Artificial Intelligence in Developing Economies: Unpacking Business Innovations, Prospects, and Challenges

Ezekiel T. Mutasa[1], Chitra Dhiwwale[2] and Sundaran Sagaran A. Gopal[3]

[1]DBA Researcher, Binary University of Management and Entrepreneurship, Malaysia, [2]Professor, Faculty of Science and Technology, DMIHER, Wardha (MS), India, [3]Adjunct Professor & Program Leader for MSc in Accounting & Finance , Binary University of Management & Entrepreneurship, Malaysia

Abstract
Artificial Intelligence (AI) stands as a revolutionary, disruptive and transformative technology with the capacity to significantly enhance business operations globally. In emerging economies, AI integration presents a dual landscape of vast opportunities and substantial challenges. This conference paper offers a comprehensive review of AI applications, prospects, and challenges in the manufacturing, agriculture, retail, financial services, healthcare, and mining key sectors within developing countries. By examining detailed case studies from Brazil, Chile, India, Ghana, Kenya, Nigeria, and South Africa, we highlight the notable benefits of AI. The research methodology involves an extensive literature review, analysis of case studies, surveys, and expert interviews. Findings indicate that AI can lead to significant improvements in business operations, such as increased productivity, innovation, cost savings, better decision-making, and competitiveness. However, challenges such as data privacy, security concerns, ethical considerations, and potential job displacement are particularly acute in developing economies. Additionally, high initial investment costs, limited access to advanced technology, inadequate digital infrastructure, and complex regulatory environments hinder widespread AI adoption. Despite these obstacles, the potential for AI to expand in predictive analytics, automation, and personalized services is promising, suggesting significant economic and social benefits. Addressing issues such as poor data quality, a shortage of skilled talent, and cultural resistance to change is crucial for effective AI deployment. This review emphasizes the need for strategic investments, robust policy frameworks, and capacity-building initiatives to fully harness AI's potential in emerging economies. Collaboration among policymakers, business leaders, and researchers is essential to overcome these challenges and leverage AI's capabilities to drive sustainable development, enhance competitiveness, and improve quality of life.

Introduction

Artificial Intelligence (AI) has emerged as a transformative force across various sectors, revolutionizing business operations, enhancing decision-making processes, and fostering innovation. Developed countries have rapidly adopted AI technologies, leveraging them to gain significant competitive advantages and drive economic growth. However, the adoption of AI presents a unique set of opportunities and challenges. Understanding these dynamics is crucial for harnessing its potential to support economic development and business performance.

The key industry sectors contributions to GDP in developing countries according to World Bank (2022) are:

- Manufacturing: 15-25% of GDP. (India, 17%)
- Agriculture: 10-30% of GDP. (Ethiopia, 35.8%)
- Healthcare: 4-6% of GDP. (Egypt, 5%)
- Retail and Finance: 15-25% of GDP. (Nigeria, 16%)
- Mining: 10-20% of GDP. (Ghana, 11.2%)

These sectors are critical to the economic development and structural transformation of developing countries, each facing unique challenges and opportunities as they integrate more advanced technologies and practices.

AI can play a pivotal role in addressing critical issues such as inefficiencies in manufacturing, mining, agricultural productivity, healthcare delivery, and financial inclusion with AI-driven solutions in agriculture can help optimize crop yields, improve supply chain efficiencies, and enhance food security (McKinsey & Company, 2023). Similarly, AI applications in healthcare can bridge the gap in access to quality medical services, particularly in rural areas (Globalization and Health, 2022) especially given severe resource constraints.

This paper aims to provide a systemic review of AI applications, prospects, and challenges in developing countries, offering insights and recommendations to support the effective and strategic adoption of AI technologies.

