

# Finlingo: A Conversational AI for Enhancing Financial Literacy Education in Africa.

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**Abstract**— Africa's Fintech revolution offers unprecedented financial opportunities, yet a persistent literacy gap hinders its full potential. Despite various educational initiatives, challenges in delivering effective financial education across diverse African contexts remain. This paper proposes the development of Finlingo, a conversational AI specifically designed to enhance digital financial literacy in Africa. Leveraging artificial intelligence, this tool aims to provide accurate, contextually relevant responses to a wide range of financial queries, addressing practical issues from basic concepts to complex financial products. By using natural language processing and machine learning, our approach seeks to overcome existing barriers, offering personalized, accessible, and up-to-date financial education. The AI system is designed to adapt to individual needs and encourage practical application of financial knowledge. This study contributes to ongoing efforts in promoting financial inclusion across Africa through an innovative, technology-driven solution, potentially bridging the gap between financial knowledge and effective decision-making.

**Keywords**— Fintech, AI language model, conversational AI education, literacy, developing countries, Africa.

## I. INTRODUCTION.

Africa is experiencing an unprecedented Fintech revolution, reshaping the continent's financial landscape and offering new opportunities for millions of underserved individuals. This sector is reshaping the financial, economic, and social landscape across numerous African countries [1], [2]. Boston Consulting Group [3] projects that by 2030, Africa will be the fastest-growing region globally for Fintech, underscoring the continent's emergence as a global center for Fintech development.

Central to this revolution is the rapid adoption of mobile technology, a catalyst that has democratized access to financial services. In a continent where traditional banking has often been out of reach for many, mobile has connected various demographics to essential financial resources and significantly

narrowed the inclusion gap [4], [5]. As of 2023, sub-Saharan Africa had 835 million mobile money accounts, representing nearly half of the global total [6].

However, despite this remarkable growth in Fintech adoption, a significant challenge remains: the widespread financial literacy gap. Numerous researchers, including Jamil et al. [7], Bashiru et al. [8], and Workneh [9], have presented empirical evidence supporting this concern. The complexity of financial products like e-wallets, savings, microcredit, and insurance products poses a significant barrier for many users, especially those with minimal experience in formal financial systems [10], [11]. This gap is particularly evident in rural and low-income populations, where understanding of complex financial concepts and the risks associated with digital financial transactions can be notably limited [12]. For instance, a study in Ghana found that only 32% of adults were financially literate, despite the country's high mobile money adoption rate [13]. This lack of understanding impedes the ability of these groups to make informed financial decisions, ultimately limiting their financial inclusion and economic empowerment.

To address this challenge, various stakeholders implemented financial literacy programs across the continent. In Kenya, for example, the FSD (Financial Sector Deepening) Trust has been running various financial literacy programs [14]. Similarly, the Ghanaian government launched several financial literacy initiatives that included training sessions, media campaigns, and the integration of financial education into school curricula [15].

Despite these commendable efforts, significant challenges in financial literacy persist as the rapidly evolving nature of financial technologies often outpaces the development and implementation of education programs [16]. Also, the diverse linguistic landscape and varying levels of digital access across different regions complicate the widespread dissemination of financial knowledge [17]. Additionally, the effectiveness of these programs in translating knowledge into behavioral change remains a concern. A study by Sayinzoga, A. et al. [18] found

that while financial literacy training improved knowledge, it did not always lead to significant changes in financial behaviors, suggesting a need for more innovative and engaging approaches.

This study aims to address the persistent challenges in financial literacy across Africa by leveraging the power of artificial intelligence. Specifically, the goal is to develop a conversational AI: Finlingo, designed to enhance digital financial literacy by providing accurate, contextually relevant responses to a wide range of questions related to financial literacy in Africa. The AI Assistant addresses practical queries — such as the process of applying for microfinancing or optimal investment strategies for small amounts of local currency. — Its primary objective is to provide clear explanations and contextual examples that improve the understanding of financial topics, thereby empowering individuals to make informed financial decisions. By reducing language barriers and simplifying complex concepts, this AI-driven approach aims to contribute significantly to financial inclusion across the continent.

This paper is structured as follows. First, Section II presents a literature review on financial literacy in Africa and conversational AI in education. Next, Section III details our research methodology, explaining Finlingo's development using the CRISP-DM framework. Subsequently, Section IV discusses the implications and potential impact of our research. Finally, Section V concludes the paper and outlines future directions.

