# The potentials of artificial intelligence in improving Africa informal cross border trade.
## What works, What doesn't, and What's next to Africans?

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**ABSTRACT**

**Context and background**

The incorporation of artificial intelligence (AI) into businesses has become increasingly widespread in recent years, particularly in developed countries, fundamentally reshaping the landscape of entrepreneurship and innovation. AI presents numerous opportunities for small businesses, including those involved in cross-border trade. It has the potential to transform various aspects of business operations, such as customer interactions, marketing research, understanding consumer behavior, optimizing routes, and forecasting sales and marketing trends. Additionally, AI can contribute to the formalization of business processes, and assist these businesses in adapting more effectively to the ever-changing dynamics of the market. However, the successful implementation of AI necessitates a meticulous assessment of AI applications to ensure alignment with the objectives and resources of each individual small business.

**Goal and Objectives:**

The primary focus of this paper is to explore the potential of Artificial Intelligence in enhancing Africa's cross-border trade. The paper will address the following research questions: What are the effective applications of artificial intelligence in cross-border informal trade in Africa, and what are the limitations? What does the future hold for African countries in terms of utilizing artificial intelligence for cross-border trade? How can African informal cross-border traders and their stakeholders benefit from incorporating artificial intelligence in their activities?

**Methodology:**

The research is purely empirical research based on observation and measurement of phenomena, as directly experienced by the researcher.

**Results:**

AI can be effectively applied by Informal Cross-Border Traders (ICBT) to enhance their businesses and enhance competitiveness. There are several AI applications accessible to ICBT within their operational context. Although the adoption and utilization of AI in Africa are still in their infancy, there is considerable promise for the future. Africans must address the challenges hindering the adoption and utilization of AI, as technology is advancing rapidly, and opportunities await those who embrace it.

**Keywords**

cross border trade, informal trade, artificial intelligence, informal economy, information technology

# 1. INTRODUCTION

In the past few decades, there has been a remarkable increase in the speed of creation and adoption of novel technologies. Artificial Intelligence, Mobile technologies, machine learning, cloud computing, big data, the Internet of Things, blockchain, and cryptocurrencies are dominating the digital economy. ITU estimated that over an estimated 5.3 billion people, or 66 percent of the world's population, will use the Internet in 2024, however, there is a digital divide based on gender, level of development, geographical location, and demographic factors. Africa is not left behind in digital revolutions. Digital revolutions that have been widely accepted in Africa are mobile money, social media networks, e-government, and e-business. For example, The State of the Industry Report on Mobile Money 2023, reported the value of mobile transactions in 2022 as $1.26trn and transactions in Africa alone were valued at $836.5b, about 66% of the global value (GSMA, 2022) findings evidence that the rate of financial inclusion in Sub Saharan Africa rises with increasing digital technologies. Therefore, Africa is part of the world's digital revolutions, hence imperative to study how African can harness modern technology to improve its economy, probably through artificial intelligence.

This proliferation of technological progress is impacting virtually every aspect of the economy, society, and culture. Modern technologies have reduced the cost of production, information flow, financial inclusion, education, health, democracy, internationalization, and son (Ndoya et al., 2023). Research in different parts of Africa found a positive relationship between technology development and poverty reduction (Oshota, 2019). Technology reduces poverty via increasing access to basics for livelihood and education. M-health improves access to health services and reduces maternal death in Africa (Senbekov et al., 2020). More importantly, technology improves agriculture through extension services, farming education, market access, and whether information (Ayim et al., 2022). Access to education through mobile phones, websites, and online courses in Africa has increased as the growth in ICT uptakes in Africa (Wirajing & Nchofoung, 2023). *The propagation of modern technologies provides Africans* with opportunities to improve their lives. However, technology itself is not a panacea that should fundamentally transform African challenges, it is an enabler that supports ground realities.

One of the fascinating technologies that brings millions of opportunities around the world at our time is Artificial Intelligence (AI). AI is the science of analyzing scientific data using mathematical algorithms that have been learned on machines (Jhawat et al., 2023). AI functions similarly to the human brain, which makes judgments depending on a variety of scenarios. According to Microsoft co-founder (Bill Gates), generative AI is the most significant technological innovation in 40 years (Gates, 2023). Artificial intelligence systems are made up of three pillars: artificial intelligence, machine learning, and deep learning. AI technologies have been widely applied in various social economic activities including education (Xu & Ouyang, 2022), health (Yu et al., 2018), manufacturing (Zeba et al., 2021), transportation and logistics (Wu et al., 2022) and many others. Although the current adoption and use of AI is little, Africa and the Middle East are expected to witness the highest rise in AI spending worldwide, with $3 billion (£2.4 billion) in 2023 and $6.4 billion by 2026. The prospects are supported by introductions of several AI research centers including Google Africa-based AI research GHANA in 2019, and the Microsoft Research Institute in Kenya 2022. Except for

South Africa, Nigeria, Ethiopia, Kenya, Zimbabwe, Togo, Libya, and Ghana, AI applications have not yet been broadly embraced throughout Africa, with most African states missing the requisite infrastructure for technology adoption. State of Artificial Intelligence in Africa 2023 recommends that, instead of just imitating ideas from the Global North, Africa should approach AI strategically, focusing on its specific issues and answers.

