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Exploring Opportunities for Artificial Intelligence Integration in Small and Medium Enterprises in South Africa

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Abstract

This study investigates opportunities to integrate Artificial Intelligence (AI) in Small and Medium Enterprises (SMEs) in Johannesburg, South Africa, focusing on employees' perspectives on current practices, potential benefits, and adoption challenges. Using a quantitative research design, data was collected from 172 respondents through an online questionnaire distributed via Google Forms. The instrument consisted of sections on respondent demographics, current AI practices, and perceived potential uses of AI in SME operations. Descriptive statistical analysis was applied, and reliability testing using Cronbach's Alpha yielded an average score of 0.900, confirming strong internal consistency. The findings reveal growing awareness of AI among employees, with positive perceptions of its potential to enhance operational efficiency, support data-driven decision-making, optimise maintenance schedules, and improve competitiveness. However, adoption remains limited due to challenges such as skills shortages, resource constraints, and uncertainty about AI applications. Respondents highlighted the importance of practical strategies, including machine learning techniques, predictive maintenance, and service diagnostics, to enable successful implementation. The study concludes that while AI offers significant opportunities for improving SME performance, training, capacity-building, and context-specific strategies are essential to support broader adoption. Recommendations are provided to guide SMEs and policymakers toward enabling sustainable AI integration.

Keywords
AI adoption, Artificial Intelligence, SMEs and South Africa

1. Introduction
Small and Medium Enterprises (SMEs) are central to South Africa's economic development, contributing to employment, poverty alleviation, and entrepreneurial activity. Despite their socio-economic value, many SMEs struggle with operational inefficiencies, resource constraints, and limited access to advanced technologies. In this context, Artificial Intelligence (AI) has emerged as a transformative technology capable of enhancing decision-making, operational efficiency, and competitiveness within these enterprises (Bughin et al. 2018; Agrawal et al. 2018). Globally, the integration of AI into business operations is accelerating, yet its adoption among South African SMEs remains limited. This is largely due to a combination of technological, organisational, and environmental barriers. Mofokeng and Marutha (2023) report that South African manufacturing SMEs lack strategic frameworks and awareness for AI integration, despite its potential to drive growth and innovation. Similarly, Moyo and Van Belle (2022) highlight weak digital infrastructure, limited technical expertise, and resistance to change as significant inhibitors in medium-sized enterprises. Nevertheless, recent studies indicate growing awareness and experimentation with AI among South African SMEs. Mashiane and Dlamini (2024) found that early adopters of generative AI technologies reported increased productivity and more effective customer engagement, although concerns around implementation costs, data privacy, and skills shortages persist. Regional studies further affirm the role of AI and digital technologies in enabling growth among small enterprises, especially when such technologies are adapted to local contexts (Kgaugelo and Van der Merwe 2023). To support adoption, scholars have proposed structured implementation models. Mokgopa (2023), for instance, applies the Technology Organisation Environment (TOE) framework to show that managerial commitment, technological readiness, and external support influence AI integration in SMEs. Additionally, Naidoo and Pillay (2024) propose a phased framework that begins with awareness and progresses toward custom AI applications, offering SMEs a realistic pathway to adoption.

Hence, this paper aims to explore opportunities for AI integration in South African SMEs by examining current practices, identifying barriers and enablers, and recommending strategies to facilitate scalable, sustainable AI adoption in this vital sector.

1.1 Objectives of the study
To better understand the study, the following objectives were developed: (1) To identify current practices related to AI integration in South African SMEs; (2) To explore the key enablers and barriers influencing the adoption of AI technologies in the South African SME context and finally; (3) To recommend practical approaches for promoting AI integration in SMEs, considering the technological, organizational, and environmental factors unique to South Africa.

1.2 Scope of the study
This study focuses exclusively on Small and Medium Enterprises (SMEs) operating in Johannesburg, South Africa. It examines employees' perspectives on the current use, awareness, and potential of Artificial Intelligence (AI) technologies within their respective organisations. The research specifically explores internal factors influencing AI readiness, perceived benefits, and challenges from an employee standpoint. It does not extend to large enterprises or SMEs outside the Johannesburg metropolitan area.

