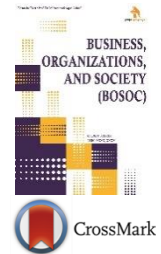




e-ISSN: 3009-1470 (Online)
CODEN: BOSUBO

BUSINESS, ORGANIZATIONS AND SOCIETY (BOSOC)

DOI: <http://doi.org/10.26480/bosoc.02.2023.56.61>



REVIEW ARTICLE

HARNESSING AI FOR AFRICA'S FINANCIAL FORTIFICATION: A REVIEW

Oluwaseun Augustine Lottu^a, Kehinde Mobolaji Abioye^b, Fuzzy Naomi Oguntinyinbo^b, Adekunle Abiola Abdul^c, Chibuike Daraojimba^{d*}

^aIndependent Researcher, UK

^bIndependent Researcher, New Jersey USA

^cIndependent Researcher, Maryland, USA

^dUniversity of Pretoria, South Africa

*Corresponding Author Email: chibuike.daraojimba@tuks.co.za

This is an open access journal distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited

ARTICLE DETAILS

Article History:

Received 13 September 2023

Revised 17 October 2023

Accepted 20 November 2023

Available online 30 November 2023

ABSTRACT

Africa's financial landscape presents a complex tapestry characterized by adversity and opportunity. It is home to a significant portion of the world's unbanked and underbanked population, with millions still lacking access to fundamental financial services. However, amid these challenges, Africa also boasts a burgeoning tech-savvy population, a growing number of innovative fintech startups, and governments increasingly recognizing the pivotal role of financial inclusion in sustainable development. This dynamic interplay between adversity and opportunity defines Africa's financial sector, shaping its trajectory during this economic and technological transformation era. This paper explores the challenges and opportunities of adopting Artificial Intelligence (AI) within the African financial sector. The study researches the current landscape, underlining key statistics such as the substantial percentage of African unbanked individuals. It also identifies significant barriers to AI adoption, such as infrastructure limitations, data quality issues, and regulatory ambiguities. To address these challenges effectively, the paper proposes actionable recommendations targeted at policymakers, financial institutions, and stakeholders. To maximize AI's potential for transforming the African financial sector, strategies for infrastructure development, data quality enhancement, regulatory clarity, skills development, and the ethical deployment of AI are discussed. This paper highlights the challenges and underscores AI's immense potential for financial inclusion and economic growth in Africa.

KEYWORDS

artificial intelligence, Africa, financial fortification, economic development, digital transformation, machine learning, data analytics, banking sector, blockchain technology

1. INTRODUCTION

Africa is the world's second-largest continent both in land area and population (Grundling & Grootjans, 2016). It is a land of immense potential and profound challenges. While its natural beauty and cultural diversity have long captivated the global imagination, its financial landscape has remained an arena of complex dynamics and pressing needs. The continent has witnessed remarkable economic growth and transformation in recent years, underpinned by an expanding middle class, increasing urbanization, and a growing appetite for innovation (Hussein & Suttie, 2016; Mukasa, Woldemichael, Salami, & Simpasa, 2017). Nevertheless, Africa's financial infrastructure has struggled to keep pace with this rapid evolution, leaving many communities underserved and hindering broader economic development (Baporikar, Nambira, & Gomxos, 2016; Shipalana, 2019). Africa's financial landscape is a tapestry woven with both adversity and opportunity. On the one hand, it bears witness to a significant portion of the world's unbanked and underbanked population, where access to even essential financial services remains a distant dream for millions. On the other hand, it boasts an increasingly tech-savvy population, a growing number of innovative fintech startups, and governments recognizing financial inclusion's pivotal role in driving sustainable development.

In an era marked by unprecedented technological advancements, the role of Artificial Intelligence (AI) in financial fortification stands as a beacon of promise for economies worldwide (R. Liu, Gupta, & Patel, 2021). Nowhere is this potential more profound and urgently needed than in the context of Africa, where a dynamic interplay of challenges and opportunities marks the financial landscape. Financial fortification refers to reinforcing a

nation's or region's financial systems to ensure resilience, inclusivity, and sustainable growth. The significance of this endeavor cannot be overstated, as robust financial systems are the lifeblood of any thriving economy. They facilitate investment, savings, entrepreneurship, and economic mobility, ultimately improving living standards and reducing poverty.

With its capacity for data-driven decision-making, predictive analytics, and automation, AI offers a transformative toolkit for achieving financial fortification in Africa (Union, 2020). Africa is home to many of the world's unbanked and underbanked populations (Bhyer, Lee, & Seyoung, 2019; Stringham, 2023). Traditional banking infrastructure often struggles to reach remote or marginalized communities. AI-powered mobile banking and digital financial services can extend the reach of formal financial institutions, bringing the unbanked into the financial fold (Kandpal & Khalaf, 2020). AI's ability to assess credit risk and tailor financial products to individual needs can create pathways to financial inclusion previously deemed unviable.