One of the areas that AI can have opportunities to transform is African cross-border trade. The World Trade Organization commented that modern technologies (including AI) can increase the efficiency of customs processes and facilitate the movement of products across borders (*WTO, 2021*). Modern technologies have already initiated the optimization of worldwide supply chains (Pournader et al., 2021). The potential for utilizing cutting-edge technology to facilitate international trade is vast, but unfortunately, it has not received much attention from scholars. Technological advancements have brought about a revolution in the global trade landscape by simplifying processes, reducing obstacles, and enhancing efficiency and transparency (McDaniel & Norberg, 2019). Customs procedures, trade costs, prediction of change in customs procedures, real-time information on the origin and movement of goods are important areas that can be improved by modern technologies (McDaniel & Norberg, 2019). Noteworthy progress has been made in various areas, including E-commerce and Online Marketplaces, Blockchain and Smart Contracts, Digital Payments and Financial Technologies, Supply Chain and Logistics Optimization, Customs and Border Procedures, Trade Facilitation Platforms, Regulatory Cooperation, and Standardization, monitoring Trade Finance and flows, trade Data Security and Privacy, and Trade Policy Analysis and Prediction.

Cross-border trade is simply the flow of goods and services across the boundaries of countries (Hailemeskel et al., 2016). Most African cross-border trade is informal/unofficial and is carried by vulnerable, petty, un-registered traders. In many African countries, informal cross-border trade (ICBT) is generally regarded as illegal since it does not pay taxes, is unregistered, unofficial, and done outside the formal system. The size of ICBT is significant in poor countries; ICBT is estimated to represent a proportion ranging from 7 to 16 percent of formal trade among African countries and between 30 and 72 percent of formal trade between neighboring nations (UNECA, 2021). ICBT is dominated by women; (Kahiya & Kadirov, 2020) reported that 60% of informal cross-border traders in Africa are women. ICBT is constrained by informality, low education, unawareness, limited knowledge about current government empowerment opportunities, insufficient border facilities, absence of a system to raise traders' issues to relevant authorities, scarcity of resources, ineffective coordination, traders' reluctance to utilize trade facilitation measures, and the informal nature of traders in neighboring countries (Charles, 2023).

The existence of technology is one factor; however, the ability of technology to solve people's challenges is another thing. Several initiatives and entitlements like contextualization, ecosystem, design and development, and empowerments are needed to ensure inclusive technology. Africa needs to ensure that the current and future technologies are becoming enablers of development through appropriate integration to various social-development aspects. Nevertheless, it is vital to tackle potential challenges such as standardizing regulations, addressing data privacy concerns, and ensuring equitable access to these technologies in order to fully leverage their positive impact on cross-border trade. The primary focus of this paper is to explore the potential of Artificial Intelligence in enhancing Africa's cross-border trade. The paper will address the following research questions:

1. What are the effective applications of artificial intelligence in cross-border informal trade in Africa, and what are the limitations?
2. What does the future hold for African countries in terms of utilizing artificial intelligence for cross-border trade?
3. How can African informal cross-border traders and their stakeholders benefit from incorporating artificial intelligence in their activities?

## 2.INFORMAL CROSS BORDER TRADE

The African economy is characterized by both formal and informal economy. The popular form of informal economy is cross border trade. Informal cross-border trade (ICBT) is blossoming in every corner of Africa. Informal cross border trade is undertaken by informal enterprises (not registered/licensed/recognized by law) (Kahiya & Kadirov, 2020). ICBT imports and exports goods and services across the country boundaries in an informal way (no business license/permit, no custom procedures, no tax, no records, no boundary). African informal cross border is mostly done by poor youth and women, who are uneducated, who can't secure formal jobs (survivalist). Although (Nakayama, 2022) sees ICBT as an outcome of the 1970s structural adjustment program, the trade was there even before the colonial era (1800s). African people used to move anywhere without boundaries; for example, people in Tanzania were trading with neighboring countries like Malawi, Zambia, Congo, Rwanda, Burundi, and Uganda as if it was a single country. They didn't know anything regarding borders. Some scholars e.g. (Golub, 2012) pointed out that pre-colonial traders had no boundary until the berlin conference (1880) which divided Africa into countries. The Berlin Conference separated African states, creating territorial, and set borders based on their de facto zones of control. After independence in the 1950s and 1960s, African countries started to lay out regulations, laws, policies, and measures to manage trades that cross the border. Some countries e.g. Tanzania established high punishment for those found to do cross border trade without license (Magendo). Post independence trade protectionism aimed at protecting domestic markets, controlling forex, and encouraging domestic production. Despite these measures trade across borders continued in a formal and informal way hence the birth of informal cross-border trade.

The definition of ICBT is not direct, due to its diversity and the way it is done. In most cases ICBT is defined based on its characteristics. ICBT and the phenomenon are frequently confused with terms such as "smuggling" and other illicit activities. These terms encompass "smuggling" or "illegal trade," "unrecorded cross-border trade," and "small-scale cross-border trade." Therefore, most of the definition's articulate features like unofficial, illegality, poverty, and nonpayment of tax as foundations for explaining what ICBT is. The most comprehensive explanations of ICTB was given by (Mafukata & Kancheya, 2015) who define as people engaging in informal and unregistered trading activities that involve trading across political borders, usually through street vending or hawking, that involves selling small quantities of goods and services to an unspecified market to sustain their livelihoods. These businesses do not pay taxes. Further explanations provided by (Ogalo, 2010) who see ICB as trade of legal goods in illegal channels. Informal trade is conducted in illegality, in the goods themselves (e.g. narcotics) or in the manner of trading (evasion of customs duties and regulations) (S. Golub, 2015). Often, these transactions are not properly documented or inaccurately reported in the official national statistics of the countries involved. Unlike the previous researcher (Afrika & Ajumbo, 2012) see ICBT as consistent with both legal and illegal trade. Many authors are in

consensus that ICBT is conducted by unregistered small-scale traders, who are poor, vulnerable, small, and unregistered to earn a livelihood and for the business to thrive.

