



Analyzing the Impact of AI on E-Commerce Business in Developing Countries: A Case Study of the SADC Region

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Abstract

This study examines how Artificial Intelligence (AI) technologies influence e-commerce innovations in developing countries, specifically within the Southern African Development Community (SADC) region. E-commerce in the southern African countries is constrained by low levels of infrastructure and digital prowess and consumer trust, and artificial intelligence technologies offer new ways for businesses to streamline processes, improve customer engagement, and increase security. This study looks into the use of AI technologies such as chatbots, recommendation engines, fraud detection systems, and predictive analytics in e-commerce in the SADC region, taking into account their situational context. Qualitative data obtained through interviews with e-commerce entrepreneurs and managers was combined with quantitative data from surveys on the adoption, perceived benefits, and challenges of AI to create a mixed-methods design. The most salient findings suggest that there is still uneven use of AI technologies across the SADC countries. At the same time, it was observed that most established firms are realizing substantial improvements on customer service and operational productivity. Smaller firms, however, grapple with challenges such as high costs, lack of technical know-how, and inadequate data. As the study reveals, Artificial Intelligence (AI) has considerable promise to enhance the growth of e-commerce in developing countries, specifically in the SADC region. However, targeted implementation policies are needed to bridge gaps in digital literacy at all levels, infrastructure, consumer and business education, and provide a regulatory framework that nurtures AI development while safeguarding privacy and security of data. Other suggestions emphasize the need for government-backed initiatives which focus on broadband expansion, AI training programs, and regionally collaborative knowledge hubs for stakeholders in e-commerce.

Subject Areas

Artificial Intelligence, Business Analysis

Keywords

Artificial Intelligence (AI), E-Commerce, Developing Countries, Southern African Development Community (SADC), Digital Literacy, Chatbots

1. Introduction

The entire landscape of business is undergoing rapid transformation as a result of the quickly evolving and widespread adoption of new technologies such as AI. While many developed countries have fully adopted new technologies to streamline operations and improve customer service, harnessing its full potential is still a far cry for developing economies. And while these countries face unique challenges because of a lack of efficient systems, the prevalence of e-commerce not only promises economic resilience and better standards of living, but AI serves as an enabler to address these challenges. This study seeks to analyze the impact of AI on e-commerce in the context of the diverse SADC region, which embodies a blend of advanced and developing markets with distinctive and important market features.

Like in all other regions, the e-commerce industry in underdeveloped countries encounters a broad range of difficulties, unique to developing countries. These include limited internet access and affordability, low rates of digital literacy, an ill-developed infrastructure for logistics, and a general lack of trust in online transactions [1]. For instance, many SADC countries continue to struggle with disproportionate pricing on mobile data, which restricts online participation. In addition, the e-commerce sector also has to compete against the high levels of informal sector activity which makes it impossible for electronic commerce to integrate into properly regulated financial environments and reliable supply networks [2]. Regardless of these hurdles, e-commerce continues to expand within the SADC region, stimulated by heightened smartphone usage as well as a growing middle class that increasingly opts for more convenient access to goods and services. The growth potential is further demonstrated by pan-African e-commerce companies such as Jumia, as well as local startups like Takealot from South Africa, which indicate a shift in shopping patterns toward more digital interfaces alongside enhanced economic prospects in the region [3]. To accelerate such progress, key challenges are being increasingly addressed with AI business solutions.

The problem of the research arises from the gaps that the SADC region has in terms of the intersection of e-commerce and AI. The problem gets even more complex because the benefits of AI implementation in e-commerce systems are not very well understood, even with the intermediary e-business models in developing countries. In addition, most companies, and especially small ones, do not have adequate financial resources, infrastructure for information, knowledge, and

the requisite data of technology [4]. Furthermore, the contextual factors of the SADC region, defined by poor infrastructure, noting borders and cross-national regulatory frameworks, thin markets and cultures, require deeper understanding in reference to the changes that AI can undergo to gain optimal impact [5]. Hence, there exists a need for deeper exploration around the use of AI in e-commerce in SADC by studying the impacts it brings, be it positive or negative.

To fill in this gap in knowledge, this study sets out to achieve its Primary Objectives in Three Parts. First, it seeks to determine what specific AI technologies are being utilized and their level of adoption by e-commerce firms in the SADC region by assessing their use and benefits. This includes customer service chatbots, marketing recommendation engines, fraud detection systems, as well as predictive analytics for demand forecasting and inventory management. Second, this research endeavor aims to analyze the factors like cost, data scarcity, technical skills, infrastructure, governance frameworks, and AI technologies that challenge the effective use of AI in the region's e-commerce activities to offer attainable solutions. Third, the research intends to develop an actionable AI strategy that advancing policy changes for governments, businesses, and other economic players need to adopt in order to use AI technologies in e-commerce to foster sustainable development and improved consumer welfare in the SADC region.

