inadequate infrastructure, financial limitations, regulatory hurdles, and heterogeneous digital literacy, it furnishes a contextually grounded and realistic conceptualisation of AI readiness for these enterprises. Ultimately, the analysis reveals that the majority of South African SMMEs remain ill-prepared for AI adoption due to pervasive readiness deficits, underscoring the urgency for targeted interventions.

As AI adoption evolves from a discretionary option to a strategic imperative, the model equips SMMEs with a robust foundation for evidence-based decision-making, uncertainty mitigation, and a systematic, assured trajectory toward integration. It advances the broader scholarship on AI and SMMEs through a bespoke readiness framework attuned to the South African milieu; integration of socio-economic impediments, including restricted ICT access and skills shortages; a versatile diagnostic tool for SMMEs and policymakers alike; and guidance for precise interventions and efficacious resource allocation.

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