Accurate and reliable data about ICBT are not available due to informality and illegality of the business. The most available statistics are merely estimates (Ayadi et al., 2013; Nkendah, 2013; Nshimbi & Moyo, 2017; UNECA, 2021). However, these estimates are not conclusive as they are limited with the methodological approach, data sources, and definition of ICBT. UNECA (2021) estimated value of ICBT in Africa ranged from $5.1 billion (low estimate) to $15.0 billion (high estimate). Furthermore, UNECA shows that ICBT makes up 16 percent of Africa's formal sector, and accounts for between 30 and 72 per cent (Kahiya & Kadirov, 2020) of formal trade between neighboring countries in Africa. The size of ICBT differs from one country to another. In West Africa, particularly in Benin and Nigeria, informal cross border trade represents approximately 75% of GDP. Also, the size and type of products traded in ICBT differ from one region to another. OECD data estimates an average value of ICBT in the SADC Region of US$ 17.6 billion per year and contributes 30-40% to intra-SADC Trade. Within West and Central Africa, women engaged in informal cross-border trading typically hire 1.2 individuals for their home-based enterprises and provide support to an average of 3.2 children.

ICBT Plays a vital role in alleviating poverty by offering trading opportunities to a substantial portion of the population, with women being the most actively involved traders, for instance. The motives for engaging in ICBT are though the scholars categorized it in 3 groups. One of the motives is relatively high profitability, since the traders are not obliged to have a store, pay direct tax, and pay other government levies and duties (Kahiya & Kadirov, 2020). Another reason is the ease of doing business in an informal environment where there are no custom documents, administrative procedures, and absence of paying government taxes (Ayadi et al., 2013). Most of ICBT are less educated, hence do not know how to make their business activities formal. Lack of education limits these poor women and youth to acquire employment in the formal sector hence rely on informal settings. Some of the ICB traders are born just near borders, and some of their family members live in the neighboring country hence for them to cross the border is not a problem. ICBT accounts for the incomes of about 43% of Africa's population, which significantly affects poverty reduction (Nshimbi & Moyo, 2017). Informal cross-border trade plays a significant role in mitigating economic challenges, diminishing poverty levels, and promoting well-being and human development in Africa (Kachere, 2011). Study in Uganda has shown that, ICBT is a safety net for the unemployed people, source of employment, income, livelihood, and source of saving (Adude, 2006, 2006; Barros & Chivangue, 2017). ICBT is a major source of livelihood, and employment for people living at border posts, hence directly and indirectly improving the quality of life (Nkoroi, 2015).

While ICBT can contribute to economic activity and livelihoods in many regions, it also presents various challenges. These challenges compromise the sector's contribution to the household and national economy and increase the costs of doing business. ICBT cannot access formal finances the same as formal traders because they don't have collaterals or formal registrations- these limit their capital growth hence continues to be small and micro businesses (Mramba et al., 2016). Government and financial sectors need to design policies, financial packages, and special treatment and strategies that will positively enhance the accessibility of financial credit to ICBT (Ama et al., 2014). ICBT are considered illegal because their businesses are neither licensed nor registered by

government/municipals (S. S. Golub, 2012). Due to illegality informal traders can be fined, jailed or their products being confiscated by the government. Unfriendly custom procedures, bureaucracy, and corruption increase operation costs, time, and erode capital. Informal traders may be stigmatized and marginalized in society, leading to social and economic exclusion (Kahiya & Kadirov, 2020). They might also face suspicions of tax evasion or involvement in illicit actions. Dealing with these issues demands a holistic approach that harmonizes the necessity for formalization with acknowledging the vital role played by informal cross-border trade in numerous economies. Possible approaches could involve streamlining customs processes, offering education and training for those involved in informal trade, enhancing infrastructure, and establishing channels for financial inclusion. Furthermore, initiatives should prioritize establishing a conducive environment that encourages the formalization of informal cross-border trade while safeguarding the rights and welfare of those engaged in it.

Information and communication technology (ICT) is changing the face of business among the operators of formal and informal sectors. The proliferation of internet, mobile phones and technologies, solar power, and reduced cost of buying technology devices has motivated the adoption and use of technology in trade. Several researchers in Africa (Anakpo et al., 2023; Etim & Daramola, 2023; Mramba et al., 2016) and many others believe that ICT has a power for transforming Africa informal cross border trade. The potential of Information and Communication Technology (ICT) as a facilitator for small businesses, including those operating within the informal sector, is widely acknowledged. ICT has potential for providing low-cost education to informal traders, access to finance through mobile money, access to marketing information, communication, and linking the supply chain (Lwoga & Sangeda, 2019). ICTs reduce informality and empower formalization process; also improve the quality of informal workers by enabling them to access social-development services (Remeikienė et al., 2022). The adoption of digital transformation has the potential to enhance financial inclusion within the informal sector by providing access to mobile banking and payment solutions, thereby enabling informal businesses to conduct financial transactions more efficiently and access formal financing options (Kelikume, 2021). Research about how informal traders interact with modern technologies e.g. Artificial Intelligence are limited, hence paucity of the knowledge.