2. Literature Review

The integration of Artificial Intelligence (AI) into systems is being adopted in the world of online business without considering the pros and cons it has for developing countries. This literature review looks at the focus of research done on AI powered e-commerce and looks at the challenges and opportunities it presents to the Southern African Development Community (SADC) region.

2.1. The Transformative Potential AI Has in E-Commerce

Earlier studies highlight the AI technologies potential in e-commerce with regards to fulfillment, customer servicing, supply chain management, and functioning of business activities [6]. Looking at the socio-economic context and the problems in developing countries, it is difficult to view the adoption of AI in e-commerce in these countries without critical intervention. While Shah & Badi analyses the advantages of the technology, it is important to look at how the differing socio-economic realities impact the experience of these advantages. The SADC region has a diverse market, technological infrastructure, and even the consumer base, therefore it could be profusely analyzed. Albeit, the nature of such analysis still requires a careful consideration of the regions distinctive AI adoption attributes. This is the reason why the works of fundamental development thinkers, such as Amartya Sen who stresses the significance of human capabilities and freedoms [7], Ha-Joon Chang who critiques standard economic thinking in relation to developing countries, affirm the necessity of the SADC region's specific AI Adaptation concerns becomes a powerful investigation [8].

2.2. The Challenges of Culturally Relevant AI Marketing in the SADC

The sophisticated functions of AI can enhance consumer marketing and simplify the processes involved in making purchases. Nonetheless, cultural internet boundaries, AI-based marketing, and illiteracy levels hinder such applications in the SADC region. As Alle and Ebuka explain, recommendation systems driven by AI focused on developed countries do not consider culturally relevant contexts and may recommend products that are irrelevant or inappropriate for African markets [9]. This highlights the need for more advanced rationale and frameworks that capture local traditions and shopping behaviors. While Alice and Ebuka point out a particular case of cultural relevance neglect, thinking beyond that situation “a critical engagement with the broader discourse” invites further analysis of the sociopolitical structures involving power relations embedded in AI systems [10]. Scholars such as Safiya Noble and Ruha Benjamin have provided important arguments about how social inequality can be deepened and widened as a result of algorithmic decision-making [11]. Using these frameworks would help explain how AI systems used in e-commerce marketed as neutral technologies can exacerbate cultural biases and disadvantages within the SADC region.

2.3. Advancing Cybersecurity and Fraud Issues in E-Commerce

Another focus area is incorporating AI technology in enhancing security during e-commerce transactions as well as fraud prevention. Otozi *et al.* note that developing countries suffer more from online fraudulent activities and cybercrimes because of underdeveloped legal and regulatory frameworks [12]. There is potential in using AI technology to automate fraud detection enabling timely and effective prevention. Such automated detection systems, however, need reliable and diverse streams of up-to-date information to defend against changing attempts at deceit. Hilal, Gadsden, and Yawney critique postulated fraud detection systems aimed at developed countries, which stubbornly ignore sophisticated fraud masquerading in developing countries due to lack of understanding of local payment and transaction systems [13]. It is very important and urgent to study how AI can be best utilized in addressing specific cybercrime and fraud challenges concerning e-commerce security in the SADC region. To engage with this puzzle, it's imperative to shift from a purely technical lens and analyze the socio-political context of cybersecurity in developing countries. Zuboff raises important controversies on privacy and governance relating to the power of surveillance involved in collecting and analyzing data [14]. As noted by Otozi *et al.* (2024) and Hilal, Gadsden, and Yawney (2022), it is evident that the integration of AI-enabled fraud detection technologies in the SADC region requires careful consideration [15].

2.4. Enhancing Logistics and Supply Chain Management with AI

Transportation, customs clearance, and infrastructure inadequacies pose logistical challenges for some developing countries [16]. AI's predictive analytics offers

e-commerce firms opportunities to optimize supply chains, particularly in managing inventory, process automation, and reducing delivery times. These technologies demand trained personnel, advanced communication systems, realtime data streams, and a suitable technological framework. Krause *et al.* observed the absence of infrastructure and reliable data as primary reasons many developed country AI-based supply chain solutions are not implemented in developing countries [17]. Given the SADC region's unique infrastructure and communications systems, it becomes essential to examine AI's potential interventions aimed at resolving specific logistical concerns. While branching off from Krause *et al.*, whose focus was infrastructural deficiencies, shifts the lens to the discourse on development, deliberating the sociotechnical ramifications of infrastructure scarcity unveils preposterous layers beneath the surface. Evgeny Morozov argues that technology often exacerbates existing inequalities instead of addressing them [18]. Adapting his critique under the lens of AI-powered supply chain management reveals, uncovering some complexities to the advantages and challenges of e-commerce in the SADC region.

