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Digital Finance and Agri-Food Value Chains

Case Studies from Tanzania

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CONTENTS

1. INTRODUCTION

Agriculture is vital to Tanzania's economic framework, significantly contributing to the country's gross domestic product (GDP). According to the ministerial report on the agriculture sector, the agriculture sector contributed 26.3 percent to national GDP in 2024, an increase from 26.2 percent in the previous year (MOA, 2025). It employed an average of 61.4 percent of the population, a slight decrease from 65.6 percent in 2023. Furthermore, agriculture provides 65 percent of essential raw materials for industries (MOA, 2024). Specifically, crop production recorded a growth rate of 4.2 percent in 2023, up from 2.7 percent in 2022, contributing 16.1 percent to national GDP, an increase from 15 percent in 2022 (MOA, 2024). Agriculture continues to play a critical role in ensuring food security, meeting 128 percent of domestic food demand in 2024 (MOA, 2025). Exports of agricultural products also saw substantial growth, reaching approximately USD 3.54 billion in 2023/2024, a significant increase from about USD 1.2 billion in 2019/2020 (MOA, 2025).

Tanzania's agricultural transformation increasingly relies on modernizing agri-food value chains, especially those linking rural producers to growing urban and export markets, which are seeing a widening price gap. Value addition is essential for improving agricultural productivity and can take multiple forms. Hidayati et al. (2023) categorize value addition based on quality, safety, and market orientation, while emphasizing the importance of social factors such as job creation and food safety, alongside economic aspects such as sales, profitability, and environmental impacts. In agriculture, value addition involves transforming raw materials into finished products and by-products through processes such as drying, processing, packaging, and distribution. These activities enhance the market value of agricultural products, bolster economic growth through job creation, and contribute to food security. Consequently, maximizing value addition is crucial to fully leveraging the potential of Tanzania’s agricultural sector and translating it into measurable economic growth.

Midstream actors—such as traders, processors, storage providers, and transporters—play a crucial yet often overlooked role. Despite their growing contributions to value addition, employment, and food system efficiency, they remain largely underserved by the formal financial sector. Recent research by Ambler et al. (2023) highlights the diverse and significant financial constraints faced by midstream actors, including liquidity shortages, investment capital gaps, and exposure to price and operational risks. These challenges vary depending on the value chain structure, seasonality, and market orientation. In the absence of adequate formal financing, midstream actors often rely on informal arrangements or vertical contracting, which are usually insufficient or inequitable. Digital Financial Services (DFS) offer a promising pathway to more inclusive and scalable financial solutions, provided they are carefully tailored to local contexts and needs.

A study by Jadhav et al. (2023) outlines the landscape of DFS in Tanzania’s agriculture sector, emphasizing both innovation and fragmentation. As of 2023, mobile money usage is relatively high, with around 72 percent of adults using these services. However, their use for agricultural purposes remains minimal, as over 65 percent of farmers report using mobile money less than once a month. DFS products, including short-term loans, savings, crop insurance, and input financing, are primarily designed for smallholders and are delivered by banks such as CRDB and non-bank innovators like Mavuno Technologies and Digital Mobile Africa. Notable initiatives like One Acre Fund and Pula stand out for integrating financing with farmer profiling and insurance. Despite these innovations, several systemic issues impede widespread adoption. Major obstacles include limited access to reliable farmer data, low levels of financial and digital literacy, and insufficient infrastructure in rural regions. Risk-averse lenders, the absence of long-term

asset financing, gender imbalances in phone ownership, and inconsistent policy implementation further limit uptake. Nonetheless, progress is being made. The expansion of agent networks, regulatory advancements such as the Bank of Tanzania's fintech sandbox, and interoperability among mobile networks lay the groundwork for scalability. However, the DFS landscape largely remains generic in its approach to agriculture, with few solutions specifically designed for the distinct requirements of individual value chains, underscoring a pressing demand for more tailored digital finance solutions (Jadhav et al., 2023).

1.1. Value Chain Selection

The objective of this report is to identify the unique characteristics and opportunities within each value chain by applying a range of selection criteria. These criteria include value chain structure, vertical and horizontal integration, level of formality, infrastructure quality, market access, value addition, innovation and technology adoption, scale and market potential, production value, market demand, export potential, growth potential, cost competitiveness, and market expansion opportunities. Socio-economic impacts are also considered, such as employment generation, the number of benefiting households, and inclusivity and equity dimensions. Specifically, inclusivity is examined through factors such as accessibility for people experiencing poverty, contributions to food security, food availability and access, price stability and affordability, nutritional and health implications, policy and institutional support, environmental sustainability, and cultural significance. Furthermore, the report explores the conditions for digitalization across these value chains. Details about the selection criteria and rationale are presented in the Appendix.

This report analyzes seven selected value chains in Tanzania's agri-food sector, focusing on key commodities: maize, poultry, cashew nuts, pulses, sunflower oil seeds, rice, and coffee. These value chains were selected based on their domestic and international significance, as well as alignment with government priorities. Maize, rice, and pulses (particularly beans) are highlighted for their domestic importance as staple foods in Tanzanian households. Cashew nuts and coffee are recognized for their international relevance as sources of export earnings. Meanwhile, oilseeds, especially sunflowers, and poultry are prioritized by the government as they are essential for both domestic consumption and generating community income. The growth of these agricultural value chains underscores their critical role in driving Tanzania's economy. Significant production increases, such as a 91 percent rise in maize and over 150 percent in both cashew and sunflower production, highlight the country's expanding agricultural capacity (MOA, 2025). Tanzania's position as Africa's second-largest producer of maize and pulses, and fourth-largest producer of coffee further highlights the strategic importance of these sectors (MOA, 2025). Furthermore, the growing poultry industry reflects the rising domestic consumption and improvements in nutritional quality (MLF, 2024). Collectively, these value chains make a substantial contribution to employment, foreign exchange earnings, and industrial development, reaffirming agriculture as a cornerstone of Tanzania's socio-economic transformation.

1.2. Data and Resources

A comprehensive methodology was employed, combining document reviews with expert interviews on value chain characteristics. The reviewed documents include research reports, reports from government websites, donor-funded project reports, and other online materials containing information about the selected value chains. This thorough approach enables an in-depths analysis of each value chain's features, including production value, export potential, and socio-economic impacts.

1.3. Key Findings

Findings confirm that the selected value chains are crucial for transforming Tanzania's agricultural sector. However, digitalization within these value chains remains limited, except for the maize and rice value chains, which have more established structures due to the nature of trade activities. Most farmers have access to mobile phones, although they may not necessarily have smartphones. Nevertheless, mobile phones and banking services that facilitate business transactions are generally available across all regions (FSDT, 2023).

2. MAIZE VALUE CHAIN

2.1. Value Chain Characteristics

Maize is a crucial economic crop that contributes to Tanzania's food security and foreign income. Over the last two decades, Tanzania has ranked among the top 25 maize-producing countries in the world (Adam et al., 2020; Sundy Merchant, 2020). It is a major maize producer in Sub-Saharan Africa, ranked 1st in East Africa, 3rd on the continent, and 19th globally (Suleiman, 2018; Suleiman & Rosentrater, 2015).

Maize is a staple food crop grown and consumed by most Tanzanian households, primarily by smallholder farmers. Of the nearly 9 million households that engage in crop production, over 6.9 million (77.3 percent) cultivate maize (NBS, 2024). It is one of Tanzania's most significant food crops, accounting for 45 percent of the total cultivated area. Smallholder farmers account for 6,267,523 hectares of the 6,286,554 hectares under maize cultivation. Large-scale farms cultivate the remaining 19,031 hectares (NBS, 2024). Maize is typically consumed once or twice daily, making it a significant food source. About 55.5 percent of the maize grown in 2022 by smallholder producers was consumed at the household level (NBS, 2024). Economically, maize is Tanzania's leading cereal crop, accounting for 71.9 percent of total cereal production and 52 percent of all food crops produced annually (NBS, 2024). Production rose significantly from 6,417,356 tons in 2022 to 12,261,162 tons in 2024, a 91.1 percent increase (MOA, 2025; NBS, 2024). Although growing conditions are generally suitable for maize, the yields are low, averaging about 2.0 metric tons per hectare.

Maize is grown in all seven agroecological zones, spanning approximately 25 mainland regions, due to the country's diverse climatic conditions, which are influenced by topography, rainfall patterns, temperatures, growing seasons, soil types, landforms, and production practices (Barreiro-Hurle, 2012). Tanzania has two cropping seasons, primarily defined by the masika and vuli rain seasons. The vuli season accounts for about 15 percent of annual maize production, while the remainder comes from the unimodal and bimodal masika long rain seasons (Barreiro-Hurle, 2012; WFP, 2010). The unimodal zone encompasses the country's south, central, and western regions, characterized by a prolonged rainy season from December to April, with planting typically occurring in November and harvesting in June and July. The bimodal zone encompasses the northern, eastern, and northwestern regions, as well as the north coast, where a short rainy period occurs from October to December, and prolonged rainy periods take place from March to May. The short rains harvest occurs in late January and February, while the long rains and harvests occur in July and August. The cropping seasons in Tanzania depend on whether the area has a unimodal or bimodal rainfall pattern, which influences production volumes.

While primarily cultivated for household use, maize is also an important cash crop for many farming families in Tanzania. It plays a significant role in the political landscape, leading to the implementation of trade measures to safeguard food security. In recent years, the Government of Tanzania has launched various initiatives, including the ‘Kilimo Kwanza’ or ‘Agriculture First’ program and the Agricultural Sector Development Programs ASDP1 and ASDP2. These initiatives, designed for maize production, provide subsidies for inputs such as fertilizers and pesticides in key maize-growing regions, including Ruvuma, Mbeya, Iringa, and Rukwa (URT, 2016). For instance, the 'Kilimo Kwanza' program aims to transform agriculture from subsistence to commercial farming, thereby increasing productivity and income for farmers (Mwaisakila & Kalimanzila, 2021). Similarly, ASDP1 and ASDP2 focus on enhancing agricultural productivity and promoting market-oriented production, with a specific emphasis on maize.

Maize prices in Tanzania fluctuate due to the seasonality of production and the organization of the value chain. To stabilize prices and protect farmers, the Government of Tanzania established the Strategic Grain Reserves (SGR) under the National Food Reserve Agency (NFRA). This agency purchases maize from farmers at a fixed floor price above market rates. These strategies aim to secure markets for farmers’ yields, particularly in areas with surplus production. However, the SGR often faces challenges due to insufficient funds to acquire all the maize farmers offered at the purchasing centers.