African business is changing rapidly, thank you for the widespread use of low-price mobile phones, and internet connectivity. Both urban and rural Africa technology is taking the pace; people buy utility, pay government levies, pay for medical services, and access information through technology devices. Despite these achievements, there is a huge gap between those who access and use technology vs those who do not (digital gap) (Malephane, 2022). Shockingly, only a mere 2% of micro-sized businesses owned by young women and 8% of those owned by young men utilize computers. The World Bank has identified sub-Saharan Africa as the region with the most substantial disparity between the availability of digital infrastructure and actual usage among its population (Welde, 2022). To bridge this gap, governments must establish a conducive digital environment that encourages the integration of technology into the daily operations of the informal sector (Kitsara, 2022). For informal enterprises operating within the informal environment, digital technology can furnish them with pertinent information to make more informed decisions and enhance their business operations (Mramba et al., 2016). Additionally, digital transformation can open doors for the informal business sector to reach new markets and customers beyond their geographical borders through e-commerce platforms, social media, and digital marketplaces (Rumanyika et al., 2021). The

participation of the informal sector in the digital economy will be a pivotal factor in enabling them to reap the benefits of the African Continental Free Trade Agreement (AfCFTA).

[1] https://www.oecd.org/aidfortrade/47715006.pdf

## 3. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN AFRICAN CROSS BORDER TRADE

For more than six and a half decades, scientists and engineers have persistently pursued the exploration of artificial intelligence (AI). The fundamental idea behind this effort is that machines crafted by humans possess the potential to achieve more than just repetitive manual tasks; they can acquire intelligence resembling that of humans. Although the history of AI dates to ancient civilizations, major achievements were observed between 1950 and 1960 when Allen Newell and Herbert Simon were designing a program to provide mathematical theorems (Simon, 1993). Later, in the 1970s and 1980s, computer programs to assist human decision-making were engineered, especially in Europe. From the 1980s to the 1990s, there were few AI initiatives due to a shortage of funding and many failures in previous projects (Spector, 2006). From the 1990s to the present day, there have been many projects focusing on natural language processing, computer vision, speech recognition, neural networks, and deep learning models (Delipetrev et al., 2020). The proliferation of AI initiatives is attributed to the innovation of powerful computers and the need to design and develop meaningful solutions for humans. In the 21st century, AI is applied in various sectors, including transportation, decision-making systems, virtual assistance, healthcare, data analysis, the education sector, and the entertainment industry. Noteworthy AI advancements include AlphaGo's victory against the global Go champion, the language generation capabilities of GPT-3, and advances in autonomous vehicle technology (Ama et al., 2014).

Artificial intelligence (AI) has penetrated many organizational processes, resulting in a growing fear that smart machines will soon replace many humans in decision making. AI holds significant potential to contribute to the advancement of socio-economic development in Africa. It has the capacity to enhance various aspects of daily life, such as business operations, agriculture, manufacturing, mining, administration, and trade. Additionally, AI can play a crucial role in improving access to high-quality healthcare and education services, reducing the need for imports from other regions. In marketing for example AI is increasingly important, due to increasing computing power, lower computing costs, the availability of big data, and the advance of machine learning algorithms and models (Huang & Rust, 2021). With its capability to automate processes and personalize experiences, AI, including platforms such as ChatGPT, has become an invaluable asset for businesses of all sizes. For small businesses, AI offers three strategic advantages to enhance customer service, strengthen marketing and sales, and drive growth (Harvad Business, 2023). In this section, we will elaborate on how AI can be an asset in informal cross-border trade.

There is no universally agreed definition of artificial intelligence. In a layman language AI is a science for studying the development of machines that can simulate the thinking process of humans (Zafari et al., 2022). USA IEEE sees AI as computer systems that can perform tasks; that normally require human intelligence, such as visual perception, speech recognition, learning, decision-making, and natural language processing (Hulsen, 2023). To make it easily understood Forbes defines AI as any

technology that tries to replicate some broader aspect of human intelligence (Mayo, 2023). Just think human activities like doing arithmetic which can take a lot of energy and effort; however, the intelligence built in calculators may do it easily. High capabilities extend beyond mere data capture and the execution of predetermined tasks; they encompass the performance of intelligent functions that involve assessing impacts, reasoning, determining what comes next, and providing various insights. With the application of advanced technologies such as smart computing, powerful computers, and internet connectivity, artificial intelligence (AI) carries out predictive analyses autonomously, with or without human cognitive input. Machines emulate human thought processes and behavior and can be trained to address specific challenges. AI systems operate by amalgamating vast datasets with sophisticated processing algorithms, executing multiple tasks rapidly in a short period. To achieve these tasks, AI leverages essential tools like "machine learning" and "deep learning," approaching the tasks in a manner akin to human cognitive processes. Microsoft has AI when it can process information without an organic brain (Lisa, 2023). It's not alive, but it can sort information.