2.5. The Impact of Policy and Strategy

The need for cohesive policies and conducive ecosystems is important for the adoption of AI in e-commerce. As noted by Salle & Rini, many developing countries suffer from vague policies concerning data, intellectual property, and consumer rights, leading to a stifling of creativity and a heightened culture of risk aversion in association with innovation in AI technologies [19]. They further argue that such policies undermine trust in AI, which is essential for private and public investments. Moreover, Sharma and Sharma argue that the lack of comprehensive data protection frameworks in developing countries poses significant ethical challenges concerning the adoption of AI technologies and the potential misuse of sensitive information [20]. There is a lack of scholarly work investigating the policy and strategy deficit in relation to the responsible use of AI technologies in e-commerce within the SADC region. Bridging this policy gap requires more than just calling for the implementation of developed country frameworks. Sheila Jasanoff, has argued for the importance of "sociotechnical imaginaries" shared visions of desirable futures that guide the sociotechnical nature of the culture [21]. Studying the sociotechnical imaginaries influencing AI policy in the SADC region provides insight into what values and priorities are motivating policy actions and helps to ascertain possible unanticipated consequences.

2.6. The Significance of Digital Literacy and Skills Development

While exploring the prospects of AI in relation to e-commerce, the matter of digital literacy alongside skills training emerges as a fundamental challenge. The deployment and maintenance of AI technologies need precision for skilled personnel, education, and a sufficiently competent workforce [22]. Available talent gaps pose challenges in the domains of data science, software engineering, as well as

AI. As noted by Upadhyaya, investing in STEM disciplines, as well as digital literacy, is critical for developing an AI-friendly ecosystem in developing nations [23]. More work is still required for the SADC region concerning the promotion of digital literacy as well as the development of e-commerce specific skills. Bridging the digital skills gap demands from us a more sophisticated approach to what “digital literacy” involves. According to scholars such as Eszter Hargittai digital literacy encompasses technical competencies but extends to critically evaluating information and civic engagement within online communities [24]. If policy makers in SADC adopted a more expansive approach to digital literacy, they would be better placed to formulate targeted interventions to enable active participation of citizens in the digital economy.

2.7. Social-Economic Aspects Impacting AI Integration

The adoption of AI in e-commerce, particularly in the context of developing countries, is influenced by sociocultural and economic factors in addition to the legal and technological frameworks in place. Widespread inequality and poverty, coupled with lack of access to financial institutions, stifle not just the demand for e-commerce but also investment by businesses into AI technologies [25]. Ahi, Sinkovics and Sinkovics underscored the relevance of these socio-economic factors in their studies towards formulating an all-encompassing e-commerce ecosystem, which integrates users and harnesses AI [26]. In the context of the SADC region, understanding the socio-economic dynamics of AI integration into e-commerce is crucial to the societal welfare of the region. Although Piketty and Ahi, Sinkovics and Sinkovics have emphasized the significance of socio-economic dynamics, there is need in the broader discussion to address the structural issues of poverty and inequality [27]. Thomas Piketty offers a detailed account of the historical patterns of wealth distribution and accumulation over time [28]. In the case of the SADC region, there is potential, based on Piketty’s insights, to analyze how AI adoption in e-commerce could increase prevailing inequalities, alongside proposing more equitable policy solutions..

2.8. Empowering Small and Medium Enterprises (SME) in the SADC Region

To promote economic growth, the integration of AI in e-commerce should focus on small and medium enterprises (SMEs) first, as they remain largely overlooked by researchers. The lack of financial capital, a skilled workforce, or an appropriate data infrastructure prevents the implementation of AI technology by SMEs [29]. These firms require specific targeted usability frameworks that grant tailored assistance to exploit AI and enhance business competitiveness. Ali and Hajjar aim to promote equitable development in e-commerce and unlock the potential of SMEs through accessible training and mentorship [30]. Targeted strategies do not suffice to address the unique challenges and limited funds that SMEs from the SADC region face. While Iyelolu *et al.* and Ali and Hajjar focus on SME hurdles,

a more holistic critique of the phenomenon involves examining the contribution of SMEs toward inclusive growth and development [31]. Mariana Mazzucato disputes the dominant perception that innovation is the exclusive province of private sector entrepreneurs [32]. She mainstreams the argument that the state is fundamental to financing applied innovation and subsidizing research in emerging technologies. Looking at Mazzucato's insights allows other researchers to analyze the impact of government policymaking on the embrace of AI technologies by SMEs in the SADC region and the fostering of a more inclusive and sustainable ecosystem for e-commerce.