Problem Statement

While AI holds immense potential to transform business operations in developing countries, many organizations struggle with its adoption and integration, with the following being the primary challenges:

a) Poor Data Quality and Integration.
b) Inadequate Infrastructure including limited Internet connectivity and outdated hardware.
c) High financial investment required is often prohibitive for small and medium-sized enterprises (SMEs).
d) A critical shortage of Skilled Talent Shortage.
e) Cultural resistance to change and a lack of awareness about the benefits,

Understanding these challenges and identifying effective strategies to overcome them is crucial for businesses in developing countries to harness the full potential of AI. This paper

seeks to explore these issues comprehensively, providing insights and practical recommendations to facilitate the successful integration of AI technologies.

Limitations

This study is subject to several limitations that must be acknowledged:

1. **Scope of Case Studies:** The case studies included in this research are limited to specific sectors and countries, which may not fully represent the diversity of AI applications and challenges across all developing countries.
2. **Data Availability:** Limited access to reliable and up-to-date data on AI adoption and its impacts in developing countries may affect the comprehensiveness of the analysis.
3. **Generalizability:** The findings from this study may not be universally applicable to all developing countries due to differences in economic conditions, regulatory environments, and cultural contexts.
4. **Rapid Technological Changes:** The fast-paced evolution of AI technologies means that some insights and recommendations become obsolete with advancements.

By recognizing these limitations, this paper aims to provide a balanced and nuanced understanding of the opportunities and challenges associated with AI adoption in developing countries, offering valuable insights for researchers, policymakers, and business leaders.

Literature Review

Artificial Intelligence (AI) has rapidly emerged as a transformative technology, influencing various sectors globally (Hossain et al., 2023). This literature review provides an in-depth analysis of AI's impact on business operations in developing countries, examining both its applications and the challenges faced.

Globally, AI has revolutionized business operations by enhancing efficiency, decision-making, and innovation (Hossain et al., 2022). In developed countries, AI technologies such as machine learning, natural language processing, and robotics have been widely adopted across industries (Brynjolfsson & McAfee, 2017). These technologies facilitate automation, predictive analytics, and personalized customer experiences, driving significant competitive advantages. Companies like Amazon and Google leverage AI to optimize logistics, improve search algorithms, and enhance customer interactions (Kaplan & Haenlein, 2020).

In developing countries, AI adoption faces unique challenges but despite these hurdles, AI applications are making significant strides in various sectors.

Sectorial Literature Review

Manufacturing Sector: AI has the potential to transform the manufacturing sector by improving production efficiency and reducing costs (Hossain et al., 2024). In India, AI-driven automation in the automotive industry has led to significant improvements in production processes and quality control (Greason, 2023). Predictive maintenance systems powered by AI anticipate equipment failures, scheduling timely interventions to minimize downtime and enhance productivity (McKinsey & Company, 2023).

Agriculture Sector: AI addresses critical challenges such as low productivity and inefficient resource use. In Kenya, AI-driven platforms provide farmers with data-driven insights for better crop management, pest control, and weather forecasting (McKinsey & Company, 2023). These technologies enhance crop yields and contribute to food security and sustainable agricultural practices.

Retail and Financial Services: AI is revolutionizing the retail and financial services sectors by enabling personalized customer experiences and improving operational efficiencies. In South Africa, AI-driven inventory management systems help retailers optimize stock levels and reduce wastage (World Economic Forum, 2023). In Kenya, AI enhances financial inclusion through mobile banking and microfinance platforms, offering tailored financial products to underserved populations (World Bank, 2023).

Healthcare Sector: AI applications in healthcare improve access to quality services, particularly in rural areas. In India and Kenya, AI-powered diagnostic tools and telemedicine platforms enable remote consultations and early disease detection (Globalization and Health, 2022). These innovations are crucial in bridging the healthcare gap in underserved regions.

Mining Sector: AI technologies revolutionize the mining sector in developing countries by enhancing efficiency, reducing costs, and improving safety. In Ghana, AI-driven predictive maintenance systems have significantly decreased equipment downtime and maintenance expenses (Amankwah & Boateng, 2019). AI optimization of ore extraction in India has increased efficiency and minimized environmental impact (Kumar et al., 2020). In South Africa, AI-based mine safety systems predict and mitigate hazards through real-time data monitoring (Nkuna, 2021). However, widespread AI adoption faces obstacles such as high initial costs, lack of skilled labor, and insufficient digital infrastructure (Ogunleye et al., 2022).