There are several classifications for AI, however in this research we consider the two which are prominent. Based on AI-enabled machines, their similarity to the human mind, and their ability to "think" and even "feel" as humans, we have 4 subcategories these are (a) reactive machines, (b) limited-memory machines, (c) theory of mind, and (d) self-aware AI. Reactive machines: Reactive machines are the primary type of AI that store memories or experiences. They solely react to a current scenario, as they are taught one thing or task and are rarely applied to other scenarios (Chung et al., 2022). The most famous example of a reactive machine is IBM's Deep Blue computer, Spam filters, Netflix recommendation engine, and Chess playing supercomputers such as Deep Blue Limited-memory machines: This algorithm emulates the collaborative functioning of neurons in our brains, resulting in an increase in its intelligence as it accumulates more data for training. It investigates the history and maneuver specific objects or situations over time (navigate through past and present data (Patel et al., n.d.). Example of limited-memory machines is self-driving cars observing other cars on the road for their speed, direction, and proximity Theory of Mind AI refers to the creation of mental models for other intelligent entities, currently primarily focused on human beings. This process involves comprehending other individuals by ascribing mental states to them and inferring what might be happening within their thoughts (Langley et al., 2022). This concept can also be referred to by various terms such as "commonsense psychology," "naïve psychology," "folk psychology," "mind reading," and "mentalizing. Ultimately, the theory of mind helps us recognize that the thoughts of other people may diverge from our own.

The last category of AI involves machines that possess self-awareness and the ability to recognize their own internal states, as well as understand the emotions, behaviors, and intelligence of others (Hassani et al., 2020). This form of AI has not been fully realized yet, but if it were to come into existence, we would likely witness a robot exhibiting a level of consciousness and intelligence on par with that of a human. Another classification is a technology-oriented approach, here we have (a) Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Superintelligence (ASI). In recent times, there has been a notable surge in the adoption of Machine Learning (ML), Deep Learning (DL), and Reinforcement Learning (RL) methodologies across diverse sectors of the economy. Machine learning falls under the umbrella of artificial intelligence (AI) and computer science. It is centered around utilizing data and algorithms to mimic human learning, with

a continuous enhancement of its precision over time (Louridas & Ebert, 2016). Machine learning involves the analysis of data through the automatic construction of an analytical model, which is derived from training data. Common examples of machine learning are Google Maps, Google assistant, Alexa, etc. Machine learning is applicable in different aspects of life including Natural Language Processing (NLP), healthcare, computer vision, finance, predictions, recommendations, decision making and so on.

AI has potentials for solving several African Challenges (Usmanova et al., 2022) pointed out that with the adoption and usage of AI tools, the initiatives of poverty prediction have become quicker, efficient, accurate and more advanced due to the creation and possibility of using different datasets. This is important to understand the state of mind, and devise mitigation strategies. Machine Learning and Machine Vision are currently used in achieving sustainable development goals. AI can perform healthcare tasks as well or better than humans (T. Davenport & Kalakota, 2019). AI is extensively applied in farming, cultivate crops, manage pests, monitor soil and growing conditions, analyzes data for farmers, and improve food supply chain (Javaid et al., 2023) where more than 80% of African depend on Agriculture.AI improves Business management activities like increase revenue by improving employee productivity, increasing consumer evaluation, setting competitive price, and creating unique resources (Hang & Chen, 2022). AI helps to predict weather, calamities, and many other risks hence take appropriate measures (Anandharajan et al., 2016). Below is a discussion: What are the effective applications of artificial intelligence in cross-border informal trade in Africa, how ICB trade can take its advantages and what are the limitations?

### 3.1 Need findings:

Businesses must understand their market needs and wants, if they want to remain successful in a competitive market (Camilleri & Camilleri, 2018). The process of trade initiation or transformation commences with thorough market research to identify the specific demands and needs of the market (referred to as "need finding"). The goal of need findings is to understand customer/market requirements, behavior, trend, scan business environment hence make wise investment decisions. The need for findings is important for categories of businesses, both formal and informal. Therefore cross-border traders must have a deep understanding of market needs before deciding which business ventures to pursue. Need finding focuses on conducting research to uncover the ultimate desires of end-users, including their purchasing motivations, buying behaviors, influencing factors, and optimal timing. The insights gained from needed research serve as invaluable input for the development of new products and determining the products to offer. Effective need analysis should incorporate a combination of qualitative and quantitative data, providing a comprehensive understanding of market dynamics. Comprehending the needs of individuals can be utilized throughout an entire business operation, offering value that extends beyond the creation of any individual product.

### 3.2 Understanding customers:

Understanding customers is a core function in market research. Artificial intelligence can do this work. AI can facilitate research planning, data collection, analysis, and assist in decision making (Huang & Rust, 2021). Automated AI systems with mechanical capabilities can efficiently gather information pertaining to the market, environmental factors, the company itself, competitors, and customer-related data. In today's interconnected digital landscape, monitoring market data has

become a straightforward process. The tasks of sensing, tracking, and gathering data, which are often repetitive and routine, can be readily handled through automation by mechanical AI. ICBT can use AI to conduct customer intelligence (studying to understand your customers) by deploying massive data collection, analysis, and making decisions through machine learning. Mechanical AI's data gathering functionality extends beyond observable behavioral data; it can also assist in the collection of survey or experimental data to capture consumer psychographics, opinions, and attitudes (Huang & Rust, 2021). As an illustration, there is no longer a need for human involvement and oversight in ongoing surveys, as this process can now be automated. Commercial survey platforms such as SurveyMonkey and SurveyCake exemplify this automation by handling survey design and data collection.