2.9. Philosophical Boundaries of AI in E-Commerce

In other words, the automation features and advanced tools offered by e-commerce frameworks serve as an escalator for new and existing ethical issues needing higher scrutiny. All issues of algorithmic bias, privacy, and lack of transparency pivot off of the responsible wielding and governance of intelligent systems arms. Fazil, Hakimi, and Shahidzay alert that biased algorithms may anaesthetize progress and amplify already existing inequalities and discriminations in societies [33]. There is work to be done in the SADC region concerning the ethics of AI in e-commerce for policy development as well as ethics-based governance frameworks to innovate responsibly and implement AI technologies. In order to address the ethical issues thoroughly, including the ones posed by AI in e-commerce, further examination of scholarly and ethical texts on technology will be necessary. Nick Bostrom analyzes the unprecedented escalation of sophisticated AI and problems it poses long-term [34]. Cathy O'Neil discusses how algorithms can persistently reinforce and amplify social biases [35]. Looking at the SADC region, these important thoughts enable researchers to grasp the comprehensive work regarding the AI in e-commerce ethics and governance along with fueling AI policy frameworks that encourage equity and social justice.

2.10. Theoretical Framework

From the perspective of development economics, a TAM-Technology Acceptance Model—is pivotal for the context of developing economies. According to TAM, technology adoption is driven by perceived usefulness and perceived ease of use [36]. In the case of AI in e-commerce, businesses and consumers from SADC have to view the AI-powered tools such as recommendation engines, chatbots, and fraud detection systems as useful and easy to integrate. This perception is often determined by the levels of digital literacy, internet infrastructural reliability, and the range of training and support available. Moreover, it relates to the developmental leapfrog hypothesis, which is often cited in development economics. Countries in the SADC region may attempt to leap certain stages of technological evolution and directly integrate advanced AI technologies to enhance competitiveness and accelerate the growth of e-commerce [37]. However, this necessitates fundamental shifts in policies pertaining to infrastructure, education, and

investment.

Further theories stemming from innovation studies are also relevant. Schumpeter's creative destruction theory emphasizes the impact of innovation, especially the use of AI, on markets and the opportunities it can form [38]. In the SADC region, the adoption of AI-powered e-commerce platforms will, on one hand, support the growth of brick-and-mortar businesses and on the other hand, initiate both the displacement of low-skilled employment and the rise of employment opportunities requiring advanced skills.

The Diffusion of Innovation Theory examines the adoption of AI-driven technologies within the SADC region [39]. The factors of relative advantage and compatibility, as well as complexity, trialability, and observability, will determine the pace at which e-commerce businesses and consumers adopt AI to enhance their operations. Policymakers and companies aiming to encourage AI utilization and reduce pushback need to consider these factors. Furthermore, the concept of absorptive capacity emphasizes a firm's potential to discern the worth of new, outside information, integrating it and strategically applying it [40]. E-commerce firms in the SADC region must strengthen their absorptive capacities if they are to strategically leverage AI solutions to gain a competitive edge.

Additionally, the framework benefits from insights gleaned from information systems theories. The Resource-Based View (RBV) defines competitive advantage as the outcome of a firm's unique and valuable resources [41]. AI, data analytics, and skilled professionals in these fields are valuable assets that can differentiate SADC-based e-commerce businesses and foster competitive advantage within the region.

The TOE framework has been established as a holistic model for understanding the determinants of technology adoption [42]. It entails the technological context of 'AI solutions' and their accessibility/availability, the organizational context of management support and culture, and the environmental context of government policies and competition for analyzing the adoption and implementation of AI in e-commerce businesses in the SADC region.

With the inclusion of these theoretical approaches, the research stands to enrich understanding of the multidimensional factors that influence the adoption and consequences of AI technology in e-commerce for the SADC region. It also permits the study of the growing issue of the role of AI in fostering inclusive e-commerce development in a developing country context, as well as the challenges and policy dilemmas it raises.

3. Research Methodology

This research undertook a systematic investigation into the effects of Artificial Intelligence (AI) technology on e-commerce businesses in developing countries, paying special attention to the Southern African Development Community (SADC). Given the technological infrastructure within SADC accompanied by the integrated business, socio-economic environment, a holistic understanding of the

phenomena required a mixed-methods approach.

This study was guided by a single research philosophy, which is pragmatism. This philosophy focuses on the consequences of a research problem and calls for the use of the most appropriate methods which answer the problem, as pointed out by Dehalwar and Sharma [43]. In these particular circumstances, such an approach allowed the researchers to merge both qualitative and quantitative components in order to provide a detailed analysis on the effect of AI on e-commerce activities. The qualitative aspect enabled the scholars to study the detailed accounts of various enterprise owners and managers, while the quantitative aspect offered statistical information about the adoption and attendant benefits.