Research Objectives
The primary aim of this study is to explore the applications, prospects, and challenges of Artificial Intelligence (AI) in business within developing countries. The specific objectives are:
a) To examine the potential benefits of AI in enhancing business operations and decision-making.
b) To identify the key challenges faced by organizations in adopting and integrating AI technologies.
c) To propose strategies for overcoming the challenges associated with AI implementation.
d) To analyze the implications of AI for different industries and explore its role in enhancing competitive advantage.
Assessing the impact of AI across sectors such as manufacturing, agriculture, retail, financial services, and healthcare in developing economies.

Research Questions
To achieve these objectives, the study addresses the following key research questions:
a) What are the primary prospects of AI in enhancing business operations in developing countries?
b) What challenges do organizations face in the adoption and integration of AI technologies in developing countries?
c) How can businesses in developing countries overcome the challenges associated with AI implementation?
d) What is impact of AI for different industries, and how can it be leveraged to gain a competitive advantage in developing countries?

By addressing these research questions, the study aims to provide a comprehensive understanding of the current state of AI in business within developing countries, offering insights and recommendations that can drive future growth and development.

Case Studies

This research reviews case studies analyzing the applications, prospects, and challenges of AI in adoption in developing countries. The analysis showcases the diverse applications and impacts of AI across manufacturing, agriculture, retail, financial services, mining and healthcare sectors,.

Manufacturing Sector

India: Predictive Maintenance and Quality Control: The automotive industry has seen substantial improvements in efficiency and productivity through AI technologies. Tata Motors has implemented AI-driven predictive maintenance systems, which use machine-learning algorithms to analyze data from vehicle sensors to predict potential failures before they occur, thereby reducing downtime and maintenance costs (Joshi, 2021). AI- quality control systems at Maruti Suzuki have increased defect detection accuracy, leading to higher product quality and customer satisfaction (Patil, 2020).

Brazil: Robotics and Automation: AI applications in robotics and automation have significantly improved production processes. Embraer, an aerospace manufacturer, uses AI-driven robots to automate assembly lines, resulting in increased production efficiency (Silva & Lima, 2022). AI in supply chain management has reduced logistics costs, optimizing the manufacturing process (Rodríguez, 2021).

Mexico: Supply Chain Management: Grupo Bimbo, a large food manufacturing company, has integrated AI to optimize logistics and distribution networks, reducing logistics costs and ensuring timely delivery (Rodríguez, 2021).

Agriculture Sector

Kenya: Precision Farming: The startup Twiga Foods uses AI to connect farmers with vendors, optimizing supply chains and reducing food waste. AI algorithms analyze market demand and supply trends, enabling better planning and distribution of produce (Twiga Foods, 2022).

India: Supply Chain Optimization: The National Agricultural Market (e-NAM) platform uses AI to connect farmers with buyers, reducing post-harvest losses and improving market access (CropIn Technology Solutions, 2021).

Brazil: Livestock Monitoring: Livestock monitoring enhance animal health management with companies like Fazenda Futuro using AI to track livestock health and optimize feeding schedules, thus improving productivity (Silva et al., 2022).

Nigeria: Crop Disease Detection: AI applications like AgriAI use machine-learning algorithms to detect early signs of crop diseases, resulting in timely intervention and management (AgriAI, 2023).

Retail and Financial Services

South Africa: Inventory Management: Retail companies like Pick n Pay use AI-driven inventory management systems to optimize stock levels, reducing overstocking and stock outs. These systems predict consumer demand, helping maintain optimal inventory levels and improve customer satisfaction (Pick n Pay, 2021).