### 3.3 Market research

Research has always played a crucial role in shaping business strategies, aiding companies in comprehending their desired customer base, assessing rivals, and making well-informed choices. Conventional market research techniques included labor-intensive data gathering, surveys using pen and paper, conducting focus groups, and performing statistical analysis. While these approaches yielded valuable insights, they frequently demanded a significant amount of time and resources and had limitations in their capacity to fully grasp the intricacies of consumer behavior. AI is a powerful tool that can uncover consumer preferences, forecast market trends, and provide actionable insights with unprecedented accuracy (Chung et al., 2022). The advent of AI algorithms and methods has brought about a transformation in the processes of gathering, analyzing, and understanding data (Verma et al., 2021). This has empowered researchers to uncover concealed patterns and acquire more profound understandings into consumer inclinations and the dynamics of the market. Utilizing the capabilities of AI, market researchers can now make quicker and more precise decisions, ultimately steering business success. ICB traders can use online free AI tools e.g. online survey forms to understand their markets.

### 3.4 Product recommendations

AI-driven recommendation systems employ artificial intelligence methods to examine extensive datasets and provide individualized user suggestions. These systems are crafted to aid users in discovering pertinent and worthwhile content or goods by considering their preferences, actions, and past interactions (Davenport & Ronanki, 2018). Generally, recommendation engines rely on machine learning algorithms to evaluate user information and produce suggestions. These algorithms employ statistical models to recognize data patterns and tendencies, such as user inclinations, purchase habits, or browsing chronicles. Subsequently, these patterns can be employed by the algorithm to forecast the user's potential interests and deliver personalized recommendations accordingly (Chinchanachokchai et al., 2021).AI can be applied by ICBT to recommend their products to the past customers, attempted customers, and customers in their locality. Instead of crossing the borders, walking hundreds of kilometers to find the customers, AI can do it. E-commerce platforms, streaming services, and social media platforms leverage AI algorithms to analyze user preferences, past purchases, and browsing history. By doing so, AI can provide tailored product recommendations, suggesting items or content that align with individual interests and preferences. This personalization not only saves time but also enhances the overall shopping experience, leading to increased customer satisfaction and loyalty.

### 3.5 Market forecasting

AI-driven predictive analytics has transformed the way businesses comprehend consumer actions; it is used to answer the question "What might happen next?". Predictive science in business is about applying data to forecast future outcomes. The process deploys data analytics skills, machine learning, artificial intelligence, and statistical models to find patterns that might predict future behavior. Through the examination of extensive data sets, AI algorithms can recognize recurring patterns in the marketing environment and emerging trends, allowing enterprises to foresee the desires and inclinations of their customers and other marketing parameters (Pucci et al., 2022; Türkbayraǧí et al., 2022). This invaluable insight empowers enterprises to base their decisions on data (informed decision), including enhancements to marketing strategies, inventory management, pricing policies, and precisely targeted marketing initiatives. As a result, consumers enjoy more pertinent and well-timed offers, thereby enhancing their overall satisfaction (Türkbayraǧí et al., 2022). AI has the capability to forecast customer actions, including but not limited to churn, retention, lifetime value, and satisfaction, by analyzing their engagements, choices, and input.

### 3.6 Customer responses

AI-driven chatbots, social media and virtual assistants have brought about substantial enhancements in customer service interactions. These intelligent systems possess the ability to comprehend and address customer queries, offering immediate support and advice (Andrade & Tumelero, 2022). Chatbots can address frequently asked questions, supplying information, and executing basic functions like scheduling appointments, handling payments, or modifying account particulars. These AI-driven chatbots can be seamlessly incorporated into multiple platforms, encompassing websites, mobile applications, social media channels, or messaging applications, to furnish uninterrupted customer service around the clock, without the necessity for human representatives. ICBT can use social media apps to integrate chatbot for enhanced customer satisfaction. Whether it involves responding to inquiries about products or resolving problems, AI-driven assistants deliver effective and 24/7 aid. This accessibility and swiftness lead to quicker issue resolution, ultimately resulting in heightened customer contentment and allegiance. For example (Andrade & Tumelero, 2022) revealed that chatbot service reduced the queues of call centers and relationship centers, allowing the human attendant to perform more complex attendances. Small businesses such as ICBT can leverage chatbots to engage with their customers around the clock, enhancing customer satisfaction, reducing operational expenses, and expanding their outreach. Embedding chatbots within social media platforms like Meta Business Suite is cost-effective, often available at no cost, making it an affordable option for ICBT. Consequently, this presents an opportunity for them to integrate AI into their business operations.

### 3.7 Analyze consumer sentiments:

AI is excellent in sentiment analysis; which is used to assess interest in certain themes, perform market/consumer intelligence to uncover market conditions, trends, and study competitors(Taherdoost & Madanchian, 2023). Sentiment analysis is important in business/marketing because it unveils the consumer behavior. Through the utilization of machine learning and natural language processing, AI algorithms can assess the sentiments conveyed in consumer reviews, social media updates, and online discussions. Enterprises can subsequently

utilize this data to acquire valuable understanding of customer inclinations, emotions, and patterns. By comprehending consumer sentiment, businesses can customize their marketing approaches, enhance their product assortments, and generate more precise advertisements that strike a chord with consumers. This focused strategy has the potential to impact purchasing choices and stimulate customer involvement. ICBT can apply sentiment analysis to uncover their customer preferences e.g., what their customers like and dislike about their products and services. Informal cross border traders with little capital, and minimal level of technology can obtain free service of sentiment analysis via social media metrics e.g. meta business suite.