## II. LITERATURE REVIEW.

### A. Financial literacy and AI.

Financial literacy plays a crucial role in enabling effective participation in the financial system and improving overall economic well-being [20, 21]. However, a significant knowledge gap persists in Africa, exacerbated by the increasing complexity of modern financial services and products [19]. While various initiatives, from traditional classroom-based education to online platforms, have aimed to address this issue, challenges remain in adapting content to local contexts and languages. This situation highlights the need for innovative, technologically driven solutions in financial education, as suggested by the OECD [22].

Notably, there is growing recognition of artificial intelligence's (AI) potential to address these challenges, with conversational AI emerging as a particularly promising approach [23]. Conversational AI, which enables human-like interactions through natural language processing, offers unique capabilities to tackle issues of accessibility, personalization, and scalability that have hindered traditional financial literacy programs [24].

Conversational AI-powered solutions can significantly enhance financial education in several key areas. First, they can keep pace with the rapidly changing fintech landscape, ensuring educational content remains current and relevant. Second, through natural language processing and multi-platform delivery, these solutions can overcome linguistic and accessibility barriers. Finally, by providing contextually relevant information tailored to individual needs and local contexts,

conversational AI can offer a more effective and personalized learning experience.

Recent studies have demonstrated the effectiveness of conversational AI in educational contexts [25]. For instance, Winkler and Söllner found that AI-powered chatbots can enhance learning outcomes and student engagement in higher education [26]. Similarly, Kuhail. et al. [27] highlighted the potential of conversational AI to provide personalized learning experiences, which is particularly relevant for financial education where individual circumstances and knowledge levels can vary significantly.

In the context of financial literacy, conversational AI offers the potential to create engaging, dialogue-based learning experiences that can adapt to the user's level of understanding and provide immediate, contextually relevant information. This approach aligns with the recommendations of Lusardi and Mitchell [28], who argue for more targeted and personalized financial education interventions.

### B. Conversational AI's types and capabilities.

Conversational AI refers to technologies that enable computers to engage in human-like dialogue through natural language processing (NLP) and machine learning (ML) [29]. These systems, often manifested as chatbots or virtual assistants, can understand, process, and respond to human language in a way that mimics human conversation [30]. Key capabilities of conversational AI, as outlined in [30, 31] and presented in figure 1, include:

1. Natural language understanding (NLU) to interpret user input
2. Natural language generation (NLG) to produce human-like responses
3. Dialogue management to maintain context and conversation flow
4. Knowledge base to store and retrieve relevant information

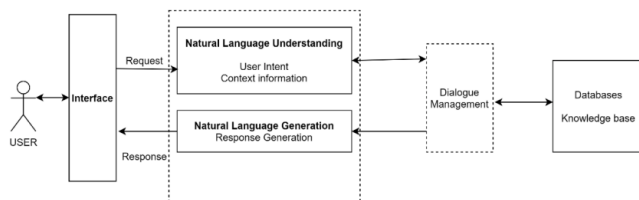


Fig. 1. Generic view of a Conversational AI's main components [30].

Conversational AI systems can be classified based on their functionality and design objectives, typically falling under three categories: informative, conversational, and task-oriented AI assistants [32]:

1. Informative AI assistants are designed primarily to deliver information to users, with FAQ-based AI being a common example that provides answers to frequently asked questions.
2. Conversational AI assistants, more advanced systems, aim to engage users in dynamic, context-aware dialogues,

leveraging sophisticated natural language processing and generation techniques to maintain coherent conversations over multiple turns.

3. Task-oriented AI assistants are designed to perform specific tasks or guide users through specific processes.

In the context of financial literacy, an informative AI assistant might provide definitions of financial terms or explain basic concepts like "savings account" or "credit score". A conversational AI for financial education could engage users in ongoing dialogues about personal finance, adapting its explanations based on the user's responses and understanding. A task-oriented financial AI could guide users through steps to open a mobile money account or comparing different loan options.