1.3 Value of the study
This study contributes to the growing body of knowledge on digital transformation within developing economies by providing context-specific insights into the integration of Artificial Intelligence in South African SMEs. By focusing on employee perspectives within Johannesburg-based enterprises, the research highlights practical enablers and barriers to AI adoption at the grassroots operational level. The findings offer valuable guidance for SME owners, technology policymakers, and support agencies seeking to promote AI-driven innovation and competitiveness in the sector.

2. Brief literature 4eview
2.1 An overview of AI
Artificial Intelligence (AI) comprises technologies such as machine learning, deep learning, and generative algorithms that enable systems to simulate human cognition and decision-making. Its applications span data analytics,

automation, forecasting, and personalised services, fundamentally transforming business operations (Haenlein and Kaplan 2019). AI's disruptive potential lies in its ability to analyse large, complex datasets, uncover patterns, and support strategic decision-making (Gikunda 2023). On the African continent, AI is increasingly recognised as a lever for socio-economic development, with the potential to impact sectors such as agriculture, healthcare, and finance (Gikunda 2023).

2.2 AI practices in businesses

Artificial Intelligence is increasingly becoming a strategic asset in contemporary business environments, offering firms new avenues for automation, insight generation, and customer engagement. In developed economies, large corporations have adopted AI to optimise functions such as supply chain management, dynamic pricing, fraud detection, and employee scheduling (Davenport and Ronanki 2018). These practices are beginning to influence how smaller businesses, including SMEs, approach technological innovation. Recent studies show that AI applications in businesses commonly fall into three categories: customer interaction, operational process improvement, and business model transformation (Haenlein and Kaplan 2019). For example, businesses now use AI-powered chatbots for 24/7 customer service, natural language processing tools to analyse client feedback, and machine learning algorithms to predict consumer behaviour and demand patterns (Schwaeke 2025; Gikunda 2023). In operations, AI supports real-time decision-making through tools like predictive maintenance, intelligent inventory management, and workflow optimisation (Akoh 2024). These applications are particularly beneficial to businesses with resource constraints, offering them ways to improve efficiency without proportionate increases in overhead costs.

In small and medium enterprises, the use of AI is growing but often remains exploratory. Many SMEs adopt AI in modular or task-specific forms, such as automated email marketing systems, social media sentiment analysis tools, or AI-driven accounting platforms (Sánchez 2025). These solutions are generally pre-packaged, cost-effective, and easy to implement, requiring only minor changes to the existing IT infrastructure. However, full-scale AI integration, where the technology informs enterprise-wide strategy and processes, remains rare in smaller firms, especially in developing countries (Muzuva et al. 2024).

In the South African context, AI usage in business is still in its infancy, but the momentum is building. Some SMEs in Johannesburg, particularly in fintech and e-commerce, are experimenting with generative AI tools for content creation, AI-based CRM systems, and even preliminary forms of recommendation engines for product promotion (Muzuva et al. 2024). However, most practices are fragmented, informal, and not embedded in long-term digital transformation strategies. According to Schoeman and Seymour (2022), while ERP and business intelligence systems are often present in medium-sized firms, AI functionalities remain underutilised due to data immaturity and a lack of AI-specific expertise.

2.3 AI Enablers and Barriers in Businesses

The adoption of AI in SMEs is shaped by a complex interplay of enablers and barriers. Enablers include technological readiness, such as infrastructure and data quality, leadership support, and access to external resources (Sánchez 2025). Frameworks like the Technology Organisation Environment (TOE) model, often integrated with Diffusion of Innovation (DOI) theory, provide a robust approach to assessing adoption dynamics (Sánchez 2025). However, barriers frequently outweigh these enablers. Financial constraints, scepticism about ROI, talent shortages, inadequate data infrastructure, and fear of losing control to automated systems limit uptake (Schoeman 2022). Specifically, South African SMEs face additional hurdles: poor-quality base data, immature ERP/BI systems, and resource limitations make AI integration difficult (Schoeman 2022). These challenges reflect broader trends in sub-Saharan Africa, where lack of awareness, limited technical skills, and regulatory ambiguity further impede AI adoption (Uwagaba et al. 2023).