## 4. POSSIBLE DIFFICULTIES OF APPLYING AI IN INCBT and WHAT TO DO

In Africa, AI's immense promise is hindered by numerous obstacles such as a scarcity of appropriate technical expertise (Botwe et al., 2021), deficient fundamental and digital infrastructure (Botwe et al., 2021), insufficient funding for research and innovation, and a demand for regulatory frameworks that are more adaptable and responsive. A significant barrier to the adoption and utilization of AI in Informal Cross-Border Trade (ICBT) is the skills gap. This challenge encompasses both the skills needed to create AI solutions tailored to the needs of informal traders and the skills required for their effective use. In terms of AI design and development, Africa faces a shortage of skilled and experienced technology designers (Gomera & Mramba, 2023). Furthermore, many of the IT professionals in Africa tend to migrate to more developed countries in search of better opportunities, leaving the region with a talent drain. Additionally, most ICT applications used in Africa are created and developed outside of the continent, limiting the capacity for local innovation. Compounding this issue, a significant proportion of ICBT traders in Africa have limited or no basic education, and some are even illiterate, as highlighted by (Moyo, 2022). Consequently, the use of technology poses challenges for them. To promote positive economic growth and development that benefits all African citizens, there is a critical need for substantial advancements in digital literacy. A noteworthy statistic from the (Digitization and Digital Skills Gaps in Africa, n.d.) report indicates that by 2030, approximately 230 million jobs in Sub-Saharan Africa will require digital skills. This underscores the urgency of addressing the digital divide and enhancing digital education in the region.

Africa lacks supportive and fundamental ICT infrastructures to support the deployment of AI. ICT infrastructure includes devices, networks, protocols, software and hardware and procedures that are employed in the telecoms or IT fields to foster interaction amongst different stakeholders (Bwalya et al., 2010). Both soft and hard infrastructure that can support adoption and use of technology are inadequate or absent in most African countries, and where available are obsolete hence increasing the cost of adoption (Nchake & Shuaibu, 2022). ICT infrastructure exerts a positive and significant impact on inclusive growth in Africa generally and specifically across subregions within the continent (Nchake & Shuaibu, 2022). Good ICT infrastructure reduces transaction costs, improves productivity and firm output, resulting in positive spillovers to growth at both macroeconomic and microeconomic levels (Roller & Waverman, 2001). Due to weaknesses of ICT infrastructure the cost of adopting and using technologies is still high in Africa, hence difficult for the ICBT to use AI. ITU (2022) noted that Africa has remained the region with the least affordable ICT service prices, despite significant improvement for all baskets since 2019. The mobile data and voice high-consumption basket saw the largest price drop, decreasing from 20 to 10 per cent, which narrowed the gap with other mobile baskets.

Research and development (R&D) funding in Africa is insufficient, with only 1.3 percent of global R&D expenditure being allocated to the continent (Kiemde & Kora, 2022). This lack of investment

not only stems from resource constraints but also contributes to Africans (Kaplinsky & Kraemer-Mbula, 2022). Some African countries have made significant efforts to boost their investment in innovation and research. They have established research institutions, universities, and technology hubs to promote scientific research and technological advancements. Additionally, there has been a focus on building partnerships with international organizations and developed countries to access funding and expertise for research projects. However, it's important to note that Africa still faces challenges in this regard, including limited financial resources, inadequate infrastructure, and a shortage of skilled researchers. Addressing these challenges is essential to further increase investment in innovation and research on the continent, as it can lead to solutions for pressing issues, such as healthcare, agriculture, and sustainable development. Also, African countries lack regulatory frameworks and supportive policies to support the application of technology.

Artificial intelligence (AI) has already become an integral part of our daily existence and will continue to play an increasingly prominent role. AI has the potential to automate and simplify various aspects of our lives, including how we communicate, think, innovate, handle tasks, educate ourselves, maintain our health, and manage economic activities. In fact, AI is already being employed for critical global decision-making processes, such as forecasting weather, managing the economy, making political decisions, guiding investments, shaping culture, and even influencing sports outcomes. AI's influence is pervasive, with approximately 80% of the electronic devices we use in our everyday lives incorporating some form or components of artificial intelligence. Furthermore, a substantial 77% of people directly or indirectly benefit from AI-powered solutions. The financial sector underscores the significance of the ongoing AI revolution. According to financial reports, the global AI market is projected to witness robust growth, reaching an estimated value of $309.6 billion by 2026, with a remarkable compound annual growth rate (CAGR) of 39.7%. AI is considered as a catalyst that can transform several human activities. Africa can't run away from the adoption and use of AI.

The digital transformation initiative of the African Union is a shining example of fostering economic growth that is both inclusive and sustainable. Within this context, science, technology, and innovation have been recognized as pivotal catalysts for driving economic expansion throughout the African continent. Importantly, the Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) mentions Artificial Intelligence (AI) as a foundation for transforming science, technology, and innovation in Africa. Important strategic directions of African Union such as Policy and Regulatory Initiative for Digital Africa (PRIDA), the Programme for Infrastructure Development in Africa (PIDA), the African Continental Free Trade Area (AfCFTA), the African Union Financial Institutions (AUFIs), the Single African Air Transport Market (SAATM); and the Free Movement of Persons (FMP) and many others consider digital transformation including AI as an important driver for achieving its objectives. Therefore, the African Union and its organs believe in the power of AI. The African Institute of Mathematical Sciences introduced a master's degree in artificial intelligence, which is financed by Facebook and Google. Data Science in Lagos aims to train 1,000,000 Nigerians in data science by 2027 and to create an attractive ecosystem to make the country an ideal partner internationally. Ethiopian Artificial Intelligence Institute, Institute des algorithmes du Sénégal, GalsenAI space are good promises for African AI.
The current adoption and use of AI in Africa is limited and very basic, however growing and showing good future potential (Ade-Ibijola & Okonkwo, 2023). Several research/reports including The State

of AI in Africa report by The AI Media Group South Africa, presents the good prospects of future AI in Africa. Designing, developing, testing, and using various AI applications in Kenya, South Africa, and Ghana demonstrates how the future of AI will be in Africa. In 2021, the Centre for Intellectual Property and Information Technology Law (CIPIT) at Kenya's Strathmore Law School identified a total of 213 AI applications specifically designed for or developed within the African continent, spanning across 33 different industries.