Finlingo, as a comprehensive financial literacy tool, aims to incorporate aspects of all three types: it can provide quick, informative answers to financial queries, engage in in-depth conversations to enhance understanding of complex financial topics, and assist with specific financial tasks or decision-making processes. This multi-faceted approach allows Finlingo to address various aspects of financial literacy education, catering to different learning styles and needs across diverse African contexts. The next section details Finlingo's development methodology, beginning with an overview of the Cross-Industry Standard Process for Data Mining (CRISP-DM) method.

### III. RESEARCH METHOD.

The development of Finlingo follows the Cross-Industry Standard Process for Data Mining (CRISP-DM) method [33]. While originally designed for data mining projects, CRISP-DM has been widely adopted and adapted for machine learning and AI development processes [34, 35]. This method consists of six phases that are cycled through iteratively: i) Business Understanding, ii) Data Understanding, iii) Data Preparation, iv) Modeling, v) Evaluation, and vi) Deployment.

*A. Business Understanding:* This phase involves defining the objectives and requirements of the project. Within the scope of Finlingo, the primary goal is to address Africa's financial literacy challenges through innovative technology. The project aims to develop a conversational AI system that can handle a wide spectrum of financial queries. The initial development focuses on bilingual capability in English and Swahili, the two most widely spoken languages in East Africa.

*B. Data Understanding:* This phase involves gathering and exploring the data available. For Finlingo, we conducted comprehensive data gathering to establish our knowledge base. The team conducted extensive web scraping to gather financial information from diverse sources, including industry publications, regulatory documents, financial news outlets, and reports. To enhance the data collection process, volunteers participated in a crowdsourcing initiative, contributing to a central data repository. This collaborative approach ensured a rich and varied dataset, laying the foundation for further development. The dataset included 5,353 documents and 436 Google Scholar research papers, offering a wide-ranging

representation of financial terminology and concepts relevant to the African context.

*C. Data Preparation:* This phase includes cleaning, transforming, and organizing the data in a form suitable for model building. For Finlingo, the collected data was preprocessed to remove any irrelevant information, ensuring the quality and relevance of the content. Data cleaning techniques like removing irrelevant symbols and standardizing text formatting have been shown to significantly reduce noise and improve model performance [36]. The texts were further divided into smaller data chunks to a maximum size of 512 tokens to overcome the computational limitations of transformer-based models.

*D. Modeling:* This phase involves building and training the machine learning model that powers the Finlingo AI assistant. The development process was characterized by a progressive approach, starting with foundational frameworks and evolving towards more sophisticated ones to meet the increasing complexity of financial literacy tasks.

#### *i) Foundational model: from RASA to LLAMA*

The first version of the Finlingo model was developed using the RASA framework, an open-source machine learning tool designed for building contextual AI assistants and chatbots [37]. RASA [www.rasa.com] provided a solid foundation for handling basic financial queries and conversations. However, as the complexity of financial tasks increased, RASA's limitations became apparent. Finlingo struggled with complex financial concepts, often producing high hallucinations and inaccurate responses when built on this framework.

To address the challenges faced with RASA, the adoption of more powerful frameworks became necessary, leading to the introduction of Llama (Large Language Model Meta AI) into the Finlingo project. Developed by Meta AI, Llama is an advanced language model designed to process and generate human-like text across a wide range of domains. Its architecture is based on the transformer model, a neural network structure that has demonstrated high effectiveness in various NLP tasks [38].

Llama's capabilities are extensive, offering advanced natural language understanding and generation, robust performance on specialized tasks, and improved context retention and utilization. A key strength of Llama lies in its comprehensive training data. The model was trained on a diverse and vast corpus of text, including sources from the internet, academic publications, and various other domains. These features make Llama particularly suitable for Finlingo, as it can handle the complexities of financial literacy topics across multiple languages, providing accurate and relevant information to users [39].

#### *ii) Developing the Finlingo Model*

The Llama AI model received specialized training to handle financial questions in Africa. This involved two main steps:

1. The first stage involved pre-training the model on a large amount of financial data from Kenya. This helped Llama learn

about East African – particularly Kenyan – markets, financial and economic practices.

2. The second stage involved fine-tuning the model by incorporating Crew-AI agents. CrewAI [www.crewai.com] is a platform that allows users to automate workflows by building, deploying, and optimizing AI agents quickly. An "Agent" in the context of AI and computer science refers to an autonomous entity or software that can perform tasks or make decisions on behalf of a user [43]. So, this process enhanced Llama's ability to apply its knowledge to real-world financial scenarios in Africa. Crew AI agents simulated various user interactions, mimicking real-world user queries and behavior.