The African financial sector, like any other, faces risks such as fraud, cyberattacks, and financial instability. AI-driven fraud detection algorithms can quickly spot fraudulent activities, safeguarding consumers and financial institutions. AI-powered risk assessment models can boost financial system stability by offering timely insights into potential weaknesses (IA & Miglionico, 2019; Ibrahim, 2019). AI-driven chatbots and virtual assistants are revolutionizing customer service in finance, offering round-the-clock support, answering customer inquiries, and simplifying account management. This accessibility builds trust and

Quick Response Code



Access this article online

Website:
www.bosoc.com.my

DOI:
[10.26480/bosoc.02.2023.56.61](https://doi.org/10.26480/bosoc.02.2023.56.61)

broadens financial service access. In resource-constrained settings, AI can automate routine financial tasks, cut operational costs, and streamline processes, benefiting financial institutions' bottom lines (Javaid, Haleem, & Singh, 2023).

AI's capacity to analyze extensive data enables personalized financial advice and investment recommendations. Tailoring financial services to individual needs helps households make informed decisions about savings, investments, and retirement planning, bolstering financial resilience at the grassroots level. In addition, Africa's financial regulatory environment is complex. However, AI can aid institutions by automating compliance checks and reporting, ensuring adherence to regulations while easing administrative burdens. In sum, AI holds immense promise in fortifying Africa's financial systems. It offers solutions to break down traditional barriers to financial inclusion, enhance security, improve efficiency, and empower individuals and businesses to make better financial decisions.

This paper will journey through Africa's diverse regions, explore the unique cultural and social dynamics that shape financial behavior, and examine the role of traditional banking institutions in the digital age. Most importantly, it will illuminate the potential of AI as a catalytic force that can bridge gaps, enhance efficiencies, and bolster Africa's financial fortification.

2. LITERATURE REVIEW

2.1 Historical and Current State of the Financial Sector in Africa

Africa, the world's second-largest continent, possesses a rich tapestry of history, cultures, and landscapes (Stevanovic & Wanyang'Ochieng, 2023). Within this diverse mosaic, the financial sector has played a pivotal role in shaping the continent's trajectory. The history of finance in Africa is deeply entwined with its colonial past (Ekeh, 1975). In their quest for economic dominance, European colonial powers established banking systems and financial infrastructure across the continent. However, these systems primarily served colonial interests, with limited benefits for local populations.

Colonial powers set up centralized financial systems that facilitated the extraction of resources. These systems were geared towards financing colonial enterprises, often sidelining indigenous financial practices. As a result, traditional African financial systems, such as the rotating savings and credit associations common in many communities, were marginalized. Independence movements in the mid-20th century ushered in a new era for African nations. Many countries sought to establish their financial sovereignty by creating national banks and currency systems. However, the transition was often marred by challenges, including financial instability, currency devaluation, and a lack of access to modern financial services for a substantial portion of the population (Bernards, 2022; Lewis, 2000; Mandondo, 2000).

Following independence, African countries began to develop their financial sectors to support economic growth and development. Key milestones include the establishment of central banks and the introduction of national currencies. African governments also created commercial banks to facilitate trade and investment. However, challenges persisted. Financial systems were often characterized by inefficiency, undercapitalization, and limited access to banking services. The dominance of state-owned banks in many countries stifled competition and innovation (Issawi, 2013; Maxfield, 1998).

As we transition to the present day, the African financial sector has experienced significant changes and continues to evolve. The financial sector in Africa is divided into Sub-Saharan Africa (SSA) and the Middle East and North Africa (MENA) region. The former is a group of economies that are often more connected to global markets than to their neighbors, while the latter is tied to the Middle East through cultural ties, including a shared language and dominant religion. The financial sector in Africa has been growing rapidly in recent years, with many countries experiencing significant economic growth (Anwar & Iwasaki, 2022; Omar Bakar, Sulong, & Chowdhury, 2022). According to a survey conducted in 2006, the financial and real estate sectors contributed the largest to economic growth in South Africa. However, the sector still faces many challenges, including a lack of access to finance for small and medium-sized enterprises (SMEs), inadequate infrastructure, and low levels of financial literacy (Beck & Demirguc-Kunt, 2006).