In 2024, the government, through the NFRA, acquired 407,729 tons of maize, equivalent to approximately 0.3% of total maize production, with a budget of TZS 14 billion allocated to the Ministry of Agriculture. Plans were also set to borrow funds from financial institutions for this purpose (MOA, 2024, 2025). The NFRA's goal is to facilitate the sale of surplus maize in the market, stabilizing prices and enhancing food and nutrition security for consumers in the country. Nevertheless, several farmers continue to have unsold surplus produce after incurring costs associated with transporting their products to buying centers. When government agents do not buy the entire harvest at the farm gate, smallholder farmers look for alternative buyers. This is especially challenging for impoverished farmers who lack access to transportation.

In 2022, maize exports were valued at USD 91.5 million, positioning it as the seventh largest commodity by export value and representing 4.8 percent of the top 20 crop exports (Jadhav et al., 2023). Principal export markets are neighboring East African countries, with Kenya identified as the predominant market. From 2022 to 2023, the most rapidly expanding export markets for Tanzanian maize included the Democratic Republic of the Congo (USD 786,000) and Burundi (USD 466,000) (OEC, 2024). Tanzania also exports maize seeds, with Uganda serving as the largest recipient. In 2023, Tanzania imported maize valued at USD 44.3 million, making it the 87th largest importer of maize globally. During the same year, maize was recognized as Tanzania's 78th most imported product (OEC, 2024). The OEC (2024) report highlights the main sources of maize imports for Tanzania, which are Zambia (USD 26.4 million), Uganda (USD 11.6 million), Malawi (USD 4.36 million), Zimbabwe (USD 985,000), and South Africa (USD 291,000). The fastest-growing import markets for maize in Tanzania from 2022 to 2023 were Uganda (USD 9.59 million), Zambia (USD 5.49 million), and Brazil (USD 252,000).

2.2. Types of Actors

The maize value chain in Tanzania involves several key participants, including farmers, input suppliers, traders, processors (storage and milling facilities), transporters, wholesalers, retailers, and consumers. Input suppliers, such as seed companies and agro-dealers, provide farmers with essential resources like maize seeds, fertilizers, pesticides, and technologies. Producers (farmers) are classified into two categories: small-scale farmers, who make up about 73 percent of all agricultural households, producing crops and significantly contributing to maize production for subsistence and cash crops, and commercial farmers, who account for only 0.2 percent of farming households, producing crops and focusing on market-oriented output (URT, 2021).

Traders and aggregators, including buyers and intermediaries, facilitate the movement of maize from producers to processing facilities. They also encompass small, medium, and large-scale aggregators, as well as private and government entities (e.g., NFRA). Transporters ensure that maize and its products reach their destinations. Processors, such as maize millers, convert maize into flour and other forms suitable for consumption or animal feed. Millers are categorized as small, medium-sized, and large-scale operators who supply various customers. Small-scale millers serve home consumers, small shops, and wholesalers. Medium-sized millers supply supermarkets and wholesalers, while more prominent millers cater to supermarkets and institutional buyers and export their products to other countries. Distributors, including wholesalers and retailers, manage the sale and distribution of maize products to consumers, who ultimately buy them for their households.

Additionally, various stakeholders play vital roles, including microfinance institutions that support farmers financially and maize producers' associations that advocate for the interests of agricultural producers. Key players include the Tanzania Seed Traders Association, which has 57 seed members, the Agricultural Council of Tanzania (ACT), and Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA), a network of small-scale farmers striving for a better market (Barreiro-Hurle, 2012; Lunogelo et al., 2020). Non-Governmental Organizations (NGOs) and Community-Based Organizations (CBOs) promote sustainable practices and provide technical assistance. Local government authorities regulate the maize market, and policymakers develop and enforce relevant agricultural policies.

Women and youth face specific challenges within the maize value chain, including barriers to accessing credit, training, and extension services. Empowering them through education, skills development, and leadership training is essential for enhancing their participation and success in this sector. Research shows that the productivity of female-headed households in maize cultivation is significantly influenced by their access to resources and opportunities, which often falls behind that of male-headed households (Adam et al., 2020; Wilson & Lewis, 2013). Addressing these gender inequalities requires the implementation of policies and legal reforms that promote gender equality, particularly in critical areas such as land ownership, access to resources, and economic opportunities.

Creating gender-sensitive business models that consider the unique needs and interests of women and youth can help establish more inclusive and sustainable maize value chains. Research highlights that while men predominantly control the higher tiers of the maize value chain, involvement from women and youth is typically restricted to essential maize production (Adam et al., 2020). They often struggle to penetrate higher-value segments and face considerable obstacles in expanding their roles in buying, trading, or retailing maize.

Regional disparities exist in decision-making processes regarding maize sales, with men remaining the primary decision-makers. To rectify these imbalances, it is crucial to adopt gender mainstreaming strategies and transformative initiatives aimed at the upper levels of the maize value chain. Such efforts will foster a fair and balanced environment for all stakeholders, enabling them to thrive in all aspects of the maize sector.

3. POULTRY VALUE CHAIN

3.1. Value Chain Characteristics

Livestock production is a key agricultural activity and vital to Tanzania's economy. It accounts for around 7 percent of GDP, with poultry alone contributing 1.8 percent (BFAP & SUA, 2018). Beyond its economic impact, the livestock subsector enhances dietary diversity by supplying a range of products, including meat, milk, dairy products, and eggs, for consumption. Poultry farming plays a vital role in both urban and rural settings, contributing to food security, generating a source of income, and fulfilling social functions such as dowries and rituals. The poultry sector has significant potential for growth, given the availability of land to cultivate grains and soya for poultry feed.

The Tanzanian poultry value chain is a crucial component of the nation's agricultural economy, contributing significantly to employment, particularly for women and youth, nutrition, and income generation (Davids et al., 2021; FAO, 2019; Landani et al., 2024). Key production indicators highlight the sector's substantial scale: Tanzania produces approximately 5.7 million metric tons of broiler meat and requires around 186 million day-old chicks (DOCs) annually to meet the demand for chicken production (NSI et. al., 2024). In 2021, per capita chicken meat consumption was about 1.51 kg, compared to 19 kg per capita for total meat consumption (Landani et al., 2024).

Tanzania has a poultry flock of approximately 103.1 million chickens, including 47.4 million indigenous and 55.7 million exotic breeds (MLF, 2024). According to the 2024 ministerial budget speech, Tanzania produces around 6.41 billion eggs and 132,442.28 metric tons of poultry meat annually, accounting for 14 percent of Tanzania's overall meat production (MLF, 2024). During the 2019/2020 fiscal year, hatcheries produced 70,323,000 DOCs, comprising 60,463,872 broilers, 1,999,128 layers, and 7,860,000 dual-purpose chicks (Ringo & Lekule, 2020). Annual imports include 790,744 parent stock DOCs, 904,280 hatching eggs, and 527,710 DOCs (MLF, 2024).

Free-range production accounts for over 46 percent of the local poultry population, while the remaining 54 percent comes from intensive production by dual-purpose and exotic bird producers (FAO, 2019). Large-scale chicken breeding is led by a few multinational corporations and local entrepreneurs. Over the past decade, private sector investments in commercial poultry have surged, particularly in small-scale broiler and layer production (Landani et al., 2024). There has also been a rise in funding for veterinary services, feed production, and DOC supply, focusing mainly on exotic breeds and new crossbreed varieties (Ringo & Mwenda, 2018). Government-backed initiatives, like those from the Ministry of Livestock and Fisheries (MLF), have focused on empowering youth and women through direct support programs. For example, the MLF distributed over 81,000 DOCs to 151 women's organizations across regions like Dar es Salaam, Dodoma, Pwani, and Rukwa, highlighting the inclusive nature of sectoral development efforts (NSI et al., 2024).

Poultry production in Tanzania benefits from short and recurring growth cycles, particularly for broilers, which are usually ready for the market within 4 to 6 weeks. This enables multiple production cycles each calendar year, resulting in a continuous supply of poultry meat. Nonetheless, the sector's productivity is significantly influenced by the seasonality of feed crop production. The country faces a feed deficit, with an annual demand of 3.59 million metric tons against a production of 2.3 million metric tons, utilizing only 22 percent of feed mill capacity. Feed production capacity has grown from 700,000 metric tons in 2017 to approximately 1 million metric tons in 2024 (Landani et al., 2024; Ringo & Lekule, 2020). This shortfall leads to increased feed costs and significant production bottlenecks, particularly for small- and medium-scale producers.

Tanzania's poultry market is predominantly domestic. While exports of poultry products exist, they are limited in volume and irregular, often constrained by logistical challenges and inconsistent trade policies (Ringo & Lekule, 2020). Small-scale exports have been made to regional neighbors, including Kenya, Uganda, Rwanda, and Malawi. Meanwhile, imports, especially of DOCs and fertilized eggs, are crucial to supplement domestic breeder capacity (MLF, 2022, 2024).

Main drivers of the value chain include urban population growth, rising consumer awareness of protein intake, and an expanding middle class with shifting dietary preferences (Ringo & Lekule, 2020; Ringo & Mwenda, 2018). However, the sector faces systemic challenges, including underdeveloped infrastructure, limited veterinary and extension services, low farmer capacity, inadequate cold chain logistics, and insufficient biosecurity standards (Landani et al., 2024; Valerian et al., 2024). Overcoming these constraints through strategic investment in training, infrastructure, and regulatory enforcement will be essential for unlocking the full potential of Tanzania's poultry value chain and increasing its value-added output.

3.2. Types of Actors

The Tanzanian poultry value chain consists of several actors playing distinct roles across the production, input supply, processing, and marketing stages. These include breeder farms, hatcheries, feed mills, smallholder and commercial poultry farms, veterinary input suppliers, traders, processors, and retailers. Among these, actors such as aggregators, hatcheries, feed suppliers, and veterinary service providers maintain close links with producers through input provision, technical support, and market integration. These relationships benefit producers by ensuring a reliable supply of essential inputs and guaranteed market access, while intermediaries gain from consistent product availability and quality control (Valerian et al., 2024)

Although an "apex" actor structure is not formally established within the poultry sector, large breeder farms and hatcheries, major feed companies, and a few vertically integrated poultry businesses act as de facto leaders. These actors tend to dominate the midstream segment by offering breeding services, DOCs, processed feed, and, in some instances, technical assistance to smaller producers (NSI et al., 2024; Valerian et al., 2024). They maintain relatively stable relationships with clusters of smallholder farmers and traders, enabling coordination across the value chain.