Fine-tuning is an essential technique for optimizing large language models (LLMs) in specific domains. It involves training the LLM on a smaller, task-specific (labeled) dataset, which effectively specializes its capabilities for the desired application [40]. In our case, the fine-tuning process helped tailor Llama's vast knowledge to African financial contexts, improving its performance in handling region-specific queries and tasks.

This iterative training process, incorporating both data and simulated interactions, enabled Llama to adapt to new information, learn from mistakes, and continuously improve its effectiveness in answering financial queries specific to the African context. The resulting specialized model, referred to as Finlingo model (full version name: Finlingo2-Llama3), was optimized for African financial contexts.

### E. Evaluation

To assess Finlingo's effectiveness, a comparative analysis was conducted against ChatGPT and Gemini, two prominent AI language models. This evaluation focused on the accuracy, relevance, and comprehensiveness of the responses provided by each model to specific financial queries.

Two queries were chosen to represent common financial literacy questions and were selected based on their relevance to the Kenyan financial landscape and their potential to assess the models' ability to provide accurate and informative responses

1. *What are Timiza loan rates?*
2. *What are Payless Africa transaction costs?*

Based on the results (Appendix 1), Finlingo demonstrated superior performance in both queries, providing accurate, relevant, and comprehensive responses. While ChatGPT and Gemini were able to provide accurate information for the first query, their responses were less comprehensive and lacked the contextual understanding exhibited by Finlingo. For the second query, ChatGPT struggled to provide relevant information, highlighting the limitations of its knowledge base in specific financial institutions.

The comparative analysis demonstrates Finlingo's effectiveness in addressing financial literacy queries. Its ability to provide accurate, relevant, and comprehensive responses, coupled with its strong contextual understanding, positions it as a valuable tool for financial education in the African context.

*F. Deployment:* The deployment phase of Finlingo involves implementing the developed model into a functional application that can be accessed and used. This phase involves developing the architecture of the system, its components, and the workflow of user interactions.

Finlingo's architecture consists of several interconnected components that work together to process user queries and provide accurate, contextually relevant financial information for East Africa. Here's an overview of the key components and their roles in the system (Figure 2):

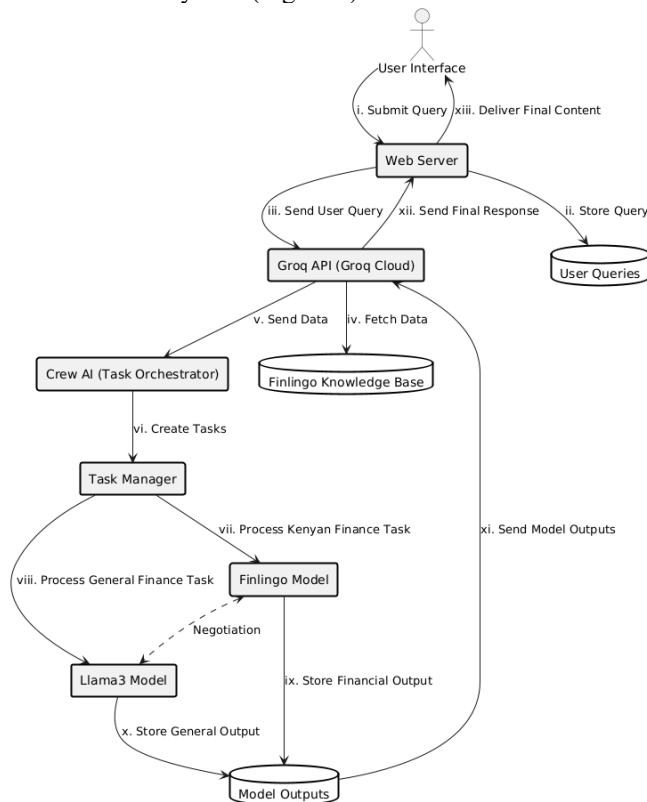


Fig. 2. Overview of the Finlingo Architecture.

#### a) User interface

The user interface functions as the primary interaction point between users and the Finlingo App. Its design prioritizes accessibility and usability. The interface accepts user queries related to financial literacy in both English and Swahili.