Many African nations have achieved notable economic growth in recent decades, driven by factors such as improved governance, increased foreign investment, and a burgeoning middle class. This growth has

provided a solid financial sector development foundation (Ali, Anufriev, & Amfo, 2021; Onifade et al., 2020). In terms of banking, South Africa has the most developed banking system on the continent (Kshetri, 2019). The country's banking sector is dominated by four large banks: Standard Bank, FirstRand Bank, Absa Bank, and Nedbank (Mushonga, Arun, & Marwa, 2019; Pietrus, Nazarian, & Izadi, 2020). These banks have been profitable historically but are now facing increasing competition from new entrants into the market. One of the most transformative developments in Africa's financial sector is the pursuit of financial inclusion. Efforts to bring unbanked and underbanked populations into the formal financial system have gained momentum. Mobile banking and digital financial services have been crucial in expanding access to financial services, especially in rural areas. Mobile banking allows people to access financial services through their mobile phones, instrumental in areas with limited access to traditional banking services.

More so, many African countries have undertaken regulatory reforms to foster a more conducive environment for financial sector growth. These reforms aim to enhance financial stability, protect consumers, and encourage competition. Africa has become an attractive destination for foreign direct investment (FDI) in various sectors, including finance. Multinational financial institutions are expanding their presence on the continent, contributing to infrastructure development and the modernization of financial services (Iqbal et al., 2018; Mallampally & Sauvart, 1999). The insurance industry in Africa is also growing rapidly. According to a report by the Swiss Re Institute, insurance premiums in Africa grew by 12% in 2018, compared to a global average of 3%. However, insurance penetration remains low in many African countries due to a lack of awareness and trust in insurance products (Bansal & Kanwal, 2018; Signé & Johnson, 2020).

In conclusion, the financial sector in Africa has come a long way over the years. While significant improvements have been made in recent years, many challenges still need to be addressed. However, with continued investment and innovation, there is no doubt that the financial sector in Africa will continue to grow and play an essential role in driving economic development on the continent.

2.2 AI Applications in Finance

Artificial Intelligence (AI) has been transforming the financial sector globally and in Africa. AI is a transformative technology that allows organizations to unlock the power of their financial data and improve decision-making while also easing regulatory compliance and providing accurate predictive and analytical insights (Awotunde, Adeniyi, Ogundokun, & Ayo, 2021; Ndung'u & Signé, 2020).

AI applications in finance globally range from the use of machine learning algorithms to improve forecasting and credit risk scoring to natural language processing powering chatbots that support customer service and report generation processes. AI's ability to improve anomaly detection provides an essential layer to help financial institutions limit insider trading and enhance fraud detection. McKinsey data suggest the potential annual value of AI and analytics within the global banking sector could reach \$1 trillion, with marketing and sales, risk, and HR as the highest-value business functions for AI support (Lund et al., 2019).

In Africa, AI has been used to address some of the challenges faced by the financial sector. For example, mobile banking has become increasingly popular in Africa, allowing people to access financial services through their mobile phones, particularly useful in areas with limited access to traditional banking services. In addition, AI has been used to develop credit scoring models to help financial institutions assess creditworthiness more accurately. AI has also been used to improve fraud detection in Africa. For example, Standard Bank in South Africa has implemented an AI-powered fraud detection system that uses machine learning algorithms to identify fraudulent transactions. The system has successfully reduced fraud losses for the bank (Kshetri, 2021).

However, many challenges still need to be addressed before AI can be fully integrated into the financial sector in Africa. One of the main challenges is a lack of data. Many African countries lack the necessary data infrastructure to support AI applications in finance. In addition, there is a shortage of skilled personnel who can develop and implement AI solutions. Another challenge is the high cost of implementing AI solutions (Vărzaru, 2022). Many African countries have limited resources, making investing in expensive technologies like AI difficult. This means that many financial institutions in Africa may not be able to implement AI solutions, which could put them at a disadvantage compared to their competitors, who have access to these technologies. There are also concerns about the ethical implications of using AI in finance. For example, there are concerns

about bias in credit scoring models developed using AI algorithms. If these models are biased against certain groups of people, it could lead to discrimination and exclusion from financial services (Remolina, 2022; Stypinska, 2023).

Despite these challenges, there are many opportunities for financial fortification in Africa using AI. For example, AI can be used to develop innovative financial products tailored to African consumers' needs. In addition, AI can improve financial literacy among African consumers by providing personalized financial advice and education. In summary, while many challenges need to be addressed before AI can be fully integrated into the financial sector in Africa, there are also many opportunities for financial fortification using this transformative technology. With continued investment and innovation, there is no doubt that AI will continue to play an increasingly important role in driving economic development on the continent.

3. AI TECHNOLOGIES IN FINANCE

The financial sector has been at the forefront of adopting AI technologies to enhance decision-making, automate processes, and improve customer service. Three of the many AI technologies stand out as transformative in finance: Machine Learning (ML), Natural Language Processing (NLP), and Data Analytics. These technologies will be explored in detail, highlighting their relevance and impact on the financial industry.