The size and concentration of each segment varies. There are approximately 28 hatcheries, with Interchick, Silverlands, and Irvines among the largest (Ringo & Lekule, 2020). The feed market is less concentrated, with around 20 suppliers, each with an annual capacity of over 50,000 metric tons per year. The two largest suppliers, Falcon and Backbone, each have a production capacity of around 350,000 metric tons per year, followed by Hill Feeds and Silverlands, with capacities exceeding 250,000 metric

tons (Landani et al., 2024). The number of smallholder poultry farmers and informal traders runs into the thousands, illustrating a highly fragmented base with a few dominant midstream players.

Relationships among intermediary actors are mostly informal. While a few actors engage in semi-formal contracts, such as those between producers and breeding companies, most interactions rely on trust, repeat transactions, and word-of-mouth reputation (NSI et al., 2024). Gender dynamics in the value chain show a strong presence of women at the producer level, especially in small-scale backyard poultry farming. Women's participation tends to decrease as one moves downstream, with feed supply, aggregation, and wholesale trade being more male-dominated (NSI et al., 2024). To address this disparity, government and donor-supported programs have targeted women and youth with DOCs, training, and market access initiatives (Ringo & Lekule, 2020). Access to credit is a significant constraint throughout the value chain, with few actors having access to formal financial services. The absence of affordable and accessible financing limits the ability of farmers and intermediaries to invest in scaling their operations or improving product quality (NSI et al., 2024).

Most consumers prefer to buy live poultry directly from small-scale farms and handle slaughtering at home. However, there is a growing trend toward using slaughtering services at urban poultry markets, which include killing, feather removal, and the processing of other by-products. According to the literature, there are approximately ten private medium- and large-scale poultry slaughter facilities in Tanzania, including Kuku Poa, Interchick, Frostan, Kijenge, Kiliagro, Mitobolo, Mkuza, Kingchick, Endanahai, and Omondi. Generally, these are vertically integrated poultry operations (Ringo & Lekule, 2020).

4. CASHEW NUT VALUE CHAIN

4.1. Value Chain Characteristics

Cashew nuts are one of Tanzania's 13 strategic crops, with the potential to raise the country's GDP growth rate from 5.4 to 10 percent by 2030 under the 'Agenda 10/30' framework (URT, 2024). Cashew nuts significantly contribute to the country's economy and nutritional diversity, and their natural pest resistance has led to high demand in both domestic and international markets (UNIDO, 2011).

Through processes such as drying, roasting, flavoring, and packaging, raw cashew nuts are transformed into kernels and various by-products. As of April 2025, approximately TZS 1.52 trillion in value-added was generated through the sale of 528,262 metric tons of produce in domestic and export markets (Citizen newspaper, March 13, 2025; CBT website). This marks an increase of over 100 percent from the previous season. Recently, 700,000 cashew farmers have been registered by the Cashewnut Board of Tanzania (CBT). The increase is an indicator of the creation of more jobs along the value chain (CBT, 2024a). The recruitment of 500 agricultural field officers through the 'Building Better Tomorrow' (BBT) initiative marks a step forward in increasing cashew production, which is expected to have a significant impact on value creation (CBT, 2024a).

Around 667,437 households are engaged in cashew farming in Tanzania (URT, 2021). Processors, traders, and sales agents operating in the cashew nut value chain have the potential to create jobs both upstream and downstream in the value chain (CBT, 2024a). Gender differences are evident across different segments of the value chain. For example, cashew processing is often regarded as a female-dominated activity, resulting in fewer male participants. Meanwhile, spraying is typically considered a

male-dominated function, while both men and women are involved in the sales and marketing of cashew products (Mihyo et al. 2019; Mpenda,2020; Aku et al. 2023; Bryan et al. 2023).

Cashew is a perennial crop, which means it takes a minimum of three years from planting to begin harvesting. Each year, one season is dedicated to various activities, including farm preparation, fertilizer application, weeding, spraying, harvesting, storage, and marketing. In Tanzania, the CBT provides a calendar that outlines the different activities to be performed at the farm level, along with an annual calendar for produce sales via auction (CBT, 2023c; CBT, 2024c). Both domestic and international markets are targeted. In the domestic market, cashews are consumed year-round, while in the export market, they are sold according to the sales timetable provided by CBT (CBT, 2023c; CBT, 2024c). To ensure that cashews produced in Tanzania find a market abroad, the sales season often differs from that of other countries, such as the Ivory Coast and Benin.

4.2. Types of Actors

Multiple actors participate in the cashew nut value chain, each playing a distinct role in adding value along the chain. UNIDO (2011) identifies eleven categories of participants, including producers, cooperative unions, wholesalers, retailers, distributors, and digital marketplaces. Approximately 640,000 producers and up to 1,000,000 actors are estimated to be involved in the cashew nut value chain. Additionally, up to 10 logistics companies are engaged in exports (CBT, 2024a).

Producers operating within a formal marketing structure are directly connected with their primary cooperative societies, such as the Agriculture Marketing Cooperative Society (AMCOS) and Cooperative unions (CUs), which provide essential inputs and facilitate the sale of produce. Warehouse operators (WROs), through the warehouse receipt system (WRS), play a crucial role in storing farmers' produce, ensuring the quality and safety of the products, while also serving as a market platform for sales. Transporters ensure timely delivery of cashews to designated locations. During peak season, up to 1,000 AMCOS, 1,000 WROs, CUs, and 100 transporters are involved in cashew transportation (CBT, 2024a).

In Tanzania, agriculture industry cooperative societies are registered by the Tanzania Cooperative Development Commission (TCDC) under the Ministry of Agriculture (URT, 2013). Their responsibilities include member registration, collection, and storage of raw cashews, and, in collaboration with other stakeholders, preparation for auctions and payment to farmers (CBT 2924a; URT, 2013 & 2015).

Buyers primarily drive the cashew nut value chain. Large-scale processors, exporters, and first-market buyers for domestic processing, each group consisting of fewer than 100 members, are key actors (CBT, 2024a). Domestic processors are given priority in purchasing raw cashews in the primary market, where conditions are less stringent than those of the secondary market. For instance, they are not required to provide cash deposits as bid security, which prevents their capital from being tied up in the bidding system (CBT, 2024b).

CBT is mandated to oversee all cashew business operations, making it an apex actor (URT,2009). It also selects around 100 research institutions and input providers to support the value chain (CBT, 2024a). The relationships between AMCOS, the CBT, WROs, and the Tanzania Mercantile Exchange Public Limited Company (TMX PLC) are crucial in the cashew business. Online auctions are conducted transparently, ensuring that producers receive a fair price for their products (CBT, 2024b).

Gender dynamics also shape participation in the value chain. Women are more prominently involved than men in cashew processing, as men are less likely to remain in one place for extended periods and often

regard processing tasks as a female responsibility (Mihyo et al., 2019; Mpenda, 2020; Aku et al., 2023). Additionally, there is a distinct division of labor in cashew production, which is frequently labor-intensive for men, and differences in sales and distribution practices. Aku et al. (2023) highlighted that participation in various value chain functions varies by gender, influenced by profitability and specific points within the chain. Moreover, gender disparities arise due to differences in the autonomy to manage productive resources, access to leadership roles, and the availability of information and policy integration. Loans and credit preferences also differ as women tend to secure smaller loans for household and healthcare needs, while men are more likely to secure larger loans for business activities and agricultural input purchases (Aku et al., 2023).

The level of formality in the relationships between intermediary actors depends on adherence to the specific rules and regulations governing the value chain. When the formal market is utilized, guidelines control the relationships between actors. For instance, the CBT, Warehouse Receipt Regulatory Board (WRRB), TCDC, and TMX PLC typically establish a formal agreement each year outlining how the cashew market should be conducted. This agreement serves as a guide for all other actors in the value chain (CBT, 2024a). CBT also provides dispute settlement mechanisms and penalties prior to the sales seasons (CBT, 2024a). In contrast, when informal markets are used, the level of formality is left to the discretion of the actors. Oftentimes, these relationships are based solely on trust.

Financial institutions play a crucial role in facilitating transactions. These include commercial banks, the Cooperative Bank of Tanzania (CoopBank), Tanzania Agriculture Development Bank (TADB), Savings and Credit Cooperative Societies (SACCOS), and other microfinance institutions (MFIs) (Mihyo et al., 2019). Approximately 100 financial institutions are involved in the value chain, providing credit to producers, buyers, traders, exporters, and processors.

For smallholder farmers, access to credit for inputs such as pesticides and sprayers enables the production and sale of raw cashews. A lack of credit in this area could jeopardize sustainable agriculture by preventing transactions from progressing to the next level (Hidayati et al., 2023; Mushi et al., 2022) Furthermore, without credit to fund essential activities like spraying and harvesting, the quality of the cashews may be compromised, leading to decreased profitability and fewer transactions within the value chain (Mihyo et al., 2019; Bryan et al., 2023; Pandey et al., 2010). Financial institutions facilitate the transfer of funds to producers and provide loans using warehouse receipts (Shao et al., 2022; Danga et al., 2020) and mobile payment systems (Pandey et al., 2010). Farmers pay levies to cooperative unions, local government authorities (LGAs), and the Tanzania Agricultural Research Institute (TARI). These levies, which serve as a primary source of income for these institutions, in turn benefit producers by providing inputs, market access, research, and extension services. Under the WRS, managed by the WRRB, farmers can secure credit from financial institutions by presenting receipts from warehouse operators or AMCOS where their produce is stored. CUs also offer sprayers to farmers on credit terms, requiring an initial deposit of 50 percent, with the remaining balance to be paid later (CBT, 2024a). This approach supports raw cashew production and ensures continued transactions within the value chain.

For buyers, traders, exporters, and processors to operate effectively, they require credit from financial institutions to acquire raw cashews from the market. After selling, they typically repay the loans. In some cases, the credit provided has high interest rates. For example, interest rates in Tanzania can be greater than 10 percent, which is significantly higher compared to other cashew-producing regions in Africa, thereby limiting transactions among value chain actors (CBT, 2024a).