Another promise for the good future of AI in Africa is the population structure. Unlike other continents, the African population is dominated by youth. German median age is 37.7, USA 38.1, China 37.7, Africa 19.5. Youth are quicker in adopting and using Information technology when compared with adults (Gwaka, 2018). Also, the future market for AI is Africa, given its high population growth rate. Africa's youth population is expected to reach 225 million by 2055. Furthermore, it is predicted that this African youth demographic will undergo a twofold increase, reaching 225 million by 2055. Looking ahead to 2100, Africa is poised to house three of the globe's largest cities. Lagos, Nigeria, is forecasted to accommodate 88 million inhabitants, Kinshasa, Democratic Republic of Congo, to have 83 million residents, and Dar Es Salaam, Tanzania, to be home to approximately 73 million people. The management of these burgeoning populations will necessitate the utilization of technology, particularly artificial intelligence (AI).

## 5. CONCLUSION IMPLICATION AND THE WAY FORWARD TO ICBT

Advances in information and communication technology, notably AI and its related fields, represent a critical turning point in the history of socio-economic development. Work automation in several fields may lead to increases in efficiency, effectiveness, inclusion, and productivity. The application of AI has the potential to transform the way we do things. The process of transformation varies depending on the nature and size of enterprises. Artificial intelligence is the cornerstone for ushering in a remarkable future where, powered by data and machines with a profound comprehension of our environment, we will collectively arrive at more enlightened choices. These forthcoming machines won't merely know the mechanics of activating switches but also comprehend the underlying reasons behind the need for such actions. In fact, there's even the possibility that they might eventually inquire whether switches are necessary at all.

Artificial intelligence (AI) has emerged as a transformative force for small informal businesses, offering numerous advantages. While the adoption and use of AI in small and informal businesses may vary, its benefits are significant. AI and its associated technologies can enhance efficiency, automate daily tasks, improve customer interactions, and provide beneficial insights through data analysis. By leveraging AI solutions, small informal businesses can gain a competitive edge, increase productivity and profitability, and adapt to changing market dynamics more effectively. However, it's important for small informal businesses to carefully evaluate their specific needs, financial constraints, and the appropriateness of AI applications to ensure a successful integration that aligns with their goals and resources. As AI continues to advance, its role in small business operations is likely to grow, further reshaping the landscape of entrepreneurship and innovation.

AI has the potential to automate Informal Cross-Border Trade (ICBT). It can facilitate market research, product sourcing, business decision-making, customer services, demand forecasting, sales, profitability analysis, business management, data analysis, and even education. ICBT, whether conducted by individuals, groups, or associations, can be transformed by AI. Through AI, traders can

make well-informed decisions regarding their businesses, leading to increased profitability, customer satisfaction, and improved trade records. As discussed, AI can benefit both those with high and low levels of education, provided they can use a mobile phone. AI can reduce the amount of time traders spend searching for customers, minimize conflicts with other traders, and reduce instances of poor trade decisions.

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## 10. KEY TERMES AND DEFINITIONS

**Cross-border Trade:** Cross-border trade refers to the exchange of goods, services, or capital between different countries or regions. It involves the movement of goods across national

boundaries, either through physical transportation or electronically, and encompasses various trade activities such as imports, exports, and international commerce.

**Informal Trade**: Informal trade, also known as underground economy or shadow economy, refers to commercial activities that occur outside the formal regulatory framework and are not officially recorded or monitored by government authorities. It typically involves the exchange of goods or services without proper documentation, taxation, or adherence to legal regulations. Informal trade can take place within a local community or across borders, often involving small-scale businesses or individuals operating in unregistered or unlicensed markets.

**Artificial Intelligence (AI):** Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to perform tasks that typically require human intelligence, such as learning, problem-solving, perception, and decision-making. AI technologies encompass a wide range of applications, including machine learning, natural language processing, computer vision, robotics, and expert systems. AI systems can analyze vast amounts of data, recognize patterns, and make autonomous or semi-autonomous decisions, leading to advancements in various fields such as healthcare, finance, transportation, and entertainment.

**Informal Economy**: The informal economy comprises economic activities that are not regulated or officially recognized by government authorities. It encompasses a wide range of informal employment, self-employment, and entrepreneurial activities that operate outside the formal sector. Participants in the informal economy may lack legal protections, social security benefits, or access to formal financial services. Informal economic activities often arise due to factors such as poverty, limited job opportunities, excessive regulations, or cultural norms, and they can have significant implications for economic development, income inequality, and social welfare.

**Information Technology (IT):** Information Technology (IT) refers to the use of computer systems, software, networks, and telecommunications infrastructure to store, retrieve, transmit, and manipulate data for various purposes. IT encompasses a broad range of technologies and applications, including computer hardware, software development, database management, cybersecurity, cloud computing, and internet technologies. Information technology plays a crucial role in modern society, facilitating communication, collaboration, automation, innovation, and access to information and services across different sectors such as business, education, healthcare, government, and entertainment.