#### a) The Web server

The web server acts as the intermediary between the user interface and the backend systems. It receives user queries from the interface and logs them in a database for future analysis and system improvement. The server forwards the queries to the Groq API for further processing. Upon receiving the final response, it delivers the content back to the user interface.

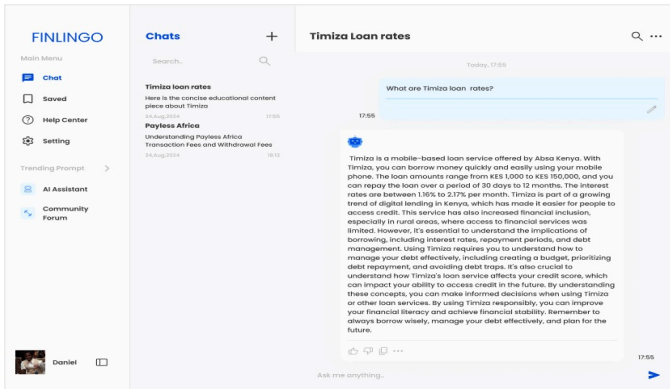


Fig. 3. Finlingo UI: English.

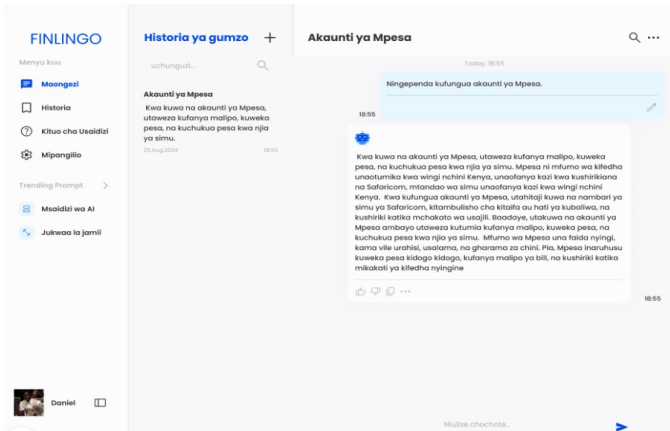


Fig. 4. Finlingo UI: Swahili.

*b) The Groq API*

The Groq API is generally a gateway to open-source language models, enabling text generation through simple input-output interactions. In Finlingo's architecture, this API acts as the central coordinator. When a user query arrives from the web server, the Groq API initiates the processing workflow by forwarding the query to CrewAI for preliminary analysis.

*c) CrewAI*

CrewAI processes the incoming query by first interpreting its content and context within the African financial landscape. It then logs this analysis and reports back to the Groq API. If necessary, CrewAI can request additional information from Finlingo's knowledge base. This comprehensive approach ensures that each query is thoroughly understood before generating a response, allowing for accurate and culturally relevant financial advice.

*d) Finlingo & Llama models*

The interpreted query is then passed first to the Llama model, which generates an initial response. If the query requires specific data or complex calculations pertaining to African financial literacy, Llama requests additional information from the Finlingo model. Llama then integrates this supplementary data with the initial response, creating a comprehensive answer. Before delivery, this response undergoes a final check for accuracy and relevance. The system then translates the answer

into the user's preferred language, either English or Swahili. Llama sends the response to the Groq API, which channels it to the web server. Finally, the user interface presents this tailored, multilingual response to the user, completing the query-response cycle. This collaboration between the two models generates explanations, advice, or instructional content tailored to the user's query and the African context the information

This multi-component architecture ensures that Finlingo can process complex financial queries, leverage collaborative AI capabilities, and deliver accurate, contextually relevant information to users in their preferred language.

IV. DISCUSSION AND CONCLUSION

*a) Research implications*

Finlingo addresses the critical issue of financial literacy in Africa. Despite rapid fintech expansion, substantial gaps in financial understanding persist across the continent. Traditional education methods have fallen short in meeting diverse demographic needs. By leveraging advanced AI technologies and tailoring its approach to Africa's unique challenges, Finlingo demonstrates the potential to revolutionize financial education in the region.