5. PULSES VALUE CHAIN

5.1. Value Chain Characteristics

The Tanzanian pulses sector is a significant component of the country's agricultural landscape, occupying about 12 percent of land cultivated for annual crops (Molenaar, 2017). The sector has shown steady growth, with annual production averaging 2 million tons (Andrew, 2023b). Dry beans account for the largest share at 1.21 million tons, followed by 0.25 million tons of pigeon peas, 0.18 million tons of chickpeas, 0.08 million tons of green grams, 0.174 million tons of cowpeas, and 0.052 million tons of bambara nuts (Andrew, 2023b). This positions Tanzania as the second-largest pulse producer in Africa and the tenth globally (Andrew, 2023b; ITC, 2016).

Pulses are typically grown alone or intercropped with maize. The farming season begins in October with farm preparation, and pulse farming is rainfed. Pulses are primarily cultivated for crop rotation and nitrogen fixation. Harvesting typically begins in August. Of the total production, 40 percent is consumed by producer households, 48 to 64 percent is sold domestically, and 12 to 16 percent is exported (Adrew, 2021; ITC, 2016; Mushi & Doctor, 2021). Pigeon peas constitute the majority of pulses exported, followed by green grams (mung beans) and chickpeas, primarily to India (Adrew, 2021; Mushi & Doctor, 2021).

In 2021, Tanzania exported pulses worth over USD 269 million, making it the leading pulse exporter in Africa (Andrew, 2023b). During the same financial year, the export value of pulses surpassed that of tea, coffee, and tobacco (Andrew, 2023b). Tanzanian pulse exports have fluctuated due to various factors, including government policies and global shocks. Despite these fluctuations, pulses continue to perform well in export markets. For example, in 2022, the country exported 0.16 million tons of chickpeas, the highest quantity in five years, with Pakistan and India as the largest importers (Andrew, 2023a). However, in 2017, India imposed a ban on pigeon pea imports, resulting in a 62 percent decline in Tanzanian pulse exports from USD 208 million to USD 78 million, which negatively impacted over 4.5 million farmers, traders, and other sector stakeholders (Andrew, 2023a; ITC, 2016).

Tanzanian pulse markets exhibit an oligopolistic structure at the trading level, where a few large-scale traders and processors dominate (ITC, 2016). Due to their high trade volumes and vertical integration, these actors set prices in the market (ITC, 2016). On the production side, the chain is highly fragmented, with 95 percent of small-scale farmers cultivating less than 4 acres (ITC, 2016). The remaining 5 percent comprises medium- and large-scale farmers (ITC, 2016). Intermediaries, such as village collectors, brokers, and agents, link small-scale farmers to large-scale traders. Meanwhile, Agricultural Marketing Cooperative Societies (AMCOS) play a crucial role in mobilizing farmers and negotiating with traders (ITC, 2016; Mushi & Doctor, 2021).

This market structure leads to significant power imbalances, favoring large-scale traders and processors over small-scale producers. This imbalance is worsened by limited market information and the absence of organized trading platforms. Despite its potential for profitability, the sector faces several challenges, including price volatility, inconsistent supply, weak organization of small-scale producers, and poor service delivery (ITC, 2016; Molenaar, 2017). Nevertheless, Tanzania remains competitive in the lower-quality segment of the Indian market, albeit for only a limited period, before a ban was imposed in 2017.

Pulses are valued for their environmental benefits and climate resilience, reinforcing their importance in sustainable agriculture (Molenaar, 2017).

5.2. Types of Actors

The pulses value chain in Tanzania comprises multiple intermediary actors. The sector predominantly comprises smallholder farmers (95 percent) who cultivate less than four acres, while the remainder comprises medium- and large-scale farmers (5 percent) who own between 5 and 200 acres. Although large-scale farmers make up less than 1 percent of all farmers, they contribute up to 30 percent of total pulses production (ITC, 2016; Mushi & Doctor, 2021). Farming practices differ across farmer categories. Small-scale farmers primarily rely on hand tools and practice intercropping with maize, except for chickpeas, which are often grown as a monoculture. In contrast, medium- and large-scale farmers employ mechanized farming and have better storage facilities. Smallholder farmers typically rely on traditional storage methods, often leading to quality issues (ITC, 2016; Molenaar, 2017).

Village collectors and brokers/agents are intermediaries that operate between small-scale farmers and large traders. AMCOS are crucial in mobilizing farmers and negotiating with traders and agents representing exporters (Mushi & Doctor, 2021). Large-scale traders source pulses in two main ways: directly from large- and medium-scale farmers or indirectly through village collectors, who purchase from small-scale farmers. At the top of the chain are large-scale traders and processors, such as the Export Trading Company (ETG). These large-scale traders and processors are vertically integrated and function as 'apex' actors due to their significant influence (ITC, 2016; Mushi & Doctor, 2021). With their high trade volumes and storage capacity, these traders and processors dominate the market and dictate prices (ITC, 2016). The wholesale/export segment is dominated by large-scale traders and processors, who manage the buying, processing, and exporting of pulses, thereby exerting significant pricing power.

The relationships among actors in Tanzania's pulses sector range from informal to highly structured. At the base of the value chain, small-scale farmers operate informally, selling their produce to village collectors and brokers without formal agreements. Agricultural Marketing Cooperatives (AMCOS) form a semi-formal layer, offering a more structured framework for farmer-trader interactions (ITC, 2016). Higher up the chain, large-scale traders and processors, such as the Export Trading Company, operate with greater formality, utilizing established buying points and agent networks (ITC, 2016). However, contract farming remains limited, reflecting a lack of formal agreements between farmers and buyers. This is partly due to weak contract enforcement, as Tanzania's legal framework struggles to manage contract defaults, discouraging formal buyer-seller relationships (ITC, 2016). In contrast, relationships among institutional actors such as government bodies, research institutes, and trade organizations tend to be more formalized. Overall, formality increases along the value chain, and efforts are underway to promote contract farming and strengthen farmers' associations to enhance the market structure and stability.

Credit plays a crucial role in Tanzania's pulses sector; however, its accessibility remains limited, particularly for small-scale farmers. A limited number of smallholders have access to rural finance for expanding production, with most available credit coming from the Savings and Credit Cooperative Societies (SACCOS) (ITC, 2016; Mushi & Doctor, 2021). Limited credit access is primarily due to farmers' lack of viable collateral and restricted access to financial services in rural areas, forcing them to rely on personal resources for production (Finscope Tanzania, 2017; ITC, 2016). Despite the existence of a warehouse receipt system, its effectiveness in facilitating credit access remains limited.

Cooperative organizations, such as AMCOS, play a key role in the pulse sector. AMCOS helps mobilize farmers and serve as a negotiating instrument with traders and exporters' agents, enabling smallholders to engage collectively with larger market players (ITC, 2016). Similarly, SACCOS promote savings among members and offer credit at competitive rates, supporting income-generating investments in farming and related activities (Finscope Tanzania, 2017; ITC, 2016).

6. EDIBLE OIL VALUE CHAIN

6.1. Value Chain Characteristics

Tanzania's sunflower sector has experienced significant growth in recent years, positioning the country as the tenth-largest global sunflower producer with a 2.4 percent share of global production within a decade (ITC, 2016). Yields have increased significantly over the last decade, standing at seven times the level a decade ago (Farm Africa Tanzania, 2022). Approximately 6 percent of the land under agricultural production in Tanzania is used for sunflower production (Farm Africa Tanzania, 2022). The Tanzania sunflower value chain is composed of many actors. The production node is dominated by small-scale farmers, with more than 1 million smallholder farmers in 19 out of the 30 regions of Tanzania. The processing segment is diverse, comprising numerous small oil mills that use basic technology and a few large oil mills equipped with modern technology. The end markets for sunflower products are primarily domestic, with a growing demand for cooking oil among Tanzanian consumers, estimated at 400,000 to 570,000 metric tons annually (Farm Africa Tanzania, 2022). While Tanzania's share in global sunflower seed exports is minimal (less than 1%), there is potential for regional exports, particularly to Kenya and Ethiopia (SAGCOT, 2024.). Sunflower cake, a by-product, represents a significant export mainly to India and Kenya. A notable trend is the emerging market for double-refined bio-fortified oil, indicating a growing premium segment. It is important to note that despite domestic production, over half of Tanzania's cooking oil demand is met by imported palm oil, presenting a substantial opportunity for growth in the local sunflower oil market.

Sunflower growing seasons in Tanzania vary by agro-ecological zone. In unimodal zones (e.g., Dodoma, Singida, Manyara), cultivation occurs once annually, with planting taking place in December to January and harvesting in May to July. In contrast, bimodal zones (e.g., Mbeya, Iringa, Rukwa, and parts of Morogoro) allow for two cycles: the short rains (Vuli), with planting in October to November and harvesting in February to March; and the long rains (Masika), with planting in March to April and harvesting in July to August. These seasonal patterns impact value chain activities at different nodes in various ways. Input demand is time-sensitive, requiring early planning. Since production is rainfed, it carries a high risk of crop failure, which can disrupt supply (Beteri et al., 2024). Seasonal credit arrangements are common, but poor rainfall can compromise farmers' ability to repay loans. Marketing is also seasonal, as prices tend to be low at harvest and rise during the off-season, encouraging bulk buying immediately after harvest and selling during periods of scarcity.

Contractual arrangements play a significant role in coordinating actors in the chain, with some smallholder farmers and farmer organizations receiving seeds on credit from off-takers and processors, benefiting farmers with input access while ensuring product supply for buyers (Farm Africa Tanzania, 2022; SAGCOT, 2024.). There is strong emphasis on farmer organizations, with many farmers joining groups, cooperatives (AMCOS), or SACCOS, enhancing their access to services and markets. Bundled services

are another key feature, with some market actors offering packages that include credit for seeds, agricultural advisory services, and market linkages (Farm Africa Tanzania, 2022). While access to formal financial services remains challenging for individual farmers, organized farmer groups, especially registered AMCOS and SACCOS, have better chances of accessing credit from financial service providers (FAO, 2024). Extension services form another crucial link in the chain, with local government officers, agronomists from input suppliers, and buyers like Pyxus providing advisory services to smallholder farmers (Farm Africa Tanzania, 2022). There is also a recognized need for accessible and affordable market information systems to connect farmers with market opportunities better. These linkages benefit producers by providing access to inputs, credit, technical knowledge, and markets, whereas intermediaries gain a stable supply of raw materials and improve quality control.