3.1 Machine Learning (ML) in Finance

Machine Learning, a subset of AI, is a powerful tool for making predictions and decisions based on data patterns. In finance, ML algorithms are leveraged in various ways to optimize processes and enhance risk management (Pawar et al., 2022).

3.1.1 Credit Scoring and Risk Assessment

One of the most notable applications of ML in finance is credit scoring. ML models can analyze various data sources, including traditional credit history, transactional data, and even non-traditional data such as social media activity. By considering a broader range of variables, ML algorithms can provide more accurate and nuanced assessments of an individual's or business's creditworthiness (Wang, Hao, Ma, & Jiang, 2011). This improves the chances of extending credit to deserving borrowers and minimizes the risk of defaults.

3.1.2 Algorithmic Trading

ML algorithms have revolutionized algorithmic trading by analyzing vast datasets in real-time to identify trading opportunities (A. Singh & Ahlawat). These algorithms can execute trades at speeds unattainable by human traders, capitalizing on fleeting market trends. They can also adapt to changing market conditions and continuously optimize trading strategies. ML has become a cornerstone of quantitative finance, powering hedge funds and high-frequency trading firms.

3.1.3 Fraud Detection

ML is instrumental in fraud detection for financial institutions. It can analyze transaction data and identify unusual patterns that may indicate fraudulent activity. These algorithms can flag potentially fraudulent transactions in real-time, preventing losses and enhancing the security of financial systems (Guevara, Garcia-Bedoya, & Granados, 2020; Lokanan, 2022).

3.1.4 Portfolio Management

ML transforms portfolio management by analyzing historical data and current market conditions to optimize investment strategies (de Prado, 2020). Robo-advisors, powered by ML, can tailor investment portfolios to individual risk profiles and financial goals (Phoon & Koh, 2017). This democratizes wealth management, making it accessible to a broader range of investors.

3.2 Natural Language Processing (NLP) in Finance

NLP is a subset of AI that focuses on enabling computers to understand, interpret, and generate human language. In finance, NLP technologies are invaluable for processing vast amounts of textual data, such as news articles, earnings reports, and customer communications (Mathews, 2019; Zhou, Duan, Liu, & Shum, 2020).

3.2.1 Sentiment Analysis

Sentiment analysis, a key application of NLP, assesses the sentiment

expressed in textual data (B. Liu, 2022). In finance, this is used to gauge market sentiment and investor sentiment. By analyzing news articles, social media posts, and earnings call transcripts, NLP algorithms can provide insights into how news events and public sentiment might impact financial markets. Traders and investors can use this information to make informed decisions.

3.2.2 Customer Support and Chatbots

NLP-driven chatbots are transforming customer support in the financial sector. These chatbots can engage with customers in natural language, answer inquiries, provide account information, and even assist with complex financial transactions. They offer the advantage of 24/7 availability and rapid response times, improving customer satisfaction and reducing operational costs for financial institutions (Alex & Lawrence; Yalla & Sunil, 2020).

3.2.3 Regulatory Compliance

Financial institutions must adhere to strict regulatory requirements, often involving analyzing extensive legal documents and reports. NLP can automate extracting key information from these documents, ensuring compliance and reducing the risk of costly regulatory penalties.

3.3 Data Analytics in Finance

Data analytics encompasses a range of techniques and technologies used to analyze, process, and visualize data. Data analytics is pivotal in gaining insights from financial data and making data-driven decisions in finance.

3.3.1 Risk Assessment

Data analytics is instrumental in assessing various types of risk, including credit risk, market risk, and operational risk. Financial institutions can quantify and manage risk more effectively by analyzing historical data and using statistical models (Kithinji, 2010).

3.3.2 Market Analysis

Data analytics tools can process large volumes of market data, such as stock prices, trading volumes, and economic indicators, to identify trends and patterns. These insights inform investment strategies and trading decisions (Ko et al., 2016).

3.3.3 Customer Segmentation and Marketing

Data analytics enables financial institutions to segment their customer base based on demographics, behaviors, and preferences. This segmentation allows for targeted marketing campaigns and personalized financial product recommendations (Makana, 2020).

3.3.4 Fraud Detection and Prevention

Data analytics is a critical component of fraud detection systems. Financial institutions can promptly flag potentially fraudulent activities and take preventive measures by monitoring transactional data in real-time and identifying anomalies.

In addition to these technologies, many other AI technologies are relevant to finance. For example, robotic process automation (RPA) involves automating repetitive tasks using software robots. In finance, RPA can be used for account reconciliation and invoice processing applications (Devarajan, 2018). Another AI technology that is relevant to finance is blockchain. Blockchain is a distributed ledger technology that allows multiple parties to share a single version of the truth. Blockchain can be used in finance for cross-border payments and trade finance applications (An, Choi, & Huang, 2021).