The overall approach, or strategy selected for this research, includes a focus on the SADC region employing case study research design. This is because case studies permit elaborate description of a given context which accommodates the complexity associated with the use of AI technology in developing countries. The SADC region was chosen because of its diverse economy, technological infrastructure, and existing regional trade agreements, making it a representative sample of the developing world in terms of the advantages and challenges presented by AI adoption in e-commerce.

Considering the impact of Artificial Intelligence (AI) on e-commerce in the context of developing economies, with specific focus on the SADC region, requires particular attention to sampling techniques. The research was based on the entire scope of e-commerce activities within SADC and used a multi-stage sampling system to fully capture the region's disparate economic and technological profile. First, four countries were selected: South Africa, Botswana, Zambia, and Tanzania. These were primary case study countries based on their differing levels of development. From each country, e-commerce firms were selected using stratified random sampling within each business tier (small, medium, large) and industry (retail, tourism, services) sector. While the targeted sample size of 200 e-commerce businesses, with 50 from each country, based on power analysis calculations to demonstrate meaningful relationships between AI utilization and performance identifiable, this sample size may be perceived as limited if one seeks to explore the nearly boundless diversity contained in the SADC region. They based this sample on available time and resource constraints. The budgetary, logistical, and time limitations imposed necessitated this compromise amid competing demands for cross-country data collection. As a supplement alongside the statistical data, a purposive sample of five managers and five business owners per country, making a total of twenty, was selected from diverse industries and degrees of AI utilization for comprehensive qualitative interviews, enhancing the context of the statistical outcomes.

Data collection involved primary and secondary sources. Primary data was collected through two main instruments: semi-structured interviews and surveys. For e-commerce businesses, in-depth interviews were conducted with owners and managers to understand the extent to which AI was implemented in their

operations, including its advantages and challenges, as well as the overall strategies used. Open-ended questions were used in the interview guide to foster elaborate responses. E-commerce businesses were surveyed to gather quantitative information on the rates of AI adoption, its perceived benefits, challenges faced, and the impact on KPIs (key performance indicators). Secondary data were collected from industry reports, scholarly books and journals, as well as government documents to provide contextual and background information and to supplement the primary data analysis.

The accuracy and thoroughness of the research, as well as its cohesiveness, were maintained by taking specific steps to enhance the validity and reliability of the research. A small number of e-commerce businesses were used for pilot tests of the interview guide and survey questions to resolve cases of unclear and incongruent elements. Research instruments addressed all pertinent issues which ensured content validity. To improve dependability, uniform protocols were adhered to for the collection and processing of the data. The survey instrument's internal consistency was evaluated using Cronbach's alpha coefficient, where a score of 0.7 or above was deemed satisfactory.

Both qualitative and quantitative methods were employed for data presentation and analysis. Qualitative data derived from interviews was subjected to thematic analysis; recurring themes and patterns were identified, and organized into categories. These themes were then utilized to richly describe and explain the experiences of e-commerce businesses within the SADC region. Quantitative analysis of survey data was conducted through descriptive statistics and inferential statistics. AI adoption alongside numerous business metrics were analyzed for significant statistical correlations. Key findings were illustrated and presented in tables, charts, and graphs. A comprehensive and nuanced scope of the impact of AI technology on e-commerce in the SADC region was achieved by integrating the quantitative with the qualitative findings.

Ethical considerations were foremost during the entire research process. Participants were fully informed and granted consent, ensuring they understood the study, its objectives, that participation was voluntary, and they could withdraw at any point. Anonymity and confidentiality was ensured by the secure storage of the data, which had any identifying components stripped away. An appropriate institutional review board approval was obtained for the research to guarantee ethical compliance considerations alongside the prior review. In addition, the presentation of the findings strived to eliminate any possibilities of bias or subjective distortion of the data, thereby ensuring objective and unprejudiced reporting of the results. The study complied with the principles of beneficence, non-maleficence, respect for persons, and justice, demonstrating ethical integrity in the conduct of the research.

4. Data Analysis, Findings and Discussions

This research utilized a case study design concentrating on the SADC region and

applied a pragmatic research philosophy. The impact of AI on e-commerce was understood through both qualitative and quantitative data in a mixed-methods approach. The purpose of the study targeted four SADC countries: South Africa, Botswana, Zambia, and Tanzania. A stratified random sampling method was applied to 200 e-commerce businesses, followed by qualitative interviews with 20 purposively sampled business owners and managers. Data collection comprised of semi-structured interviews and surveys and thematic analysis was conducted on qualitative data while quantitative data was analyzed through descriptive and inferential statistics.

4.1. Demographic Overview of Respondents

Before delving into the core findings, understanding the demographic profile of the respondents is crucial. **Table 1** summarizes the key demographic characteristics of the participating e-commerce businesses.

Table 1. Demographic characteristics of surveyed e-commerce businesses (N = 200).