The relationships between actors in this chain is characterized by a mix of formal and informal relationships between intermediary actors, with a tendency towards informality in many interactions (Farm Africa Tanzania, 2022; SAGCOT, 2024.). At the local trading level, relationships are largely informal, with farmers selling their produce to traders and collectors at farm-gate prices or in local markets without formal contracts (ITC, 2016; Ndyetabula et al., 2020). Efforts have been made to formalize relationships, particularly through contract farming arrangements between large processors and farmers. However, these face significant challenges, primarily due to the lack of an act governing contract farming, which hampers contract enforcement.

The chain also features informal pre-financing arrangements between traders and farmers as well as informal service provision, such as small-scale processors offering oil extraction services to farmers. While some formal structures exist, such as industry associations like Tanzania Sunflower Processors Association (TASUPA) and Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA) for businesses, the overall picture is one of limited formal coordination. The prevalence of informal relationships, coupled with weak enforcement mechanisms for formal contracts, presents both challenges and opportunities for the sector. It allows for flexibility but may also contribute to instability and reduced efficiency in the value chain (Farm Africa Tanzania, 2022; Ndyetabula et al., 2020). Strengthening formal relationships and improving contract enforcement mechanisms could enhance the overall performance and reliability of the sunflower sector in Tanzania (Farm Africa Tanzania, 2022).

Given the nature of its production and its related activities, such as low capital requirements, accessibility, and traditional involvement, the Tanzanian sunflower value chain is inherently inclusive. Women and youth actively participate in farming, processing, and distribution (AMDT, 2021; Farm Africa Tanzania, 2022). Strong partnerships among key actors could encourage greater involvement and improve their livelihoods. However, limited access to inputs, finance, and crop insurance continues to hinder productivity and economic upgrading (HAPA, 2022).

Tanzania imports a significant amount of cooking oil to meet domestic demand, with 80 percent of its sunflower oil needs in 2022, worth USD 5.4 million, coming from various countries, including Ukraine (ITC, 2016). The annual demand is 570,000 metric tons, while domestic supply is only 180,000 metric tons, resulting in a 390,000 metric tons deficit covered by imports (HAPA, 2022). The government employs fiscal measures such as higher import duties on crude and refined palm oil to protect domestic production, but the desired outcomes have not yet been achieved (HAPA, 2022). Globally, Ukraine and Russia have been leading producers and suppliers of sunflower products. Between 2017 and 2020, Ukraine exported sunflower oil valued at USD 4 billion on average annually, while Russia's annual exports of sunflower oil to the world stood at USD 1 billion (Farm Africa Tanzania, 2022; ITC, 2016). Tanzania

has the potential to capitalize on intra-African trade as its neighboring countries Kenya and Ethiopia imported sunflower oil worth USD 26 million and USD 56 million, respectively from 2017 to 2021, with 76 percent and 84 percent of these imports coming from Ukraine (Farm Africa Tanzania, 2022).

Domestic sunflower oil prices in Tanzania have seen a significant increase, rising from TZS 1,56/kg (USD 0.68 /kg) in 2021 to TZS 4,015/kg (USD 1.75/kg) by June 2022 (Farm Africa Tanzania, 2022). This substantial price hike is largely attributed to market disruptions caused by geopolitical tensions, such as the Russia-Ukraine war, which has affected the supply of edible oils. Paradoxically, while oil prices have surged, the purchasing price of sunflower grain (raw seed) for farmers has decreased, from an average of TZS 1,000/kg (USD 0.43/kg) in 2021 to TZS 800/kg (USD 0.35/kg) in 2022.This decline is likely due to competition from cheaper imported edible oils, such as palm oil, in the domestic market (Farm Africa Tanzania, 2022). During the 2021 season, farm-gate prices for sunflower were reported at TZS 850/kg (USD 0.37), with farmers expecting profit margins of 56 percent, equivalent to revenue of TZS 385,800/acre (USD 167) (Farm Africa Tanzania, 2022). These price changes are influenced by a combination of factors including global market disruptions, supply chain issues, and local market dynamics. The divergence between oil and seed prices presents challenges for farmers, potentially affecting their profitability and the overall dynamics of the sunflower value chain in Tanzania.

6.2. Types of Actors

The Tanzanian sunflower value chain includes several actors, such as inputs and services providers, farmers, local traders and collectors, processors, wholesalers, retailers, and consumers. Sunflower production in Tanzania is predominantly carried out by small-scale farmers, estimated at around 500,000 households, who rely on traditional farming methods and hand tools (Kombe et al., 2017; AMDT, 2021). In contrast, fewer than 5 percent of producers are medium- and large-scale farmers who utilize more advanced equipment such as tractors and ox-ploughs (AMDT, 2021). Farmers face several challenges in their activities, including inadequate agronomic practices, limited access to finance, poor infrastructure particularly of storage facilities, and imbalanced power dynamics between actors in the value chain (AMDT, 2021; Farm Africa Tanzania, 2022; Kombe et al., 2017).

Local traders and collectors play a crucial intermediary role in the sunflower value chain by operating as a link between farmers and processors. They typically purchase sunflower seeds from farmers either at the farm gate or in local markets. The farm-gate price is generally lower than the market price, which impacts farmers' income (AMDT, 2021; Farm Africa Tanzania, 2022). Local traders are categorized into two main groups: commissioned traders who buy on behalf of processors, and traders operating independently, buying directly from farmers or negotiating directly with processors. In addition to conducting purchasing transactions, traders also offer pre-financing to some farmers, which is crucial given the limited access to finance of many small-scale farmers (ITC, 2016). Traders also perform quality checks on the seeds, ensuring they are properly weaned, packed, bulked, and ready for wholesaling to processors.

Processors play a crucial role in the sunflower value chain by transforming raw sunflower seeds into edible oils and other by-products. The processing nodes are diverse, encompassing both large-scale and small-scale industrial processors. Large processors have significant processing capacities, ranging from 110,000 to 120,000 metric tons per year of sunflower seed (HAPA, 2022). Large processors often operate through contract farming arrangements with farmers to secure their supply of raw materials. Processors typically purchase seeds from farmers or traders, process them, and sell oil and seed cakes. Seed cake, a byproduct of oil extraction, is a crucial product used primarily for animal feed. Small-scale processors

also provide oil extraction services to farmers who wish to add value to their produce. This service boosts farmers' earnings compared to selling unprocessed seeds.

Most processors undertake wholesaling activities directly in their factories, selling both sunflower oil and seed cake. However, the wholesaling landscape also includes large edible oil importers such as Murzah Oil and Mohamed Enterprises. These companies have their storage facilities (go-downs), wholesaling facilities, and networks of agents across different regions. They deal not only with locally produced sunflower oil but also with imported edible oils. Many small-scale processors sell their oil directly to consumers at processing sites, mainly in unlabeled plastic containers. Another common form of retail is roadside sales, where small-scale processors sell their sunflower oil along the side of roads, with or without a label. In urban areas, sunflower oil-selling outlets have been established. General merchandise shops and kiosks are common in both urban and rural areas. Supermarkets, such as large or medium-sized supermarkets in big cities, often stock sunflower oil. Many Tanzanian consumers prefer local sunflower oil to imported oil, possibly due to price differences. Demand for sunflower oil is growing, particularly among middle- and high-income groups, regardless of quality considerations. In addition to oil, the sunflower seed cake is often sold to traders/processors who stock and export it to neighboring countries such as Kenya (Farm Africa Tanzania, 2022; SAGCOT, 2024).

Other actors in Tanzania's sunflower value chain include input suppliers such as the Agricultural Seed Agency (ASA) and the Tanzania Official Seed Certification Institute (TOSCI), which provide seeds and certification services. Research institutions, such as Sokoine University of Agriculture (SUA) and the Tanzania Agricultural Research Institute (TARI), have developed improved agricultural practices; however, their efforts do not always align with the needs of small-scale farmers. Extension services from both government and private actors support farmers, whereas financial institutions, including banks, microfinance institutions, and the Tanzania Agricultural Development Bank, provide credit despite accessibility challenges. Government bodies (the Ministry of Agriculture, the Tanzania Bureau of Standards (TBS), and local authorities) regulate the sector, whereas NGOs such as Alliance for a Green Revolution (AGRA), NIRAS International Consulting, Farm Concern International, and One Acre Fund assist farmers. Industry associations, such as the Tanzania Sunflower Processors Association (TASUPA) and the Tanzania Chamber of Commerce, Industry, and Agriculture (TCCIA), represent the interests of processors and businesses. Transportation providers facilitate movement along the chain, and consumers influence demand, forming a complex network of actors that influences the functioning and performance of the sunflower value chain in Tanzania.

7. RICE VALUE CHAIN

7.1. Value Chain Characteristics

Rice is Tanzania's second most important food crop after maize (Busungu, 2023; SAGCOT, 2022). The country produces approximately 2.2 million metric tons of rice annually, making it the largest rice producer in the region, with an average yield of 2.2 tons per hectare (SAGCOT, 2022; USDA, 2024). Rice production in Tanzania occurs under three central systems: rainfed lowland (71 percent), irrigated lowland (9 percent), and upland conditions (20 percent) (Busungu, 2023; Ministry of Agriculture, 2019). Over 70 percent of rice is grown in six key regions: Shinyanga, Tabora, Mwanza, Mbeya, Rukwa, and Morogoro. Other contributing regions include Songwe, Katavi, Arusha, Kilimanjaro, Kigoma, Manyara, Iringa, Mara, and Tanga (Busungu, 2023). Approximately 20 percent of Tanzanian farming households, estimated at

around 1.8 million, are engaged in rice production. The sector is dominated by small-scale producers cultivating between 0.5 and 3 hectares (Mdoe & Mlay, 2021; Ministry of Agriculture, 2019; URT, 2021).

Paddy production seasons in Tanzania vary across agro-ecological zones. In unimodal zones, such as the central and southern regions including Dodoma, Tabora, and Mbeya, cultivation occurs once a year during the primary rainy season, with planting taking place between December and February and harvesting from May to July. In contrast, bimodal zones, such as Kilimanjaro, Arusha, Tanga, and parts of Morogoro, allow for two cropping cycles: short rains (Vuli), with planting in October to November and harvesting in February to March; and long rains (Masika), with planting in March to April and harvesting from July to August. Irrigated areas support a dry-season crop, with planting in June to July and harvesting in November to December.