2.4 SMEs in South Africa

Within South Africa, AI integration among SMEs remains modest but shows signs of both potential and promise. A systematic literature review of manufacturing SMEs found low overall adoption rates, primarily due to the lack of structured frameworks and limited innovation capacity (Akoh 2024). Nonetheless, the operational benefits of AI when adopted are significant, although implementation costs and technical skill gaps serve as deterrents. Region-specific studies, such as those focusing on the Northern Cape, confirm that inadequate infrastructure and high costs hinder adoption; yet, digital tools show promise in supporting resilience and competitiveness when adapted to local conditions (Weilbach 2025). Moreover, a qualitative exploration of generative AI's impact on SME productivity in South Africa found early adopters reporting improved operational efficiency, enhanced decision-making, and market

expansion. Still, the study emphasised the persistence of barriers such as lack of technical expertise, initial investment costs, and concerns over data security (Muzuva et al. 2024).

3. Methods

3.1 Research design

This study employed a quantitative research design to assess opportunities for Artificial Intelligence (AI) integration in Small and Medium Enterprises (SMEs) in Johannesburg, South Africa. The design enabled the collection of standardised data from SME employees, focusing on current AI practices, perceived enablers and barriers, and potential use cases. The quantitative approach was appropriate given the study's objectives, which involved identifying practices, measuring perceptions, and comparing responses across different SME contexts. Structured data collection via a survey enabled efficient analysis and increased the generalisability of the findings. According to Creswell and Creswell (2018), quantitative methods are effective for examining relationships between variables and producing statistically valid insights. This approach also offered advantages such as objectivity, scalability, and the ability to apply descriptive and inferential statistics, thereby supporting evidence-based recommendations for AI integration in SMEs

3.2 Data collection

Data for this study were collected using a structured questionnaire designed to capture employees' perspectives on the integration of Artificial Intelligence (AI) in South African SMEs. The questionnaire was divided into three main sections: (1) Respondent demographics, (2) Current AI practices in SMEs, and (3) Perceived potential use of AI in SME operations. To measure attitudes and perceptions, a five-point Likert scale was used, ranging from "Strongly disagree" to "Strongly agree." This allowed for the quantification of subjective opinions and facilitated statistical analysis. The questionnaire was distributed online via Google Forms, enabling faster, contactless response collection and a broader reach among Johannesburg-based SMEs. The online format also ensured convenience for respondents and supported efficient data compilation and analysis.

3.3 Population and Sample

The target population for this study comprised employees working in Small and Medium Enterprises (SMEs) across South Africa. However, due to practical constraints and accessibility, the actual data collection was limited to SMEs in Johannesburg, a major economic hub with a diverse range of SME activities. A non-probability snowball sampling method was employed. Initial respondents were selected for convenience, and they were encouraged to share the online questionnaire with other eligible participants in the SME sector. This approach was effective in reaching a broader network of respondents with relevant insights into AI practices and perceptions within their organisations. While the study aimed for a target sample size of 200 respondents, 172 completed responses were received and included in the final analysis. This sample size was deemed sufficient for the exploratory and descriptive nature of the study.

3.4 Data analysis

The collected data were analysed using descriptive statistics to gain an overall understanding of employees' perspectives on the integration of Artificial Intelligence (AI) in SMEs. Responses from the Google Forms questionnaire were exported to Microsoft Excel and IBM SPSS Version 29 software for cleaning, coding, and analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise demographic data and examine patterns in respondents' perceptions of current AI practices, existing barriers, and the potential use of AI within their organisations. The use of Likert-scale items enabled the quantification of attitudes and perceptions, allowing for clear interpretation of trends across the respondent group. This method of analysis was appropriate given the exploratory nature of the study, which aimed to provide a broad overview of current AI awareness and adoption within Johannesburg-based SMEs. Descriptive analysis supported the identification of areas with high or low perceived readiness for AI integration, which in turn informed the development of practical recommendations aligned with the study's objectives.