In conclusion, AI technologies such as machine learning, natural language processing, data analytics, RPA, and blockchain are transforming the financial sector globally. These technologies are being used for a variety of applications, including fraud detection, credit scoring, investment management, customer service, risk management, invoice processing, cross-border payments, and trade finance. With continued investment and innovation in these technologies, there is no doubt that the financial sector will continue to evolve and become more efficient.

4. CHALLENGES AND BARRIERS TO ADOPTING AI IN THE AFRICAN FINANCIAL SECTOR

The adoption of AI in the African financial sector holds immense promise for enhancing financial inclusion, improving efficiency, and fortifying financial systems. However, several challenges and barriers hinder its widespread implementation and utilization across the continent, as presented in Table 1.

Table 1: Challenges and Barriers to Adopting AI in the African Financial Sector

	Challenges	Implications	References
Infrastructure and Connectivity	Limited access to reliable internet connectivity and digital infrastructure in many African regions impedes deploying AI-powered financial services. Additionally, a lack of affordable smartphones and computers hinders user access.	Without adequate infrastructure, AI technologies cannot reach remote and underserved populations. Financial institutions face difficulties in delivering digital services, and customers in such areas may remain excluded from the benefits of AI-driven financial tools.	Amankwah-Amoah and Lu (2022); (Hernandez & Roberts, 2018); Mhlanga (2021)
Data Quality and Availability	AI relies on high-quality data for training and decision-making. In Africa, the quality and availability of financial data can be inconsistent, fragmented, and incomplete. This poses challenges for building accurate and effective AI models.	Inaccurate or incomplete data can lead to unreliable AI outcomes. Financial institutions may struggle to develop robust risk assessment models or offer personalized financial services, limiting the potential benefits of AI.	Roselli, Matthews, and Talagala (2019); Teng, Zhang, and Sun (2023)
Regulatory Frameworks	Developing and adapting regulatory frameworks to accommodate AI in finance is complex. Striking the right balance between encouraging innovation and safeguarding consumer rights and financial stability requires careful consideration.	Regulatory uncertainties can deter financial institutions from investing in AI solutions due to concerns about compliance and legal risks. Additionally, inconsistent regulations across African countries can create a fragmented AI landscape.	Azzutti (2022); V. K. Singh (2022)
Financial Literacy and Education	Individuals need a certain level of financial literacy to use AI-driven financial services effectively. Many African populations lack access to financial education, making it difficult to understand and utilize AI-based tools.	The success of AI adoption depends on the ability of users to navigate and make informed decisions within these technologies. Without adequate financial literacy, the potential of AI in improving financial inclusion may not be fully realized.	Atkinson and Messy (2013); Moll and Yigitbasioglu (2019)
Cybersecurity Concerns	As financial services become increasingly digital, the risk of cyberattacks grows. Financial institutions in Africa may be ill-equipped to defend against sophisticated cyber threats.	Cybersecurity breaches can result in data theft, financial losses, and a loss of trust among customers. Institutions must invest in robust cybersecurity measures to protect against these threats, adding to the cost of AI adoption.	Ghelani, Hua, and Koduru (2022); Ulsch (2014); (P. Wang, D'Cruze, & Wood, 2019)
Talent Shortages	There is a shortage of skilled professionals in AI and data analytics in Africa. This shortage hinders the development and deployment of AI solutions in the financial sector.	The scarcity of talent can slow down the implementation of AI initiatives. Financial institutions may struggle to find and retain qualified professionals to design, develop, and manage AI systems.	Davenport and Ronanki (2018); Sutherland (2020)
High Initial Costs	Implementing AI systems can require significant upfront infrastructure, technology, and talent investments. Many African financial institutions may find these initial costs prohibitive.	The high initial costs of AI adoption can deter smaller financial institutions or startups from entering the market. This could result in limited competition and innovation in the financial sector.	Bharadiya (2022); Fountaine, McCarthy, and Saleh (2019)
Legacy Systems and Resistance to Change	Many African financial institutions operate with legacy systems that may not be easily integrated with AI technologies. Resistance to change within these organizations can further impede adoption.	Retrofitting legacy systems to accommodate AI can be costly and complex. Organizational resistance to change can hinder implementing AI-driven processes and services effectively.	Lee and Shin (2018); Von Solms (2021)
Ethical and Bias Concerns	AI algorithms can inadvertently perpetuate biases present in historical data. This raises ethical concerns, especially in lending and risk assessment decisions.	Biased AI outcomes can lead to discrimination and fairness issues, potentially resulting in legal and reputational risks for financial institutions.	Buckley, Zetsche, Arner, and Tang (2021); Sargeant (2022)

5. CONCLUSION AND RECOMMENDATIONS

The research underscores the transformative potential of AI, encompassing ML, NLP, and Data Analytics, to reshape Africa's financial sector positively. AI technologies promise to bolster financial inclusion, elevate risk management, and streamline financial operations. However, the adoption of AI in this context faces several formidable challenges.