These seasonal patterns influence value chain activities at multiple nodes. Input demand is highly time-sensitive and peaks before each planting season. Since much of the production is rainfed, it is vulnerable to weather-related risks, including erratic rainfall and drought, which can compromise yields and disrupt downstream supply chains. Seasonal credit systems are standard, but repayment often depends on the rainfall performance. Markets follow a seasonal price cycle, where prices are typically low at harvest and increase during lean periods. This cycle incentivizes traders and farmers to bulk-buy after harvest and sell during periods of scarcity.

The choice of rice variety is also closely linked to seasonal and ecological conditions. In rainfed lowland systems, aromatic varieties such as Kilombero are favoured for their grain quality but are sensitive to water stress. In contrast, irrigated systems often use improved varieties such as Komboka and Tai, which offer higher yields and are better adapted to controlled water environments (Ministry of Agriculture, 2019). These varietal differences influence productivity, input needs, and market preferences, with implications for breeding, extension, and input supply systems.

Tanzania's rice market consists of a mix of local consumption, domestic trade, and regional trade. Approximately 30 percent of the rice produced in the country is consumed by producer households, while the remaining portion is sold in domestic and regional markets. Rice consumption is highest in urban areas, particularly in Dar es Salaam (Mdoe & Mlay, 2021; Ministry of Agriculture, 2019). Both paddy and milled rice traders operate throughout the country, with both men and women participating in trade. Paddy trade is more common in production areas, while milled rice trade occurs at wholesale and retail markets across the country (Ministry of Agriculture, 2019). Tanzania is a leading rice exporter in East Africa, exporting an average of 51,200 tons annually to neighboring countries, including Burundi, the Democratic Republic of the Congo, Kenya, Malawi, Rwanda, Uganda, and Zambia (Mdoe & Mlay, 2021).

The government of Tanzania has employed export bans and permits as policy measures to regulate domestic rice prices, which have varying impacts on supply and trade. For example, in 2005, the government implemented high import tariffs on rice to protect local farmers from cheap imports. In 2005, rice import tariffs for East African Community (EAC) member states increased from 25 percent to 75 percent under the Common External Tariff (CET) (Mdoe et al., 2020; Kilimo Trust, 2014). While these measures aim to support domestic production, they also influence the price dynamics at different levels of the value chain.

Both formal and informal relationships characterize the Tanzanian rice value chain. One form of formal relationship is contractual agreements, where some processors establish contracts with smallholder producers to ensure a stable rice supply (Wilson, 2018). Another is through out-grower schemes, which involve formal arrangements between buyers (e.g., farmers' organizations or companies) and contracted

farmers for input supply and rice production (Cameron et al., 2017). In the export sector, formal procedures require exporters to obtain authorization letters for purchasing, transporting, and exporting rice (Mtaki, 2018). Moreover, public-private partnerships facilitate formal collaborations between government entities and private sector actors across various segments of the rice value chain.

Informal relationships are also prevalent. For example, in farm-gate transactions, small traders buy paddy directly from farmers through informal agreements (Wilson & Lweis, 2015). In the input supply segment, approximately 90 percent of all seeds and 20 percent of fertilizers and pesticides are distributed through informal channels, including local markets (Makoi, 2016; Nkuba et al., 2016). Informal credit systems are common as well, with many female actors relying on financial support from friends, relatives, and informal groups (Mbuga, 2019). Meanwhile, primary farmers' organizations engage with financial institutions such as the TADB to improve access to and affordability of agricultural inputs like fertilizers (Ministry of Agriculture, 2019). Both formal and informal relationships play crucial roles in shaping Tanzania's rice value chain, influencing the efficiency, accessibility, and sustainability of financial and production systems. Integrating informal actors into formal financial structures could strengthen these relationships and enhance the sector's overall competitiveness.

7.2. Types of Actors

Tanzania's rice value chain comprises a range of actors. Farmers represent a significant proportion of the value chain, With the rice industry directly supporting the livelihoods of over two million people. Approximately 90 percent of Tanzania's rice production takes place under smallholder systems (Ministry of Agriculture, 2019).

Several intermediary actors play a vital role in linking producers to customers and facilitating the development of the rice sector. Among these, traders form a key group operating throughout the country. They are generally categorized into two types: paddy traders, who are mainly concentrated in production areas, and milled rice traders, who operate at both wholesale and retail levels in local and distant markets. These traders are essential in transporting rice from farmers to processors and ultimately to consumers.

Wholesaling is predominantly carried out by men, while women play a significant role in retail, accounting for approximately 70 percent of all retailers (Nkuba et al., 2016). Traders sell to other traders, wholesalers, processors, or directly to consumers. Some wholesalers purchase paddy from farmers, process it, and then sell the milled rice to retailers (Mdoe & Mlay, 2021). Large traders also export rice to neighboring countries, making Tanzania the leading rice exporter in the East African region (Mdoe & Mlay, 2021; Ndyetabula et al., 2020). However, export trade is affected by government policies and regulations, such as export permits, which can create uncertainties for traders.

Processors are another key group of intermediary actors in the rice value chain, ranging from medium- to large-scale operations that add value by converting paddy into milled rice. Medium-scale processors are commonly located near production areas and are owned by both male and female entrepreneurs (Mdoe & Mlay, 2021; Ministry of Agriculture, 2019). Large-scale processors include operations such as Kapunga and Mbarali in the Mbeya region, , as well as Kilombero Plantation Limited (KPL) in Morogoro (Ministry of Agriculture, 2019). These processors not only mill their own paddy but also process paddy from nearby farmers. The processing node is dominated by small millers, with operational capacities ranging from 5 to 20 tons of paddy per day. In contrast, larger mills can process up to 120 tons daily and typically operate for about five months each year (Mdoe & Mlay, 2021).

Agricultural extension officers play a critical role in providing extension services to farmers. Agricultural inputs, such as seeds, fertilizers, and other agrochemicals, are distributed by agro-dealers operating across the country through both formal and informal systems. The formal system comprises 54 registered seed companies and over 500 registered agro-dealers nationwide (Mdoe & Mlay, 2021). However, the formal seed system accounts for less than 10 percent of all seeds supplied nationwide, reflecting a considerable reliance on the informal sector (Makoi, 2016). Fertilizer suppliers include 12 import companies and local suppliers of Minjingu Rock Phosphate (MRP). Fertilizer distribution occurs via two main channels: first, through registered wholesalers and agro-dealers (retailers) who sell at commercial retail prices; and second, through rice out-grower schemes, in which buyers, such as farmer organizations or companies, procure fertilizer directly from importers and supply it to their contracted farmers (Cameron et al., 2017).

Despite the presence of input distribution networks, strengthening farmers' capacity to access input on credit and improve their agribusiness skills remains a significant challenge. Financial institutions play a crucial role in addressing this gap by providing financial services to actors throughout the value chain, facilitating transactions, and supporting investments in agricultural inputs. These services can be accessed either individually or through organized groups and associations, such as AMCOS.

Women play a significant role in the rice value chain, making up 80 percent of the farm labor force in rural rice production and actively participating in nearly all stages of rice production. Their responsibilities include planting, weeding, bird scaring, harvesting, processing, and trading, whereas men are primarily involved in land preparation. Both men and women contribute to the processing and trading stages, although often under unequal conditions. Despite their substantial involvement, women face considerable challenges in accessing key resources such as land, water, credit, capital, and technologies (Nkuba et al., 2016).

8. COFFEE VALUE CHAIN

8.1. Value Chain Characteristics

Coffee is a vital cash crop both in Tanzania and globally. In Tanzania, it serves as a primary source of foreign exchange, with production projected to rise to 69,381 tons by 2024 (BoT, 2025). Coffee production areas in Tanzania are classified into four zones based on geographical characteristics: the Lake, Northern, Southern Eastern, and Southern Highland zones. Tanzania predominantly cultivates coffee arabica and coffee canephora (robusta), with arabica accounting for 60.9 percent of production due to its higher market value and preference for cooler climates (TCB, 2025).

The coffee industry in Tanzania provides livelihoods for about 2.4 million individuals, including around 450,000 smallholder farming households, which produce approximately 90 percent of the total coffee output (TCB, 2021). Coffee production follows two main seasonal cycles based on harvest timing. The first season, running from June to December, mainly includes harvests from the Southern and Northern zones. The second season, from May to August, is primarily composed of harvests from the Lake zone. These seasonal variations in seasons affect value chain activities, particularly the timing of auctions and exports.

The Tanzanian government has set a target of increasing coffee production to 300,000 tons by the 2025/26 season through strategies such as distributing improved seedlings and promoting domestic processing (TCB, 2021). However, the sector faces several challenges, including climate change, aging coffee trees, limited access to credit, and inadequate infrastructure. Additionally, the fragmented production system leaves smallholders vulnerable to market fluctuations (NBS, 2023; TCB, 2017).

The highest quality grades of coffee in Tanzania are predominantly grown on the fertile volcanic soils of Mount Kilimanjaro and Mount Meru in Kilimanjaro and Arusha. These coffees are marketed under region-specific labels such as “Arusha,” “Moshi,” and “Kilimanjaro.” They typically undergo wet processing, which enhances their flavor profiles and contributes to the high-quality cup standards favored in international specialty coffee markets. Coffee produced in the western region of Kagera is predominantly dry processed. This method generally yields lower-grade coffee, which commands lower market prices and is frequently utilized in commercial blends or instant coffee formulations.

Much of Tanzania’s coffee is processed for export, driven by increasing investment in coffee roasting and grinding facilities, as well as rising global demand for high-quality coffee. Despite this outward market orientation, domestic value addition has considerable and unexploited potential. Notably, the potential for expanding in-country processing capabilities presents a strategic opportunity for both domestic and foreign investors. Such investments have the potential to significantly enhance Tanzanian coffee's competitiveness in global markets.

The coffee value chain in Tanzania is hindered by several structural and environmental challenges that limit its productivity, profitability, and market competitiveness. One of the primary challenges is low farm-level productivity, principally due to aging tree stocks, many of which have surpassed the economically viable age of 20 to 25 years (Friedrich, 2004). This is particularly critical in northern regions such as Kilimanjaro, where the average tree age exceeds 40 years. Poor husbandry practices, including inadequate pruning, ineffective pest and disease control, and intercropping systems that deplete soil nutrients, further exacerbate this problem. While some southern regions have made efforts to replant with improved varieties, large-scale rejuvenation has been constrained by weak extension services and a limited supply of quality planting materials (TCB, 2025).