Characteristic	Category	Frequency	Percentage
Country	South Africa	50	25%
	Botswana	50	25%
	Zambia	50	25%
	Tanzania	50	25%
Business Size	Small	80	40%
	Medium	70	35%
	Large	50	25%
Industry Sector	Retail	90	45%
	Tourism	40	20%
	Services	70	35%
Years in Operation	Less than 3 years	60	30%
	3-5 years	80	40%
	Over 5 years	60	30%

Researcher's Construct (2025).

4.2. Qualitative Data Analysis: Findings and Discussion

The qualitative component in this research stemmed from the in-depth interviews with 20 business owners and managers. Their perspectives provided a deep understanding regarding the experiences of operating e-commerce businesses in the SADC region, particularly with respect to adopting AI technology. Thematic analysis extracted important components about the advantages and disadvantages, and general influence of AI related to the support and implementation of their technology.

Perceived Benefits of AI Adoption

Improved operational efficiency as a result of AI adoption stood out as a striking theme from the interviews. Respondents pointed to enhanced accuracy and efficiency as a result of automation of menial tasks by AI tools. A South African business owner said, “AI has allowed us to automate our customer service responses, freeing up our staff to focus on more complex issues. This has significantly improved our efficiency and reduced our response times.” This supports Al-Surmi, Bashiri and Koliouis on AI and operational efficiency [44]. However, the impact of efficiency gains differed depending on the depth and breadth of AI adoption.

Another important advantage observed was an improved customer experience. AI provides customers with tailored experiences using marketing and promotion, recommendation systems, and ongoing interaction through chatbots. It ensures customer acquisition and aids in retention. A manager from a tourism e-commerce company in Botswana remarked, “Our AI-driven recommendation engine has helped us to personalize travel packages for our customers, leading to increased sales and customer satisfaction.” This provides additional evidence for the argument that AI empowers businesses to create more customized and sophisticated interactions, which is vital in the current era of aggressive competition in e-commerce [45].

Challenges of AI Adoption

Adopting AI technologies resulted in several challenges for businesses, even when considering the advantages. One of the issues was the considerable expense incurred during implementation and ongoing maintenance. Significant investment as well as continuous training and technical support costs posed challenges for businesses, especially small and medium enterprises (SMEs). A Zambian business owner noted, “The cost of implementing AI is very high. We are a small business, and it is difficult for us to afford the necessary infrastructure and expertise.” This highlights the risk of a digital divide whereby smaller businesses stand to suffer more from the lack of AI adoption as compared to larger resource abundant businesses [46].

Another critical challenge was the inadequate number of skilled professionals. Businesses had a hard time retaining employees with the required skills to design, develop, and operate the AI systems. “Finding skilled AI professionals is a major challenge. There is a shortage of talent in the market, and the available talent is very expensive,” said a manager from a retail e-commerce business in Tanzania. These statements, combined with Aderibigbe’s findings, showcase the need for proactive efforts from governments and universities focused on education to close the widening skill gap in AI.

In addition, there was the issue of data privacy and security. Businesses were particularly concerned about the risk of data breaches and the necessity for compliance with data protection laws. A South African business owner remarked, “We are very concerned about data privacy and security. We need to ensure that we

are protecting our customers' data and complying with all relevant regulations." This underscores the need for creating rigorous data governance and cybersecurity frameworks to address risks that come with the adoption of AI technologies [47].

Impact of AI on Business Outcomes

The interviews also focused on the perception of the impact of AI technology on critical business performance indicators. Businesses reported increases in sales revenue, customer retention, and improvement in the reputation of the company. However, these improvements were not uniform as they depended on the particular AI tools used and the overall business strategy. It is important to note that not all businesses AI implementations, some faced initial negative impacts due to the challenges and costs associated with AI implementations.

Discussion of Qualitative Findings

The qualitative findings illuminate the intricacies of AI adoption within the SADC region. Businesses understand the advantages AI could offer; however, there are considerable challenges concerning costs, skills, and data privacy. This is in accordance with prior studies focusing on technology adoption in developing countries which articulated the need to address the infrastructural and skills gap within a developing country to aid equitable access to technology [48]. Moreover, these factors demonstrate the need for custom-tailored support and training specialized aimed to help businesses overcome these challenges in fully harnessing the promises of AI.

4.3. Quantitative Data Analysis: Findings and Discussion

The quantitative data collected through surveys provided statistical insights into AI adoption rates, perceived benefits, challenges, and the impact on key performance indicators (KPIs).

4.3.1. AI Adoption Rates

Table 2. AI adoption rates by country and business size.

Characteristic	Category	Number of Businesses	AI Adoption Rate (%)
Country	South Africa	50	60%
	Botswana	50	40%
	Zambia	50	30%
	Tanzania	50	20%
Business Size	Small	80	25%
	Medium	70	45%
	Large	50	70%
Total		200	36.5%

Researcher's Construct (2025).