A key focus of Finlingo is addressing gender disparities in financial understanding. For instance, [41] observed that women in Kenya often resort to informal credit systems such as Chamas, largely due to a lack of financial literacy. This trend not only underscores the gender gap in financial knowledge but also increases women's vulnerability to over-indebtedness. Finlingo's AI-driven financial education platform is specifically tailored to address these disparities. By enhancing women's understanding of both informal and formal financial avenues, Finlingo aims to equip them with the knowledge necessary for prudent financial decisions, thus promoting gender equality in financial participation.

Language diversity presents another significant challenge to financial literacy in Africa. In Tanzania, for example, over 120 languages are spoken, and low literacy rates impede the adoption of financial services and technologies [42]. This linguistic diversity has hindered individuals' ability to manage finances and understand the true costs of loans. Finlingo's approach of translating financial concepts into local languages has the potential to dramatically increase financial inclusion. By enabling local microfinance institutions – like FINCA – to offer mobile banking services in local languages, Finlingo could potentially reach 5 million previously excluded individuals.

*b) Research limitations*

Despite its promising approach, Finlingo faces limitations including reliance on internet connectivity and digital devices, challenges in addressing diverse financial systems across Africa, and the need for constant updates to keep pace with evolving financial technologies. Nonetheless, Finlingo's contributions are substantial. It has developed a multilingual AI system capable of

explaining complex financial concepts in local languages, adapting to diverse cultural contexts across Africa. This demonstrates the potential of AI in overcoming language barriers and tailoring content to users' needs in financial education.

### c) *The way forward*

Finlingo is currently in its prototype phase, with initial technical validation completed through comparative analysis against existing AI models. However, we acknowledge the critical need for empirical research to assess its practical effectiveness in real-world settings. Our immediate next steps include conducting pilot studies in partnership with selected financial institutions in Kenya to gather quantitative and qualitative data on user engagement, learning outcomes, and behavioral changes. This will be followed by implementing a phased rollout strategy, starting with controlled user groups to measure the tool's impact on financial decision-making and literacy levels through pre- and post-intervention assessments. We are also establishing research partnerships with academic institutions to design and execute longitudinal studies that will track the long-term effects of AI-driven financial education on user financial behaviors and outcomes. The long-term vision is to create a comprehensive, scalable multilingual financial literacy tool that can cater to the diverse linguistic landscape of Africa, thereby maximizing the reach and impact of financial education across the continent.

In conclusion, while challenges remain, Finlingo represents a pioneering approach to financial literacy in Africa. Its success could serve as a model for similar initiatives, showcasing the power of AI in addressing critical social and economic challenges in developing regions.

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*Appendix: Finlingo responses vs other models*

| ChatGPT                                                                                                                                                                                                                                                                                                                                | Finlingo                                                                                                                                                                                                                                                                                                                                     | Company info                                                                                                                                                           | Gemini                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Timiza offers instant loans to its users, with amounts varying based on the user's credit score, transaction history, and repayment behavior. The loan amounts can range from as low as KSh 50 to up to KSh 150,000 or more.                                                                                                           | The loan amounts range from KES 1,000 to KES 150,000, and you can repay the loan over a period of 30 days to 12 months. The interest rates are between 1.29% to 2.96% per month                                                                                                                                                              | Access Timiza loan from Kes1000 up to Kes 150,000. b. Repayment period of 30 days. d. Best price in the market of 5% facility fee and interest fee of 2.96% per month. | Loan Rates: Interest Rate: 1.083% charged once. Facilitation Fee: 5% of the amount borrowed. Term: 30 days.                                                                                                                                                                                   |
| Payless Africa is a mobile payment service that allows users to make transactions, pay bills, and transfer money. It is used in Kenya and integrates with mobile money services like M-Pesa. Payless Transaction Costs: The transaction costs associated with Payless can vary depending on the specific services being used, such as: | As a user of Payless Africa services, it's essential to understand the transaction fees and withdrawal fees associated with using their platform. This knowledge will help you make informed decisions about your financial transactions and avoid any unexpected costs. This fee varies depending on the type of transaction you're making. | Zero transaction fees will be applied to the following services: Payless to Payless transfers Payless to M-PESA transfers Payless Send to Bank transfers               | Payless Africa transaction costs can vary depending on the specific transaction type and amount. However, they generally offer competitive fees compared to other digital payment specific rates may have changed since my last update, here's a general breakdown of their transaction costs |