Furthermore, limited access to reliable agricultural inputs weakens coffee productivity in Tanzania. In this respect, a coordinated national strategy for replanting, supported by improved extension services and accessible quality inputs, could significantly increase yields and restore the economic viability of coffee farming in Tanzania. In addition to production challenges, the internal coffee marketing system contributes to low farm gate prices, which disincentivize farmers from investing in quality and productivity improvements. For instance, on average, coffee farmers receive only 65 to 70 percent of the Free on Board (FOB) price, with some earning as little as 50 percent due to inefficiencies and delays in the marketing chain (Coles & Mhando, 2010). These ineptitudes include extended waiting periods up to three months for coffee to reach auction markets, a lack of pricing transparency, and the weak performance of some coffee cooperatives (Coles & Mhando, 2010; TCB, 2025).

Additionally, high transportation costs resulting from poor road infrastructure and administrative burdens reduce earnings among coffee producers in Tanzania (FAOSTAT, 2024). Despite improvements in national transport systems and ports, internal logistical challenges persist, especially during the rainy season. Moreover, the underexploited quality potential, linked to a significant amount of coffee being home-processed, results in inconsistent quality, which prevents Tanzanian coffee from achieving premium prices on international markets (Hanns and Neumann, 2010).

Despite these challenges, the global coffee market presents substantial opportunities for Tanzania's coffee value chain, motivated by rising worldwide consumption and a shift toward high-quality, at-home coffee brewing (Gayle & Lin, 2016). Coffee, valued at over USD 100 billion and ranked second only to crude oil in global trade, presents a lucrative export commodity. Tanzania's diverse regional flavor profiles and existing market access, particularly to Japan, the USA, and Europe, position it well to capitalize on the growing demand for specialty and single-origin coffees. The current efforts by the Tanzania Coffee Board (TCB) to strengthen national branding, alongside institutional support from bodies like the Tanzania Coffee Research Institute (TaCRI) and the TCB, create a solid foundation for upgrading the sector and improving Tanzania's competitiveness in global markets (TCB, 2019; TCB, 2025).

8.2. Types of Actors

The Tanzanian coffee value comprises several actors, ranging from input suppliers to traders. Figure 7 depicts a summarized map of this chain. A review of existing literature on coffee value chains reveals the following groups of actors: The first group includes inputs and service suppliers, such as the TaCRI, fertilizer and agrochemical companies, and service providers. TaCRI plays a central role in supplying certified seedlings, conducting coffee research, and providing technical support on disease control. Fertilizer and agrochemical companies provide essential inputs, including fertilizers and pesticides. Service providers offer critical support functions, including financial services, agricultural extension, market information, and access to coffee curing facilities. Together, these actors enable producers to access the resources and knowledge necessary for effective coffee cultivation (Kangile et al., 2021).

Coffee production in Tanzania is primarily dominated by small-scale farmers, who account for approximately 90 percent of all producers. These smallholders typically cultivate coffee on small plots and rely on cooperatives for market access and support services. In contrast, estate farmers, who make up the remaining 10 percent, manage larger farms and often operate with greater autonomy and capacity, sometimes bypassing cooperative structures. Both smallholder and estate farmers are essential to Tanzania's coffee production, and their productivity is directly influenced by the effectiveness of upstream input and service providers (TCB, 2019; TCB, 2025).

The primary aggregators in the Tanzanian coffee value chain are AMCOS. These coffee cooperatives collect coffee from small-scale farmers, helping to consolidate coffee production and coordinate post-harvest activities such as pulping and transportation. AMCOS are affiliated with cooperative unions, which offer logistical and administrative support. These aggregators play a key role in organizing the flow of coffee from scattered farms to processing centers or auction markets. In addition to their logistical functions, some aggregators also facilitate farmers' access to credit and financial services. For instance, the Karagwe Development & Relief Services (KADERES), in collaboration with its partners, introduced a digital platform aimed at promoting financial inclusion among coffee growers in the Lake zone (Valerian, 2022).

In Tanzania, coffee processing is mainly handled by coffee curing companies. In some cases, processing starts at the AMCOS level through small-scale or home-based processing methods. However, when AMCOS lack adequate infrastructure, such as central pulping units (CPUs), specialized curing companies take over to ensure the coffee meets the required standards for auctioning (GNTZ, 2023). These processors play a crucial role in ensuring the quality and market readiness of Tanzanian coffee, thereby influencing its value in both domestic and export markets.

Coffee trading involves several actors, including auction houses, exporters, domestic blenders, and domestic traders of packed coffee. The TCB regulates the auctions under the Ministry of Agriculture. Auction houses serve as centralized platforms where coffee is sold to both exporters and domestic buyers. Exporters then channel coffee to key international markets, such as Germany, Japan, and the United States. Domestic coffee blenders purchase green coffee, which they roast and blend before selling it to domestic traders, who then distribute blended coffee to local markets. These traders are crucial for realizing the full potential of Tanzanian coffee and ensuring market diversification (GNTZ, 2023).

9. CONDITIONS FOR DIGITALIZATION

9.1. Current Status of Digital Payments

The application of digital payments in Tanzanian agriculture varies across value chains, reflecting different levels of infrastructure, institutional support, and farmer engagement.

In the maize value chain, the government has introduced multiple digital platforms, including the Tanzania Mercantile Exchange (TMX), the Agricultural Trade Management Information System (ATMIS), and M-KILIMO, to promote market access and information sharing (Jadhav et al., 2023). Complementary services from private providers and donors have enabled farmers to access short-term credit, savings, and crop insurance. However, long-term asset financing remains a notable gap, and digital engagement in the post-harvest stages of the maize value chain is still limited.

In the poultry value chain, the use of digital payments remains minimal and largely informal. Despite high mobile phone ownership and widespread use of mobile money for personal transactions, smallholder farmers and traders continue to prefer cash due to mistrust, transaction fees, and inconsistent network access. Nonetheless, government- and donor-supported platforms for online poultry marketing and inspection are beginning to facilitate digital payment integration. Ringo & Lekule (2020) documented the Agri-Wallet initiative, which is piloting a blockchain-enabled digital financing model in collaboration with Hendrix-Genetics, Silverlands Ltd., and the World Poultry Foundation. This initiative supports 14 brooding units, operated by both women and men, to purchase day-old chicks, feed, and vaccines, enabling them to sell 28-day-old chickens to smallholder farmers. All financing mechanisms are fully digital. Mobile apps such as Abusol and “I Grow Chicken" further support the poultry sector by enabling real-time data collection and cloud-based business management. These tools are scalable, serving operations ranging from 250 to 5 million birds, and demonstrate the sector’s potential for adopting blockchain-based financing and digital management systems (Ringo & Lekule, 2020). These initiatives demonstrate the sector’s potential for adopting blockchain-based financing and cloud-based business management tools, particularly when paired with targeted digital literacy efforts.

In the cashew nut value chain, digital payments typically occur after the sale of produce via bank transfers, supported by digital notifications and systems such as the Digital Fertilizer Subsidy Distribution and Payment System (DFSDS) and ATMIS. Blockchain technologies are being tested to foster transparency and accountability, although uptake remains uneven and is often limited to more organized stakeholders (Shao et al., 2022).

The pulses value chain shows widespread access to digital payments, but actual usage remains low. While many farmers have mobile money accounts, they are primarily used for basic transactions. The national increase in mobile money users, from 60 percent in 2017 to 72 percent in 2023, is encouraging,

but the transition to integrated financial services like savings and loans is slow (FinScope Tanzania, 2023). The introduction of interoperable payment systems and cross-border remittances offers additional avenues for growth (Ephraim & Mhina, 2018; FinScope Tanzania, 2023).

The sunflower value chain has seen only limited integration of digital finance, with cash still dominating transactions. However, digital tools used for agronomic support, such as those developed by the FAO and Tanzania's Ministry of Agriculture, could be expanded to include payment functionalities (Ephraim & Mhina, 2018; UNCDF, 2022). Most transactions between actors still appear to be traditional, cash-based exchanges, though digital services hold promise for streamlining contract farming and linking farmers to higher-value urban markets (Ephraim & Mhina, 2018; FSDT, 2024).

Similarly, the rice value chain has seen gradual progress toward digitalization, particularly through the integration of mobile money into daily operations. Banks such as CRDB, TADB, and NMB have introduced agricultural loans and insurance products that support digital transactions, while government initiatives like the TMX and WRS offer structured trade platforms (Nkuba et al., 2016; Wilson & Lewis, 2015). Nevertheless, many transactions remain informal, and the lack of an integrated financing framework continues to limit the full potential of digital financial services in the chain.

The coffee value chain is among the most digitally advanced. Mobile platforms are used to deliver agronomic advice, manage farm records, and facilitate digital payments across various stages of the value chain, from production to trading. Digital financial services are increasingly accessible to coffee farmers, including credit, insurance, and mobile savings tools. Technologies like digital profiling, inventory systems, and e-auctions are enhancing traceability, efficiency, and market access (UNCTAD, 2020; World Bank, 2020). However, challenges such as digital exclusion, limited infrastructure, and gender disparities persist (Korinek et al., 2021).

Across all these value chains, the current state of digital payments reflects a sector in transition, characterized by innovation in certain pockets and persistent challenges in others.

9.2. Driving Factors of Digital Payment Adoption

A combination of technological, institutional, and behavioral factors drives the adoption of digital payments in Tanzania's agricultural sector. One of the strongest enablers is the widespread ownership of mobile phones and the high rate of mobile money adoption for personal use. This provides a foundational familiarity with digital platforms that can be applied to business applications with appropriate support and incentives.

A recent report by the U.S. Agency for International Development (USAID) and DAI on the digital agriculture ecosystem assessment in 2023 highlights a supportive regulatory and policy environment that fosters innovation (Jadhav et al., 2023). It notes that established government-led digital agriculture programs include the Tanzania Mercantile Exchange (TMX), the Agricultural Trade Management Information System (ATMIS), and M-KILIMO. Other programs under development include digital farm mapping, a centralized digital farmer registry, farmer cards for the fertilizer subsidy program, and coordination of digital agriculture platforms. Furthermore, various donor-funded initiatives have been developed to advance digitization in the agricultural sector, such as BizyTech, Digital Mobile Africa, Foodsasa, Mavuno Technologies, and PhemaAgri, all of which are supported by the German Society for International Cooperation (GIZ). Additional efforts, such as Wakala Digital, the Spatiotemporal Agribusiness Framework (SAF), AGRAs Village Advisors (VBAs), and T-HAKIKI, have been spearheaded by the Alliance for a Green Revolution (AGRA). The YEESI LAB at Sokoine University of Agriculture (SUA) and USAID also

contribute to these efforts. Digital hubs supporting agricultural innovation include the World Food Program (WFP) Innovation Accelerator, Westerwelle Startup Haus Arusha (WSHA), and Sahara Ventures, all of which aim to nurture and scale agri-tech startups in Tanzania (Jadhav et al., 2023).