3.4 Reliability

To assess the internal consistency and reliability of the Likert-scale items, Cronbach's Alpha was calculated for the questionnaire's key sections. The resulting alpha values exceeded the commonly accepted threshold of 0.70, indicating that the instrument was reliable for measuring respondents' attitudes and perceptions regarding AI adoption.

This approach was suitable given the exploratory nature of the study, and it enabled the researcher to identify broad patterns and areas of readiness or concern regarding AI in SMEs, directly supporting the study's research objectives.

4. Results and Discussion

4.1 Demographics

Figure 1shows that most respondents (45%) hold a Matric Certificate, followed by 23% with an Honour's degree, 18% with a Post-Matric Certificate/Diploma, and 14% with a Bachelor's degree. No respondents reported having a Master's or PhD qualification. This indicates that the majority of SME employees in the sample have lower to mid-level academic qualifications, which may influence their awareness, readiness, and confidence in adopting AI technologies. These findings support the study's focus on assessing employee perspectives and highlight the need for training and upskilling to enable effective AI integration in SMEs.

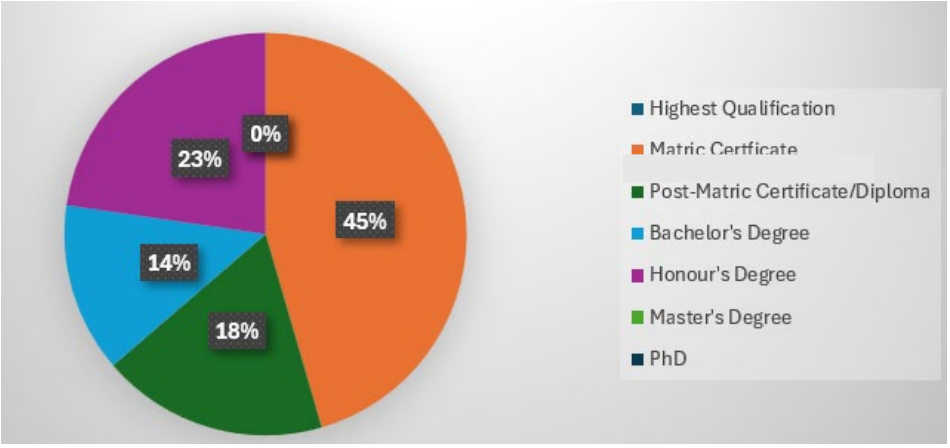

Figure 1. Respondents' Qualification

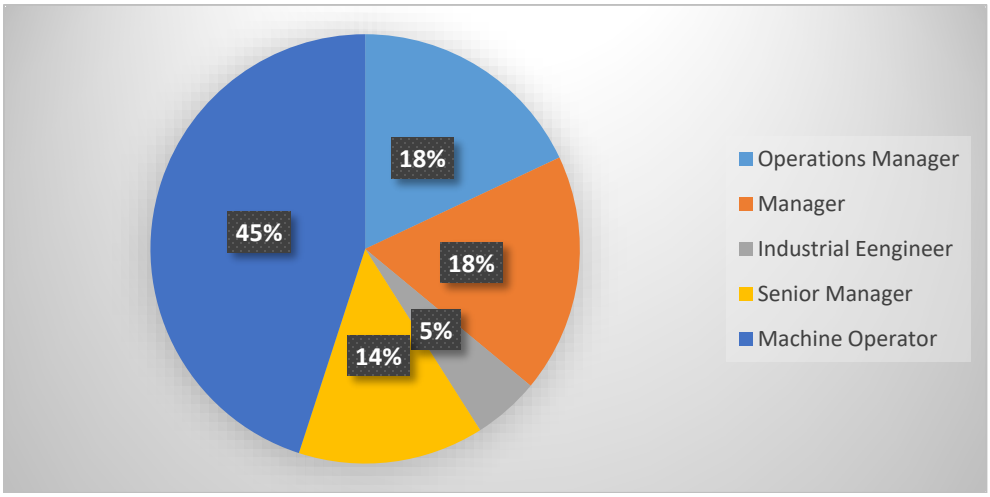

Figure 2. Respondents' Position

Figure 2 shows that most respondents (45%) are Machine Operators, followed by Operations Managers and Managers at 18% each. Senior Managers account for 14%, Industrial Engineers represent 5%, and there were no General Managers among the respondents. This distribution suggests that the majority of participants hold operational roles, while fewer hold strategic or leadership positions. For this study, which focuses on AI integration in SMEs, these insights are valuable as they reflect employee perspectives from the operational level, where AI implementation would have direct impacts. However, the lower representation of senior leadership may indicate limited input on strategic decision-making related to AI adoption.