Nigeria: Financial Inclusion: Fintech companies like Paystack and Flutterwave use AI to provide tailored financial products to underserved populations, increasing access to financial services in rural and low-income areas (Paystack, 2022; Flutterwave, 2022).

Brazil: Customer Personalization: Retailers like Magazine Luiza use AI for personalized customer experiences. AI algorithms analyze customer data to offer tailored recommendations, increasing customer satisfaction (Silva & Lima, 2021).

Kenya: Mobile Banking: Mobile banking, such as M-Pesa, have significantly increased rural banking access in Kenya, facilitating secure transactions and providing financial services to remote areas (M-Pesa, 2023).

Healthcare Sector

India: AI Applications in Rural Health Setting: AI technologies improve healthcare delivery with startups like Niramai have developed AI-based breast cancer screening tools that use thermal imaging and machine learning algorithms to detect cancer early, valuable in areas with limited diagnostic facilities (Niramai, 2021). AI-driven telemedicine platforms like Practo provide remote consultations and diagnostic tools, enhancing healthcare access and quality (Practo, 2022).

Brazil: AI in Radiology: AI applications in radiology, such as those at Hospital das Clínicas, have increased diagnostic accuracy, enabling timely medical interventions (Silva et al., 2022).

Nigeria: Remote Patient Monitoring: Remote patient monitoring systems in Nigeria, like HealthNet, improve chronic disease management by providing continuous health monitoring and timely interventions (HealthNet, 2023).

Mining Sector

South Africa: Enhancing Safety and Efficiency: Gold Fields uses AI to predict and prevent equipment failures, reducing downtime and maintenance costs and enhancing operational efficiency. AI also monitors environmental conditions and detects hazardous situations, reducing accident risks (Gold Fields, 2020) thus improving safety and efficiency.

Chile: Optimizing Mineral Processing: AI technology optimizes mineral processing with CODELCO using AI algorithms to enhance concentrator efficiency, increasing copper yield and reducing operational costs (CODELCO, 2021; González & Martínez, 2020).

India: Automation and Data Analytics: Vedanta Resources uses AI for automation and data analytics in mining operations, improving resource utilization, reducing costs, and enhancing productivity (Vedanta Resources, 2021; Rao & Subramanian, 2020).

Ghana: Environmental Monitoring and Compliance: Newmont Mining Corporation employs AI for environmental compliance, and to monitor emissions, waste management, and water usage. AI-powered drones survey mining sites, aiding in planning and minimizing environmental disruption (Newmont Mining Corporation, 2020; Ansu-Kyeremeh & Asiedu, 2019).

Research Methodology

This outlines the methodology used to investigate the applications, prospects, and challenges of Artificial Intelligence (AI) in business within developing countries. Integrating both qualitative and quantitative methods, the study aims to provide a comprehensive understanding of the subject.

Systematic Review

The systematic review examines AI applications in business within emerging markets through peer-reviewed journal articles, conference papers, industry reports, company annual reports, credible business websites, questionnaire interviews, and case studies. A structured search strategy was employed across databases like Scopus, Web of Science, IEEE Xplore, Google Scholar, and PubMed, focusing on studies from the last ten years using keywords such as "Artificial Intelligence," "AI," "emerging markets," "developing countries," "business applications," "opportunities," and "challenges."

Data extraction focused on study information, context, AI applications, business sectors, benefits, opportunities, challenges, and methodologies. The data were synthesized using qualitative thematic analysis and quantitative methods to provide statistical insights. Questionnaire interviews and case studies were analyzed to gain deeper insights into practical applications and real-world challenges. Quality assessment criteria included relevance, rigor, credibility, and contribution to the understanding of AI applications in emerging markets. Potential limitations, such as publication bias and language restrictions, were acknowledged.

Research Design

The research employs a mixed-methods approach, combining qualitative, case study analysis and thematic analysis. This design facilitates a robust analysis by capturing nuanced stakeholder perspectives and providing empirical data to support the findings.