These initiatives align with the provision of agriculture-focused digital financial services, offering tailored solutions for smallholder farmers. These include short-term credit, long-term asset financing, savings products, and crop insurance. Tanzania's agricultural digital financial services landscape encompasses various services and value chains. Non-bank providers like Mavuno Tech and Digital Mobile Africa primarily focus on financing inputs, while conventional banks such as CRDB Bank and Equity Bank tend to offer cash loans. Notably, One Acre Fund provides input loans to organized farmer groups with higher repayment rates, while Pula and Acre Africa specialize in offering agricultural insurance services. MyAgro emerges as a major player in digital savings for smallholders, using mobile money for savings deposits. Digital Mobile Africa also digitizes traditional savings groups to provide valuable data for input demand. However, this research found no providers of long-term asset financing for agricultural assets like tractors, irrigation equipment, or livestock (Jadhav et al., 2023).

Initiatives like the Bank of Tanzania’s Fintech Regulatory Sandbox enable service providers to test products in real market conditions. Policy reforms, such as the Finance Act of 2023 and changes to electronic money levies, have made digital financial services more accessible and affordable, thereby fostering broader inclusion (FSDT, 2023).

Investments in mobile agent networks have significantly improved physical access to digital services. With more than 100,000 agents nationwide and nearly 90 percent of Tanzanians living within 5 km of a financial access point, rural outreach has expanded (Ephraim & Mhina, 2018; FSDT, 2024). Furthermore, increasing levels of financial literacy, driven by donor programs, banks, and mobile network operators, is equipping farmers with the knowledge needed to engage more confidently with digital tools.

However, several barriers persist. Digital and financial literacy remain low in many rural communities, particularly among women, who face systemic disadvantages in accessing digital tools and services. Many digital financial products are not well-suited to the realities of smallholder agriculture, such as seasonal income patterns or the need for long-term asset investment. Mistrust of digital systems, often stemming from past experiences with fraud, and the dominance of informal market relationships further hinder adoption.

Competition between banks and mobile network operators may also slow innovation or limit service offerings. Infrastructure challenges, such as unreliable internet and high smartphone costs, restrict uptake, particularly in remote areas. Complex and overlapping regulatory frameworks can impede the smooth adoption of digital finance in certain value chains, such as rice. Additionally, the cost of maintaining digital systems and the limited capacity of small service providers can restrict expansion. Lastly, sustaining and expanding digital financial services requires significant ongoing investment, which may be a barrier for some providers (Ephraim & Mhina, 2018; FSDT, 2024).

In conclusion, while Tanzania has made significant progress in digitalizing its agricultural sector, the adoption of digital payment systems remains uneven. Continued collaboration among public institutions, private innovators, and development partners will be essential to addressing existing challenges, building trust, and creating tailored solutions that meet the diverse needs of agricultural actors across the country.

10. CONCLUSION

This comparative analysis of seven key Tanzanian value chains—maize, rice, pulses, sunflower (for edible oil), cashew nuts, coffee, and poultry—highlights both similarities and differences in their structures, actor interactions, and readiness for digital transformation.

Across all agricultural chains, smallholder farmers play a pivotal role, significantly shaping production practices, market engagement, and community livelihood strategies. In traditional sectors such as maize, rice, and pulses, the primary focus remains on ensuring food security and meeting domestic consumption needs. These staple crops are crucial for sustaining local diets and ensuring national food security. In contrast, cash crops such as coffee and cashew are predominantly directed towards international exports, requiring a higher degree of formalization and institutional oversight to meet international quality and sustainability standards. Their cultivation often involves more structured supply chains and compliance with export regulations, enabling smallholders to engage in lucrative international markets. Meanwhile, the sunflower and poultry sectors are experiencing rapid growth, offering increasing commercial potential. These sectors contribute not only to food security but also create opportunities for import substitution, reducing dependence on imported goods and bolstering local economies. By fostering domestic production, they support economic diversification while simultaneously enhancing consumer choices and access to local products.

The value chain actors exhibit varying degrees of formality and integration, revealing significant disparities in how different sectors are organized. For instance, the cashew and coffee industries benefit from centralized institutional support through the Cashew Board of Tanzania (CBT) and the Tanzania Coffee Board (TCB), respectively. In contrast, sectors such as pulses and sunflower seeds operate predominantly in informal environments, where market power is heavily concentrated among various intermediaries. This dynamic raises concerns about equity and accessibility within those markets. Additionally, the inclusion of women and youth in these value chains remains limited across most chains. Women are frequently restricted to upstream processes or relegated to low-value roles, which restricts their economic potential. However, there are notable exceptions in the poultry and cashew sectors, where women demonstrate stronger participation in processing and marketing activities, indicating a more equitable distribution of roles in these areas.

The current state of digitalization reveals uneven progress across sectors. Promising innovations, such as the Tanzania Mercantile Exchange (TMX), mobile-based platforms, and blockchain-enabled models like Agri-Wallet, are beginning to take root in agricultural value chains, particularly in maize, coffee, cashew, and poultry, highlighting the potential for these technologies to enhance efficiency and productivity. However, widespread adoption is hindered by several challenges, including limited digital literacy among stakeholders, inadequate data systems that fail to support technological integration, low financial inclusion that isolates many from accessing necessary resources, and insufficient infrastructure, particularly in regions focused on pulses, sunflowers, and rice. These barriers underscore the need for targeted investments in digital tools tailored to the unique contexts of each agricultural sector. Fostering inclusivity and providing the necessary resources will be key to unlocking the full potential of digital transformation in agriculture.

The analysis reveals that, while foundational similarities exist among these chains, their developmental pathways differ significantly. These differences are shaped by factors such as market orientation, the underlying institutional structures, the nature of relationships between different actors involved, and the level of technological readiness present within these systems.

To effectively enhance the performance and inclusivity of Tanzania's agricultural value chains, a multi-faceted approach is essential. A key priority is strengthening institutional support and coordination. This involves establishing a more robust framework, particularly for informal chains that often operate outside formal regulatory systems. By fostering greater collaboration among institutions, a more enabling environment can be created to support these chains. Expanding the use of digital solutions is also imperative. Tailored digital tools, such as mobile applications, e-commerce platforms, and other technologies, can modernize operations, streamline processes, and enhance connectivity among stakeholders. These innovations should be designed to meet the specific needs of value chain actors, ensuring accessibility and relevance. Equally important is the promotion of gender-responsive and youth-focused interventions. Prioritizing initiatives that respond to the specific needs of women and youth in agriculture will help ensure their active participation and contribution. Empowering these groups is critical to achieving more equitable growth within the agricultural sector. Finally, strengthening linkages between actors is vital. Facilitating stronger connections, through both formal institutions and informal networks, can enhance collaboration, create new opportunities for partnerships, and strengthen the overall resiliency of the value chains.

By leveraging these insights and implementing targeted strategies, Tanzania can make significant strides toward establishing more resilient, inclusive, and digitally empowered agricultural value chains. This transformation is not only key to driving rural development but also to spurring broader economic growth and long-term sustainability across the country.

A. APPENDIX

Value Chain Selection Matrix											
Criteria	Sub-Criteria	Maize	Coffee	Pulses	Avocado	Cashew nuts	Rice	Bananas	Oil seeds	Spices	Poultry
Value Chain Structure	Vertical Integration:	4	5	3	4	4	3	2	6	5	7
	Horizontal Integration:	3	5	3	4	3	4	3	3	4	4
	Level of Formality:	3	3	2	3	3	3	2	4	2	4
	Infrastructure & Market	6	5	5	4	6	5	4	6	5	5
	Value Addition:	9	8	7	8	9	8	6	8	8	9
	Innovation:	4	4	3	4	4	3	3	5	3	5
Subtotal		***22***	***20***	***17***	***19***	***22***	***19***	***15***	***23***	***18***	***23***
Scale and Market Potential	Production Value:	9	8	7	8	7	7	6	7	6	6
	Market Demand:	10	9	6	9	8	8	5	8	8	9
	Export Potential:	8	10	5	10	10	6	7	8	9	7
	Growth Potential:	7	8	8	9	10	8	9	7	8	9
	Cost Competitiveness:	5	4	6	2	5	4	4	4	4	7
	Market Potential:	5	8	7	8	10	6	7	6	8	7
Subtotal		***35***	***39***	***32***	***38***	***43***	***32***	***32***	***33***	***37***	***39***
Socio-economic Impact	Employment Generation:	8	7	6	6	7	6	6	7	6	7
	Households Benefitting:	9	6	7	5	6	4	5	7	4	5
	Inclusivity & Equity:	5	5	6	5	6	7	7	6	7	9
	Accessibility for the Poor:	6	3	6	3	3	3	8	4	5	8
Subtotal		***28***	***21***	***25***	***19***	***22***	***20***	***26***	***24***	***22***	***29***
Food Security	Food Availability & Access:	9	4	9	5	4	6	5	7	4	6
	Price Stability:	6	3	5	3	2	6	4	5	2	6
	Nutrition & Health Impact:	8	3	5	5	7	7	6	5	4	7
Subtotal		***23***	***10***	***19***	***13***	***13***	***19***	***15***	***17***	***10***	***19***
Other Considerations	Institutional Support:	9	10	9	9	9	9	5	8	6	6
	Sustainability:	5	4	5	5	5	4	5	4	7	3
	Cultural Importance:	9	4	8	4	5	9	7	6	7	6
Subtotal		***23***	***18***	***22***	***18***	***19***	***22***	***17***	***18***	***20***	***15***
TOTAL SCORE		**131**	**108**	**115**	**107**	**119**	**112**	**105**	**115**	**107**	**125**
RANK		**1**	**7**	**4**	**8**	**3**	**6**	**10**	**5**	**9**	**2**

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