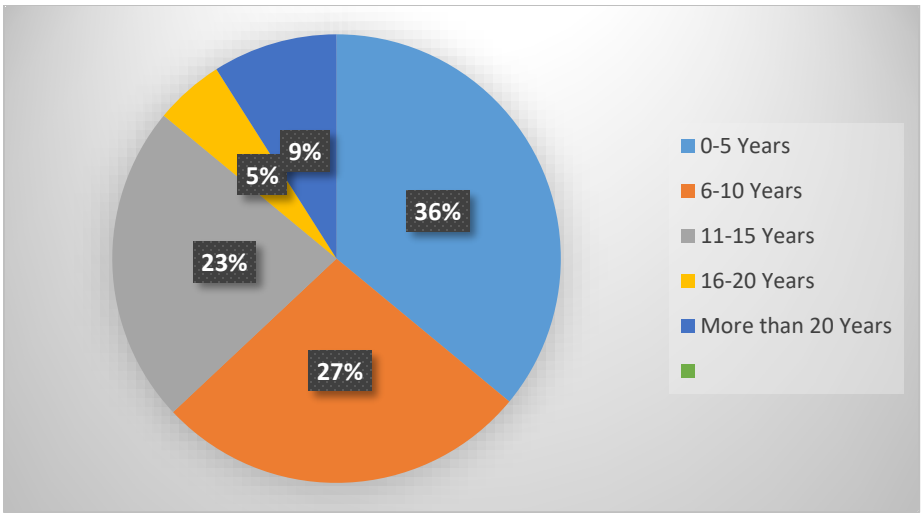

Figure 3 Respondents' Years of Experience

The Figure 3 above shows that the largest group of respondents (36.4%) have 0–5 years of work experience, followed by 27.3% with 6–10 years, and 22.7% with 11–15 years. A smaller proportion (9.1%) have more than 20 years of experience, while only 4.5% fall within the 16–20 years range. This distribution indicates that the majority of respondents are relatively early- to mid-career professionals, which is relevant to this study as it reflects the perspectives of employees who are more likely to adapt to technological change, including AI adoption. However, the smaller representation of highly experienced employees may limit insights into long-term strategic considerations regarding AI integration in SMEs.

4.2 AI integration practices in South African SMEs

Figure 4 illustrates employees' perspectives on current AI integration practices within SMEs. A notable 45% of respondents agree that data-driven decision-making is being adopted, showing a positive shift toward using AI to improve business insights. Similarly, operation optimisation received strong support, with 33% strongly agreeing and another 32% agreeing, indicating that many SMEs are leveraging AI tools to enhance efficiency. For predictive maintenance, 41% agree on its relevance, reflecting growing awareness of AI's potential in preventing downtime and reducing operational risks. Interestingly, 45% of respondents remained neutral on the optimisation of maintenance schedules, suggesting either limited implementation or insufficient knowledge of AI's role in this area. Overall, these findings reveal that while data-driven decision-making and operational optimisation are becoming increasingly common, other practices, particularly predictive and preventive maintenance, are less consistently applied. This highlights an opportunity for SMEs to expand AI adoption into maintenance and resource planning through training, investment, and strategic integration efforts.