Key hurdles to widespread AI adoption in Africa's financial sector include infrastructure limitations, inadequate connectivity, data quality disparities, regulatory intricacies, and a scarcity of AI expertise. These impediments pose significant barriers to realizing the full potential of AI-driven financial services. Nevertheless, the promise of financial inclusion remains one of AI's most potent prospects, with mobile banking and digital financial services powered by AI extending access to vital financial tools and services to previously underserved populations.

To overcome these challenges, policymakers must prioritize clear and adaptable regulatory frameworks that balance innovation with consumer protection. Investments in digital infrastructure and financial literacy programs should also be made to facilitate AI adoption. Additionally, financial institutions should concentrate on data quality and governance

while adhering to ethical AI practices. Collaboration and partnerships across various stakeholders can drive AI talent development and provide opportunities to share best practices.

In summary, AI represents more than just technological advancement; it symbolizes a transformative force capable of fortifying Africa's financial sector. It offers the potential for enhanced financial inclusion, improved risk management, cost reduction, innovation, data-driven decision-making, and global competitiveness. While challenges are present, proactive measures and collaboration among policymakers, financial institutions, and stakeholders can pave the way for realizing AI's full potential, resulting in a resilient and inclusive financial ecosystem that benefits all segments of society.

REFERENCES

- Alex, D., & Lawrence, J. Redefining Banking with Artificial Intelligence Strategy for Future. LIBA's Journal of Management, 44.
- Ali, E. B., Anufriev, V. P., & Amfo, B. 2021. Green economy implementation in Ghana as a road map for a sustainable development drive: A review. Scientific African, 12, e00756.