Table 2 presents the AI adoption rates among the surveyed e-commerce businesses.

As illustrated in **Table 2**, the average AI adoption rate for the e-commerce businesses surveyed stood at 36.5%. Adoption rates differed markedly from one country to the other, with South Africa having the highest rate of 60% and Tanzania the lowest at 20%. In addition, larger businesses demonstrated a greater propensity to adopt AI as opposed to smaller businesses. All of these findings support the notion that the level of a country's economic development, technological infrastructure, and access to resources considerably influences the adoption of AI just as Al Hadwer *et al.* advocated concerning factors impacting technology adoption [49].

4.3.2. Perceived Benefits of AI (Quantitative)

Respondents were asked to rate the extent to which they agreed with statements about the benefits of AI on a Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). **Table 3** summarizes the mean scores for each perceived benefit.

Table 3. Perceived benefits of AI (mean scores).

Benefit	Mean	Standard Deviation
Improved Operational Efficiency	4.2	0.7
Enhanced Customer Experience	4.0	0.8
Increased Sales Revenue	3.8	0.9
Reduced Costs	3.5	1.0

Researcher's Construct (2025).

The findings reveal that operational effectiveness, as well as the overall customer experience, improves with the introduction of AI technologies, which all businesses, to some extent, endorses. However, the cost reduction benefits, in comparison, were not as evident. These findings confirm the qualitative data that were gathered, underscoring the mention of the efficiency improvements along with AI enhanced customer experience as the major drivers of value.

4.3.3. Challenges of AI Adoption (Quantitative)

Similarly, respondents were asked to rate the extent to which they agreed with statements about the challenges of AI. **Table 4** shows that challenges of AI adoption:

Table 4. Challenges of AI adoption (mean scores).

Challenge	Mean	Standard Deviation
High Cost of Implementation	4.5	0.6
Lack of Skilled Personnel	4.3	0.7
Data Privacy Concerns	4.0	0.8
Integration with Existing Systems	3.8	0.9

Researcher's Construct (2025).

The qualitative data, in particular, aligns well with the themes emerging from the quantitative data, suggesting that the high expense associated with the implementation, as well as insufficient skilled personnel within the organization, represented the most critical difficulties. Data privacy issues also stood out as important obstacles.

4.3.4. Impact on Key Performance Indicators (KPIs)

This study performed regression analysis in order to assess the effect of AI on key performance indicators (sales revenue growth, customer retention rate, and customer satisfaction) in e-commerce companies. The analysis performed revealed that AI usage showed a statistically significant positive correlation with revenue growth ($\beta = 0.32$, $p < 0.05$) and customer retention ($\beta = 0.28$, $p < 0.05$). This means that firms that embraced AI were able to achieve significant sales revenue growth and improvement in customer retention. On the other hand, the relationship of AI usage on customer satisfaction was low, suggesting that though the company may be adding revenue and retaining customers through the use of AI systems, it is not increasing their satisfaction.

Discussion

SADC region informants shed light on the interplay of e-commerce and AI in the region, showcasing the vernacular and textual nature of the research. The figure shows that the adoption rate of AI in businesses stands at 35 percent, which means this reflects where there is only conservative adoption of technology in the AI application in e-commerce within the region, indicating AI technology challenges projected in the article regarding business relations in developing economies. This aligns with prior research that emerging countries are typically perpetually lagging behind developed countries regarding the adoption of technology due to lack of developed infrastructure, skilled personnel and regulatory ambiguity [50].

As noted by Berry & Singh, the current focus of investment in artificial intelligence is aimed at the promotion and marketing of services, improvement of operational effectiveness, and patron servicing [51]. Aside from these factors, overall and sector-specific installation costs, underqualified personnel, data identity protection, and the scarce technical resources chiefly from developing nations pose industrywide challenges [52].

Qualitative data shows that while businesses recognize the potential value of AI, acting on that understanding remains particularly difficult. The combination of inadequate technical expertise and high cost of implementation create considerable challenges, particularly among small and medium sized enterprises (SMEs). This underscores the need for more tailored policy frameworks targeting AI adoption among SMEs that enable affordability to AI-enabled systems, advanced training and skills development funding, and robust regulations on ignorable systems legislation.

The findings regarding the impact on employment have telling inconsistencies. While some businesses complain about losing new potential employees to

competition, other firms express optimism about new opportunities to hire. This fits into the broader conversation surrounding the working world in the age of AI. Action from governments and businesses is required to resolve the concerning gap in education and workforce training directly pertaining to the new positions anticipated to emerge due to technological advancements.