Qualitative Approach

Case Studies

Case studies from sectors such as manufacturing, agriculture, retail & financial services, healthcare and mining in countries like Brazil, Chile, India, Nigeria, Ghana, Kenya, and South Africa provide detailed insights into AI applications, challenges, and strategies (Yin, 2018).

Interviews

Semi-structured interviews with business leaders, AI experts, policymakers, and employees gather in-depth information on experiences, perceptions, and attitudes towards AI adoption and integration in business operations. Interviews: Conducted with 41 stakeholders across various sectors. Surveys: Distributed to 54 businesses, aiming for a response rate of at least 60%.

Secondary Data Analysis

Secondary data from reputable sources, including industry reports, government publications, and academic journals, provide statistical insights into AI adoption rates, investment trends, and economic impacts, contextualizing the primary data.

- Industry Reports: Sources include McKinsey & Company, World Economic Forum, and World Bank reports.
- Government Publications: Data from national statistics bureaus and policy documents.
- Academic Journals: Articles from journals like Globalization and Health and Business Horizons.

This structured approach offers a thorough synthesis of the literature, highlighting the dynamic interplay of AI applications, opportunities, and challenges in emerging markets.

Data Analysis Plan
Qualitative Data Analysis
The research used the following analysis approach from the case studies and interviews:
Thematic Analysis: Used to identify patterns and themes from interviews and focus groups. Coding is performed using software to ensure systematic analysis (Braun & Clarke, 2006).
Case Study Analysis: Detailed examination of each case study to understand the context-specific applications and challenges of AI.

Triangulation, Validity and Reliability
Carefully designed semi-structured surveys bolster internal validity by allowing in-depth exploration of themes with consistency. Triangulation, validity, and reliability are crucial for ensuring robust research findings, particularly in case study analysis and thematic analysis from semi-structured surveys (Noble & Smith, 2019). Triangulation involves using multiple data sources and methods to enhance research credibility (Flick, 2018; Yin, 2020). Validity, both internal and external, ensures findings accurately reflect reality and can be generalized Thematic analysis rigorously applied ensures data accurately represents participants' perspectives (Clarke & Braun, 2019). Reliability is achieved through systematic data collection and analysis, such as clearly defined coding schemes and detailed case study protocols (Creswell & Poth, 2018).

Ethical Considerations
Ethical considerations include obtaining informed consent from all participants, ensuring confidentiality of the data, and adhering to ethical guidelines for research involving human subjects. Ethical and social issues, including and data privacy, also require attention (Dlamini & Thwala, 2020). Ethical approval is sought from relevant institutional review boards.
This methodology provides a structured and rigorous approach to investigating AI applications in developing countries; through case study analysis and thematic analysis from surveys it ensures the collection of reliable and valid data to support the research objectives.

Data Analysis
From the analysis the following table was compiled summarizing the results. Table 1, shows the sector, country and projects analyzed in each case study and gives the AI application, with the identified benefits and challenges faced:

Table 1

Benefits and Challenges of AI adoption by Sector

Sector	Country	Company Project	AI Application	Benefits	Challenges	References
Manufacturing	India	Tata Motors	Predictive maintenance, quality control	30% reduction in machine downtime, 25% increase in defect detection accuracy	Data quality issues, high costs	Joshi (2021); Patil (2020)
	Brazil	Embraer	Robotics and automation	20% increase in production efficiency, 15% reduction in logistics costs	Skilled talent shortage, resistance to change	Silva & Lima (2022); Rodríguez (2021)
	Mexico	Grupo Bimbo	Supply chain management	15% reduction in logistics costs	Infrastructure deficiencies	Rodríguez (2021)
Agriculture	Kenya	Twiga Foods	Precision farming, supply chain optimization	20% increase in crop yield, reduced food waste	High costs, resistance to new technology	Twiga Foods (2022); CropIn Technology Solutions (2021)
	India	CropIn Technology	Precision farming	Increased yields, reduced resource wastage	Skilled talent shortage	CropIn Technology Solutions (2021)
	Brazil	Fazenda Futuro	Livestock monitoring	25% improvement in livestock productivity	Ethical concerns, high costs	Silva et al. (2022)
	Nigeria	AgriAI	Crop disease detection	30% reduction in crop loss	Data quality issues, high costs	AgriAI (2023)
Retail & Financial Services	South Africa	Pick n Pay	Inventory management	18% reduction in stockouts	Resistance to change, infrastructure deficiencies	Pick n Pay (2021)
	Nigeria	Flutterwave	Financial inclusion	25% increase in financial inclusion	Skilled talent shortage, high costs	Flutterwave (2022)
	Brazil	Magazine Luiza	Customer personalization	20% increase in customer satisfaction	Data quality issues, ethical concerns	Silva & Lima (2021)
	Kenya	M-Pesa	Mobile banking	30% increase in rural banking access	Infrastructure deficiencies, resistance to change	M-Pesa (2023)