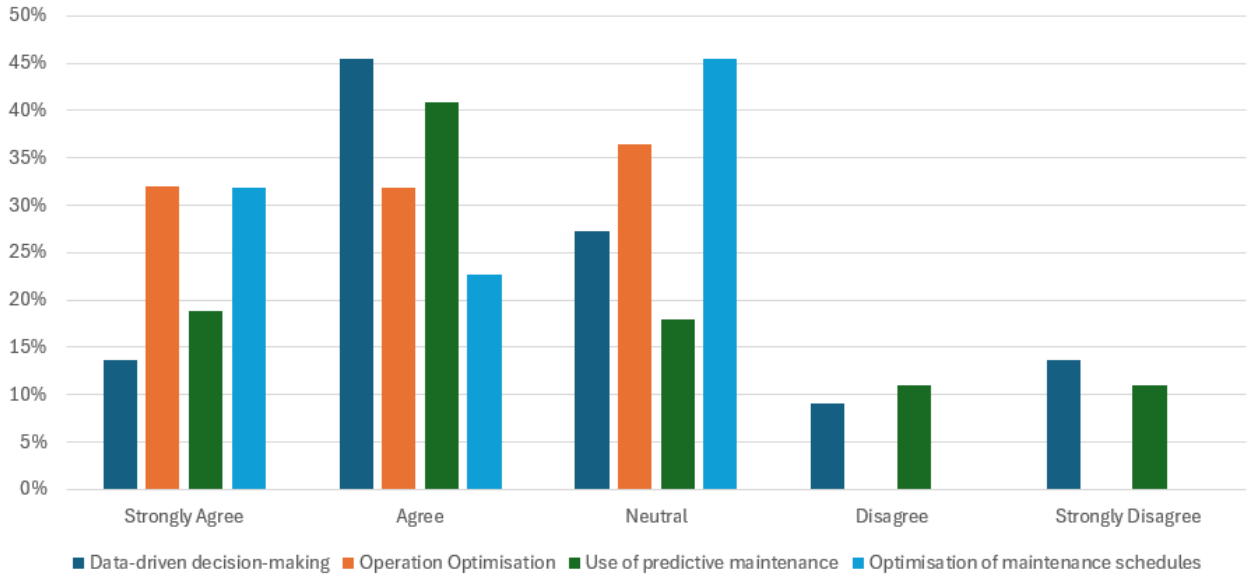

Figure 4. AI integration practices in South African SMEs

4.3 Practical approaches for promoting AI integration in SMEs

The Figure 5 illustrates respondents' views on practical approaches to enhance AI integration within SMEs. A significant proportion (60%) strongly agree that vehicle sequencing, ensuring components are installed in sequence, is critical for optimising operational efficiency. Similarly, a high percentage (45%) agree that implementing human and machine learning techniques would improve AI-driven decision-making and productivity. Regarding the use of service diagnostics and prognostics to monitor machinery performance, responses are positive, with a notable portion agreeing or strongly agreeing on its importance. However, perceptions toward data-mining techniques to reduce supplier material variation are mixed: 55% of respondents remain neutral, suggesting uncertainty or lack of exposure to such practices, while approximately 31% agree on its relevance. Overall, these findings indicate that employees recognise the value of machine learning, vehicle sequencing, and predictive diagnostics in driving AI integration within SMEs. However, the neutrality toward data-mining techniques suggests a potential skills or awareness gap, underscoring the need for training and capacity-building to fully leverage AI's potential in improving SME operations