- Amankwah-Amoah, J., & Lu, Y. 2022. Harnessing AI for business development: a review of drivers and challenges in Africa. *Production Planning & Control*, 1-10.
- An, Y. J., Choi, P. M. S., & Huang, S. H. 2021. Blockchain, cryptocurrency, and artificial intelligence in finance. In *Fintech with artificial intelligence, big data, and blockchain* (pp. 1-34): Springer.
- Anwar, A., & Iwasaki, I. 2022. The finance-growth nexus in the Middle East and Africa: A comparative meta-analysis. *International Journal of Finance & Economics*.
- Atkinson, A., & Messy, F.-A. 2013. Promoting financial inclusion through financial education: OECD/INFE evidence, policies and practice.
- Awotunde, J. B., Adeniyi, E. A., Ogundokun, R. O., & Ayo, F. E. 2021. Application of big data with fintech in financial services. In *Fintech with Artificial Intelligence, Big Data, and Blockchain* (pp. 107-132): Springer.
- Azzutti, A. 2022. AI trading and the limits of EU law enforcement in deterring market manipulation. *Computer Law & Security Review*, 45, 105690.
- Bansal, J., & Kanwal, A. 2018. Qualitative research on issues and trends in the bancassurance model in India: An interview report. *International Journal of Banking, Risk and Insurance*, 6(2), 67.
- Baporikar, N., Nambira, G., & Gomxos, G. 2016. Exploring factors hindering SMEs' growth: evidence from Nambia. *Journal of Science and Technology Policy Management*, 7(2), 190-211.
- Beck, T., & Demirguc-Kunt, A. 2006. Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & finance*, 30(11), 2931-2943.
- Bernards, N. 2022. A critical history of poverty finance: colonial roots and neoliberal failures: Pluto Press.
- Bharadiya, J. P. 2022. Driving Business Growth with Artificial Intelligence and Business Intelligence. *International Journal Of Computer Science And Technology*, 6(4), 28-44.
- Bhyer, B. S., Lee, & Seyoung. 2019. Banking the Unbanked and Underbanked: RegTech as an Enabler for Financial Inclusion. The RegTech Book.
- Buckley, R. P., Zetzsche, D. A., Arner, D. W., & Tang, B. W. 2021. Regulating artificial intelligence in finance: Putting the human in the loop. *Sydney Law Review*, The, 43(1), 43-81.
- Davenport, T. H., & Ronanki, R. 2018. Artificial intelligence for the real world. *Harvard business review*, 96(1), 108-116.
- de Prado, M. M. L. 2020. Machine learning for asset managers: Cambridge University Press.
- Devarajan, Y. 2018. A study of robotic process automation use cases today for tomorrow's business. *International Journal of Computer Techniques*, 5(6), 12-18.
- Ekeh, P. P. 1975. Colonialism and the two publics in Africa: A theoretical statement. *Comparative studies in society and history*, 17(1), 91-112.
- Fountaine, T., McCarthy, B., & Saleh, T. 2019. Building the AI-powered organization. *Harvard business review*, 97(4), 62-73.
- Ghelani, D., Hua, T. K., & Koduru, S. K. R. 2022. Cyber Security Threats, Vulnerabilities, and Security Solutions Models in Banking. *Authorea Preprints*.
- Grundling, P.-L., & Grootjans, A. 2016. Peatlands of Africa. In *The wetland book*: Springer Science and Business Media, LLC.
- Guevara, J., Garcia-Bedoya, O., & Granados, O. 2020. Machine learning methodologies against money laundering in non-banking correspondents. Paper presented at the Applied Informatics: Third International Conference, ICAI 2020, Ota, Nigeria, October 29-31, 2020, Proceedings 3.
- Hernandez, K., & Roberts, T. 2018. Leaving no one behind in a digital world.
- Hussein, K., & Suttie, D. 2016. IFAD Research Series 5-Rural-urban linkages and food systems in sub-Saharan Africa: The rural dimension. IFAD Research series.
- IA, G., & Miglionico, A. 2019. Artificial intelligence and automation in financial services: the case of russian banking sector. *Law and Economics Yearly Review*, 8(1), 125-147.
- Ibrahim, U. 2019. The Impact of Cybercrime on the Nigerian Economy and banking system. *NDIC Quarterly*, 34(12), 1-20.
- Iqbal, B. A., Turay, A., Hasan, M., & Yusuf, N. 2018. India's outward foreign direct investment: emerging trends and issues. *Transnational Corporations Review*, 10(1), 98-107.
- Issawi, C. 2013. An economic history of the Middle East and North Africa: Routledge.
- Javaid, M., Haleem, A., & Singh, R. P. 2023. ChatGPT for healthcare services: An emerging stage for an innovative perspective. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 3(1), 100105.
- Kandpal, V., & Khalaf, O. I. 2020. Artificial intelligence and SHGs: enabling financial inclusion in India. In *Deep Learning Strategies for Security Enhancement in Wireless Sensor Networks* (pp. 291-303): IGI Global.
- Kithinji, A. M. 2010. Credit risk management and profitability of commercial banks in Kenya.
- Ko, S., Cho, I., Afzal, S., Yau, C., Chae, J., Malik, A., . . . Ebert, D. S. 2016. A survey on visual analysis approaches for financial data. Paper presented at the Computer Graphics Forum.
- Kshetri, N. 2019. Cybercrime and cybersecurity in Africa. In (Vol. 22, pp. 77-81): Taylor & Francis.
- Kshetri, N. 2021. The role of artificial intelligence in promoting financial inclusion in developing countries. In (Vol. 24, pp. 1-6): Taylor & Francis.
- Lee, I., & Shin, Y. J. 2018. Fintech: Ecosystem, business models, investment decisions, and challenges. *Business horizons*, 61(1), 35-46.
- Lewis, J. 2000. Empire state-building: war & welfare in Kenya, 1925-52: Ohio State University Press.
- Liu, B. 2022. Sentiment analysis and opinion mining: Springer Nature.
- Liu, R., Gupta, S., & Patel, P. 2021. The application of the principles of responsible AI on social media marketing for digital health. *Information Systems Frontiers*, 1-25.
- Lokanan, M. E. 2022. Predicting money laundering using machine learning and artificial neural networks algorithms in banks. *Journal of Applied Security Research*, 1-25.
- Lund, S., Manyika, J., Woetzel, J., Bughin, J., & Krishnan, M. 2019. Globalization in transition: The future of trade and value chains.
- Makana, A. P. 2020. Customer Segmentation On Mobile Money Users In Kenya. University of Nairobi,
- Mallampally, P., & Sauvart, K. P. 1999. Foreign direct investment in developing countries. *Finance and development*, 36(1), 34.
- Mandondo, A. 2000. Situating Zimbabwe's natural resource governance systems in history.
- Mathews, S. M. 2019. Explainable artificial intelligence applications in NLP, biomedical, and malware classification: A literature review. Paper presented at the Intelligent Computing: Proceedings of the 2019 Computing Conference, Volume 2.
- Maxfield, S. 1998. Gatekeepers of growth: the international political economy of central banking in developing countries: Princeton University Press.
- Mhlanga, D. 2021. Artificial intelligence in the industry 4.0, and its impact on poverty, innovation, infrastructure development, and the sustainable development goals: Lessons from emerging economies? *Sustainability*, 13(11), 5788.
- Moll, J., & Yigitbasioglu, O. 2019. The role of internet-related technologies