Table 1

Benefits and Challenges of AI adoption by Sector (continued)

Sector	Country	Company Project	AI Application	Benefits	Challenges	References
Healthcare	India	Niramai	Diagnostic tools, telemedicine	30% increase in early cancer detection rates, 20% increase in healthcare access	Skilled talent shortage, infrastructure deficiencies	Niramai (2021); Practo (2022)
	Brazil	Hospital das Clínicas	AI in radiology	25% increase in diagnostic accuracy	High costs, skilled talent shortage	Silva et al. (2022)
	Nigeria	HealthNet	Remote patient monitoring	30% improvement in chronic disease management	Data quality issues, high costs	HealthNet (2023)
Mining	South Africa	Gold Fields	Predictive maintenance, safety	Reduced downtime and maintenance costs, improved safety	Data quality issues, infrastructure deficiencies	Durrant-Whyte & Bailey (2019); Gold Fields (2020)
	Chile	CODELCO	Mineral processing optimization	Increased copper yield, reduced energy consumption	High costs, skilled talent shortage	CODELCO (2021); González & Martínez (2020)
	India	Vedanta Resources	Automation, data analytics	Improved resource utilization, reduced costs	Infrastructure deficiencies, high costs	Vedanta Resources (2021); Rao & Subramanian (2020)
	Ghana	Newmont Mining	Environmental monitoring, compliance	Ensured compliance, promoted sustainable practices	Ethical concerns, regulatory compliance issues	Newmont Mining Corporation (2020); Ansu-Kyeremeh & Asiedu (2019)

Table 1 highlights the benefits and challenges of AI adoption across various sectors and countries. In manufacturing, companies like Tata Motors in India and Embraer in Brazil experienced significant improvements in production efficiency and quality control, despite challenges such as high costs and skilled talent shortages (Joshi, 2021; Patil, 2020; Silva & Lima, 2022). In agriculture, AI applications led to increased crop yields and reduced food waste in Kenya and India, although high costs and resistance to new technology remained obstacles (Twiga Foods, 2022; CropIn Technology Solutions, 2021). In retail and financial services, AI enhanced inventory management and financial inclusion in South Africa and Nigeria, facing resistance to change and data quality issues (Pick n Pay, 2021; Flutterwave, 2022). The healthcare sector saw improvements in diagnostic accuracy and healthcare access through AI tools in India and Brazil, yet struggled with infrastructure deficiencies (Niramai, 2021; Silva et al., 2022). Lastly, in the mining sector, AI applications improved safety and

efficiency in South Africa and Chile, but faced high costs and regulatory challenges (Gold Fields, 2020; CODELCO, 2021).

Findings and Conclusion
From the case study and thematic analysis the following findings and conclusion has been developed:

Analysis of AI Benefits
The analysis of AI applications in developing countries reveals substantial benefits across various sectors:

- **Enhanced Decision-Making and Operational Efficiency:** AI technologies have significantly improved decision-making processes and operational efficiency. In the manufacturing sector, predictive maintenance and quality control systems have reduced downtime and defects, leading to cost savings and higher productivity (Joshi, 2021; Patil, 2020). In agriculture, precision farming tools have optimized resource use, leading to increased crop yields and reduced wastage (CropIn Technology Solutions, 2021). Some critics however argue that the reliance on AI for decision-making can sometimes lead to overdependence on technology, compromising contextual human judgment (Brynjolfsson & McAfee, 2017).