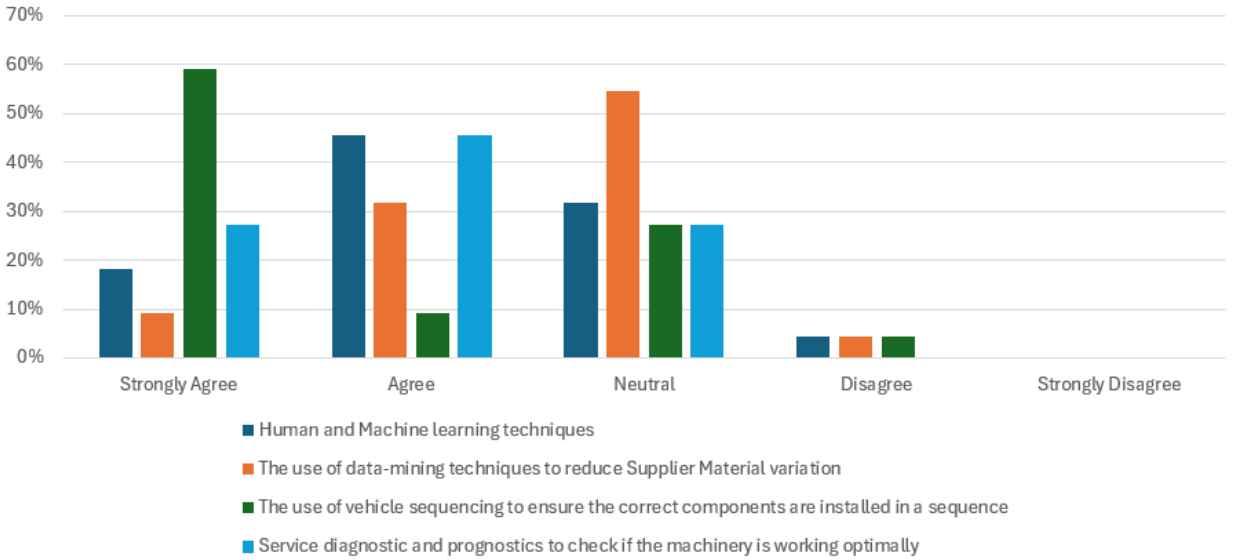

Figure 5. Practical approaches for promoting AI integration in SMEs

4.4 Reliability analysis: Cronbach's alpha

Table 1 presents the Cronbach's Alpha results used to assess the internal consistency and reliability of the questionnaire items. The analysis shows that the section on AI integration practices in South African SMEs achieved a Cronbach's Alpha of 0.924 across 11 items, indicating excellent reliability. Similarly, the section on practical approaches to promoting AI integration in SMEs yielded a Cronbach's Alpha of 0.836 across 6 items, indicating high reliability. The overall Cronbach's Alpha for the questionnaire was 0.900, exceeding the commonly accepted threshold of 0.70 (Creswell and Creswell, 2018), confirming that the instrument used in this study was highly reliable. This ensures that the collected data is consistent and dependable for analysing employees' perspectives on AI practices and potential integration strategies within SMEs.

Table 1. Cronbach's alpha

Objectives	**Cronbach's Alpha**	**No. of items**
AI integration practices in South African SMEs	0.924	11
Practical approaches for promoting AI integration in SMEs	0.836	6
Average Cronbach's Alpha	**0.900**	

6. Findings and conclusions

This study examined opportunities for Artificial Intelligence (AI) integration within Small and Medium Enterprises (SMEs) in Johannesburg, South Africa, from an employee perspective, focusing on current practices, enablers, barriers, and adoption strategies. The findings indicate that, although awareness of AI is increasing, its implementation remains limited and fragmented. Employees acknowledged AI's potential to enhance operational efficiency, enable data-driven decision-making, optimise maintenance, and improve customer service; however, adoption is constrained by skills deficits, limited technical expertise, and resource constraints. The predominance of entry- to mid-level qualifications among respondents further influences readiness for advanced AI applications, contributing to cautious engagement with complex techniques such as predictive maintenance and data mining. In addition, the study supports as well that key risks associated with AI adoption, including high implementation costs, data privacy and security concerns, potential workforce displacement, and over-reliance on automated systems, may introduce operational vulnerabilities if not properly managed.

The study highlights the critical role of employee readiness, targeted upskilling, and context-specific strategies in advancing AI adoption within South African SMEs. It recommends capacity-building initiatives, accessible AI solutions, and collaborative engagement among SME stakeholders to facilitate effective implementation while mitigating associated risks. Future research should extend beyond Johannesburg and employ mixed-method approaches to deepen insights into organisational readiness and strategic adoption. Overall, AI presents a significant opportunity to enhance SME competitiveness, productivity, and sustainability, contingent on addressing capability gaps, managing adoption risks, and fostering supportive innovation ecosystems.

7. AI declaration

This study was developed with the support of Artificial Intelligence (AI) tools (ChatGpt 5.1 and Claude) to enhance language clarity, structure, and academic expression. The AI was used solely for editorial assistance and did not contribute to the conceptualisation, data collection, analysis, or interpretation of the research. All intellectual content, findings, and conclusions presented in this study are the original work of the author. The author accepts full responsibility for the accuracy, integrity, and authenticity of the research.

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Biographies

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