- in shaping the work of accountants: New directions for accounting research. *The British accounting review*, 51(6), 100833.
- Mukasa, A. N., Woldemichael, A. D., Salami, A. O., & Simpasa, A. M. 2017. Africa's agricultural transformation: Identifying priority areas and overcoming challenges. *Africa Economic Brief*, 8(3), 1-16.
- Mushonga, M., Arun, T. G., & Marwa, N. W. 2019. The cooperative movement in South Africa: Can financial cooperatives become sustainable enterprises? *Strategic Change*, 28(4), 259-271.
- Ndung'u, N., & Signé, L. 2020. The Fourth Industrial Revolution and digitization will transform Africa into a global powerhouse. *Foresight Africa Report*, 5(1), 1-177.
- Omar Bakar, H., Sulong, Z., & Chowdhury, M. A. F. 2022. The role of financial development on economic growth in the emerging market countries of the sub-Saharan African (SSA) region. *International Journal of Emerging Markets*, 17(3), 789-811.
- Onifade, S. T., Çevik, S., Erdoğan, S., Asongu, S., & Bekun, F. V. 2020. An empirical retrospect of the impacts of government expenditures on economic growth: new evidence from the Nigerian economy. *Journal of Economic Structures*, 9(1), 1-13.
- Pawar, L., Singh, J., Bajaj, R., Singh, G., & Rana, S. 2022. Optimized ensembled machine learning model for iris plant classification. Paper presented at the 2022 6th international conference on trends in electronics and informatics (ICOEI).
- Phoon, K., & Koh, F. 2017. Robo-advisors and wealth management. *The Journal of Alternative Investments*, 20(3), 79-94.
- Pietrus, A., Nazarian, A., & Izadi, J. 2020. Spillover effects in the banking sector of emerging economies: a South Africa case study. *European Journal of International Management*.
- Remolina, N. 2022. The Role of Financial Regulators in the Governance of Algorithmic Credit Scoring. *SMU Centre for AI & Data Governance Research Paper*(2).
- Roselli, D., Matthews, J., & Talagala, N. 2019. Managing bias in AI. Paper presented at the Companion Proceedings of The 2019 World Wide Web Conference.
- Sargeant, H. 2022. Algorithmic decision-making in financial services: economic and normative outcomes in consumer credit. *AI and Ethics*, 1-17.
- Shipalana, P. 2019. Digitising financial services: A tool for financial inclusion in South Africa?
- Signé, L., & Johnson, C. 2020. Africa's insurance potential: Trends, drivers, opportunities and strategies.
- Singh, A., & Ahlawat, N. A Review Article:-The Growing Role Of Data Science And Ai In Banking And Finance.
- Singh, V. K. 2022. Regulatory and Legal Framework for Promoting Green Digital Finance. In *Green Digital Finance and Sustainable Development Goals* (pp. 3-27): Springer.
- Stevanovic, D., & Wanyang'Ochieng, M. 2023. Growth and Success: In the Context of Startups in Sub-Saharan Africa. In.
- Stringham, E. P. 2023. Banking regulation got you down? The rise of fintech and cryptointermediation in Africa. *Public Choice*, 1-16.
- Stypinska, J. 2023. AI ageism: a critical roadmap for studying age discrimination and exclusion in digitalized societies. *AI & society*, 38(2), 665-677.
- Sutherland, E. 2020. The fourth industrial revolution—the case of South Africa. *Politikon*, 47(2), 233-252.
- Teng, Y., Zhang, J., & Sun, T. 2023. Data-driven decision-making model based on artificial intelligence in higher education system of colleges and universities. *Expert Systems*, 40(4), e12820.
- Ulsch, M. 2014. *Cyber threat!: how to manage the growing risk of cyber attacks*: Wiley Online Library.
- Union, A. 2020. *The Digital Transformation Strategy for Africa (2020-30)*.
- Vărzaru, A. A. 2022. Assessing the Impact of AI Solutions' Ethical Issues on Performance in Managerial Accounting. *Electronics*, 11(14), 2221.
- Von Solms, J. 2021. Integrating Regulatory Technology (RegTech) into the digital transformation of a bank Treasury. *Journal of Banking Regulation*, 22, 152-168.
- Wang, G., Hao, J., Ma, J., & Jiang, H. 2011. A comparative assessment of ensemble learning for credit scoring. *Expert systems with applications*, 38(1), 223-230.
- Wang, P., D'Cruze, H., & Wood, D. 2019. Economic Costs And Impacts Of Business Data Breaches. *Issues in Information Systems*, 20(2).
- Yalla, M., & Sunil, A. 2020. Ai-driven conversational bot test automation using industry specific data cartridges. Paper presented at the Proceedings of the IEEE/ACM 1st International Conference on Automation of Software Test.
- Zhou, M., Duan, N., Liu, S., & Shum, H.-Y. 2020. Progress in neural NLP: modeling, learning, and reasoning. *Engineering*, 6(3), 275-290.