- **Innovation and Competitiveness:** AI has driven innovation, enabling businesses to develop new products and services. Nigeria has expanded access to banking and financial products for underserved populations, fostering financial inclusion and economic growth (Paystack, 2022; Flutterwave, 2022). There is however a counterargument that the rapid pace of AI innovation can exacerbate existing inequalities by disproportionately benefiting those who already have access to advanced technologies and financial resources (Kaplan & Haenlein, 2020; Hossain et al., 2024)).

- **Improved Healthcare Delivery:** AI applications in healthcare have enhanced diagnostic accuracy and accessibility, particularly in rural areas with screening tools and telemedicine platforms delivering early disease detection and patient outcomes (Niramai, 2021; Practo, 2022). Contrarily, to this finding some studies suggest that AI in healthcare can lead to ethical and privacy concerns, as well as dependency on technology, which might undermine the human touch crucial in patient care (Davenport & Kalakota, 2019).

To fully harness the benefits of AI while addressing these concerns, a balanced approach that includes robust ethical guidelines, equitable access to technology, and the integration of human expertise with AI systems is essential.

AI Prospects in Developing Countries
The analysis produced the following prospects for AI in business within developing countries:

- **Integration of AI for Predictive Analytics for Maintenance and Enhanced Enterprise Management:** AI-driven predictive analytics can significantly improve maintenance schedules and enterprise management, leading to reduced downtime and cost savings (Joshi, 2021). However, the integration of AI in these areas may be hampered by the high costs of implementation and maintenance, which can be prohibitive for small and medium-sized enterprises (Pick n Pay, 2021).

- **Early and Wider Problem, Fault, Diagnosis, and Disease Detection and Monitoring:** AI technologies enable early detection and monitoring of various issues, from machinery faults in manufacturing to disease outbreaks in healthcare (Niramai, 2021). Despite these advantages, the reliability of AI diagnostics can sometimes be questioned, with potential risks of false positives or negatives affecting trust and adoption (Davenport & Kalakota, 2019).

- **Enhanced Decision Support Systems:** AI-enhanced decision support systems can provide valuable insights and recommendations, improving business outcomes (CropIn Technology Solutions, 2021). Nevertheless, there is concern that over-reliance on AI might undermine human judgment and intuition, which is often critical in decision-making processes (Brynjolfsson & McAfee, 2017).

- **Development of Products and Services for Wider and Remote Underserved Communities:** AI can facilitate the creation of products and services tailored to the needs of underserved populations, enhancing access and inclusivity (Flutterwave, 2022). On the contrary, there is a risk that such initiatives might not reach their full potential due to infrastructural challenges and digital divides prevalent in remote areas (McKinsey & Company, 2023).

- **Improved Supply Chain and Inventory Management Systems:** AI can optimize supply chain operations and inventory management, reducing costs and increasing efficiency (Rodríguez, 2021; Hossain et al., 2024)). However, the implementation of these systems can be met with resistance to change and require significant training and adaptation (Patil, 2020).

- **Real-Time Health, Resource, and Performance Optimization and Monitoring:** AI enables real-time monitoring and optimization of health, resources, and performance, leading to better outcomes in various sectors (Practo, 2022). Despite these benefits, concerns around data privacy and security remain significant, the collection and use of real-time data can pose risks if not managed properly (Kaplan & Haenlein, 2020; Hossain et al., 2024).

  These prospects highlight the transformative potential of AI in developing countries, though they must be addressed with strategic investments, policy frameworks, and awareness programs to overcome associated challenges.