From the perspective of policymakers, corporate leaders, and other researchers, the findings of the study raise some decisive insights. It is imperative for those in charge of public policy to concentrate on AI adoption by strengthening the overall framework, improving the skill-level ratio of the workforce, and issuing clear regulatory policies. It is equally important that business leaders design strategies aimed at the appropriate AI utilization in their frameworks. Other researchers need to investigate the implications of AI technology in the e-commerce sector and other industries in developing nations.

While regression analysis provides some valuable insight with respect to correlation, understanding the causative factors of how AI affects business performance greatly deepens the analysis. For example, the correlation of AI usage and growth of sales revenue ($\beta = 0.32$, $p < 0.05$) is notable. However, what particular factors contribute to this outcome? To illustrate, AI-based recommendation systems can suggest relevant products to customers by reviewing their purchase and browsing history, consequently facilitating more sales. Likewise, AI-based dynamic pricing systems can adjust prices in real-time, based on current market conditions, to maximize revenue. Regarding the positive correlation with retention ($\beta = 0.28$, $p < 0.05$), the causal factors are likely pre-determined by AI systems, which include Chabot's granting instant customer support, resolving matters promptly, which aids in retaining loyalty and cultivating customer appreciation.

Tailored marketing messages and offers further enhances a customer's perception of the brand, thus improving retention, as aided by artificial intelligence. The strong correlation with customer satisfaction, albeit weaker than that with retention, suggests that AI strategies, while effective in maintaining customer engagement through loyalty programs or automated communications, striving to enhance customer retention might fall short in delivering the more subtle elements of customer experience that elicit true satisfaction, such as AI algorithms addressing specific pain points, or offer real concern. Such investments in customer services aimed at improving this outcome were done by Berry & Singh. Hence, additional studies should attempt to determine and measure these particular causal pathways to enable a deeper analysis on the consequences of AI in relation to business performance and facilitate more precise implementation strategies.

5. Conclusion and Recommendations

Especially in the SADC regions, AI has considerable potential in advancing e-commerce activities in developing countries. However, its adoption and impacts vary widely. Established e-commerce companies are experiencing notable returns as a result of advanced customer service, greater operational efficiency, and

improved marketing functions from AI technologies. On the other hand, smaller businesses struggle to breach urgent AI-related barriers such as in-house technical expertise, high cost of AI solutions, quality data, and data privacy and security issues. The successful application of AI hinges on targeted policy actions to address extensive gaps in digital infrastructure, boost digital skills among consumers and enterprises, and develop frameworks that stimulate AI development while ensuring data privacy and security. If left uncorrected, these factors would mean that the full promise of AI to reshape e-commerce in the SADC region remains unrealized.

To address the gaps identified in the study, the following suggestions are made to aid the effective implementation and use of AI technologies in the e-commerce businesses within the SADC region:

Government Investment in E-Commerce Owners' AI Skills: Governments ought to launch and fund campaigns aimed at improving the digital skill levels and offering targeted AI training to entrepreneurs, managers and workers in e-commerce businesses. This may take the form of offering scholarships or conducting workshops and providing other relevant materials tailored to the needs of the e-commerce sector.

Enhanced AI Utilization through Easier Access to Internet: Enhanced access to the Internet by e-commerce businesses requires better and cheaper broadband infrastructure. It is therefore necessary to expand coverage of the networks, reduce costs, and implement initiatives for bridging the digital divide.

Increased Investment for Research, Development, and Partnerships in the E-Commerce Industry: Establishing regional AI hubs would foster innovation, collaboration, and knowledge sharing for the stakeholders of e-commerce. The hubs can be used for the research and development of AI solutions for the region and can also facilitate collaboration between businesses, academia, and government agencies for the SADC region.

Creation of AI-Friendly Regulatory Frameworks: Governments ought to construct specific and elaborate regulatory frameworks that balance promoting AI innovation with addressing ethics, data privacy, and security risks. Such frameworks should be responsive to the evolution of AI technologies and aim to balance innovation with the protection of consumer rights.

Promote Accessibility and Sharing of Data: Support the responsible sharing of anonymized and aggregated data among e-commerce businesses to enhance AI algorithm effectiveness and decision-making processes. This also demands the establishment of data governance frameworks that guarantee data's integrity, security, and adherence to privacy laws.

6. Areas for Further Research

Although this research greatly contributes to understanding the effect of AI on e-commerce businesses within the SADC region, there are some points which require additional attention:

The Economic Consequences of AI Implementation in E-commerce Over

Time: The longitudinal economic consequences of AI in e-commerce, especially in relation to job opportunities, productivity, and economic growth in the SADC region, continue to require research focus.

AI and Its Role in Fostering Inclusive Practices in E-commerce: More active investigation is needed into the ways in which AI can be utilized to foster inclusive e-commerce practices for underrepresented populations, including women, the youth, and people living with disabilities.

Conflicts of Interest

The authors declare no conflicts of interest.

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