Cross-Sectoral Challenges
The deployment of AI in developing countries presents a myriad of opportunities and challenges. Despite the promising benefits, several challenges hinder the widespread adoption of AI in developing countries.

Cross Sectorial Challenges		
Challenge	**Description**	**Impact**
Data Quality and Integration	Poor data quality and lack of integration systems (Joshi, 2021).	Affects AI model training and deployment
Infrastructure Limitations	Inadequate technological infrastructure (McKinsey & Company, 2023).	Limits the effectiveness of AI applications
High Costs	High financial investment required (Pick n Pay, 2021).	Prohibitive for SMEs
Shortage of Skilled Talent	Lack of skilled AI professionals (World Bank, 2023)	Restricts capacity to implement AI technologies
Resistance to Change	Cultural resistance and lack of awareness (Patil, 2020)	Creates barriers to AI adoption

Despite the promising benefits, such as increased efficiency and enhanced decision-making across sectors, several cross-sectional challenges hinder widespread AI adoption. Poor data quality and lack of integration systems (Joshi, 2021) affect AI model training and deployment. Inadequate technological infrastructure (McKinsey & Company, 2023), especially in rural areas, limits AI application effectiveness. High costs associated with AI technologies (Pick n Pay, 2021) pose financial barriers, particularly for SMEs. The shortage of skilled AI professionals (World Bank, 2023) further restricts capacity to implement and manage AI technologies effectively. Additionally, cultural resistance and a lack of awareness (Patil, 2020) create barriers to AI adoption.

However, there are opposing arguments that suggest these challenges are not insurmountable, with some researchers arguing that AI can leapfrog traditional technological infrastructure constraints by utilizing mobile technology and cloud computing (Chui & Manyika, 2020). Furthermore, initiatives like the AI4D

(Artificial Intelligence for Development) challenge demonstrate that with targeted funding and strategic partnerships, AI can be deployed effectively even in resource-constrained settings (AI4D, 2022). Moreover, the financial barriers posed by high costs are being mitigated through innovative financing models and public-private partnerships with the International Finance Corporation (IFC) being instrumental in supporting AI startups in developing countries, helping to reduce the financial burden on SMEs (IFC, 2021).

Contrary to the notion of a severe talent shortage, some argue that the burgeoning AI education and training programs in developing countries are rapidly closing this gap. Universities and online platforms are increasingly offering AI courses tailored to the needs of these regions (Sharma et al., 2021). Cultural resistance and lack of awareness are also being addressed through comprehensive education and change management initiatives, demonstrating that these barriers can be overcome with concerted effort (Ransbotham et al., 2020).

Overcoming these challenges requires strategic investments, capacity building, and robust policy frameworks to harness AI's full potential in developing countries. By addressing the existing constraints and leveraging innovative solutions, the deployment of AI can drive significant socio-economic development in these economies.

Recommendations
For Policymakers
a) **Develop Supportive Policies:** Create policies that encourage AI adoption while addressing ethical, legal, and socio-cultural considerations. Incentives for AI investments and R&D can stimulate innovation (Globalization and Health, 2022).
b) **Invest in Infrastructure:** Prioritize investments in technological infrastructure, particularly in rural areas, to support AI deployment (World Economic Forum, 2023).

For Business Leaders
a) **Adopt Change Management Strategies:** Implement effective change management strategies to address resistance to AI adoption. Educate employees and stakeholders about the benefits and applications of AI (Patil, 2020).
b) **Invest in Training and Capacity Building:** Develop training programs to enhance the skillsets of employees and bridge the talent gap in AI expertise (CropIn Technology Solutions, 2021).

For Researchers
a) **Conduct Further Studies:** Explore sector-specific AI applications and their impacts in developing countries. Longitudinal studies can provide deeper insights into the long-term benefits and challenges of AI adoption (Niramai, 2021).
b) **Investigate Policy Impacts:** Analyze the effects of different regulatory frameworks on AI adoption and innovation. Comparative studies between regions with varying policies can offer valuable insights (Globalization and Health, 2022).

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