

ENHANCING AGRICULTURAL MARKET EFFICIENCY THROUGH THE INTEGRATION OF VALUE CHAINS INTO TANZANIA’S AGRICULTURAL COMMODITY EXCHANGE AND WAREHOUSE RECEIPT SYSTEM

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Abstract: Improving the performance of small-scale agriculture remains a strategic priority for the Tanzanian government in its journey toward industrialization, as articulated in the Integrated Industrial Development Strategy. To support this vision, the integration of the Agricultural Commodity Exchange (ACX) with the Warehouse Receipt System (WRS) was introduced to strengthen forward market linkages for products originating from smallholder farms. However, as the agricultural sector continues to evolve, it has become increasingly evident that the existing marketing framework requires reassessment and adaptation to meet emerging needs. This study was conducted to evaluate the necessity of upgrading the current market structure, with a particular emphasis on the sunflower sub-sector a key contributor to rural livelihoods and national agribusiness. Using a cross-sectional survey design, primary data were collected from smallholder sunflower farmers across Kondo and Itigi district councils. Gross margin analysis revealed a significant disparity in earnings: farmers engaged in sunflower oil production achieved substantially higher returns compared to those selling raw sunflower seeds. Complementary secondary data sourced from the Tanzania Cooperative Development Commission (TCDC), Tanzania Mercantile Exchange (TMX), and the Warehouse Receipt Regulatory Board (WRRB) confirmed that the current system lacks mechanisms to support the trading of processed agricultural products. This gap limits the potential of smallholder farmers to fully capitalize on value addition. In light of these findings, the study recommends a strategic enhancement of the existing framework to include a dedicated trading platform for value-added agricultural goods. Such a reform would not only improve income generation for smallholder farmers but also elevate the overall performance of Tanzania’s agricultural sector, driving inclusive economic growth.

Keywords: Small-scale agribusiness, commodity exchange market, warehouse receipt system, gross margin, sunflower sub-sector
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INTRODUCTION

Smallholder farmers in Tanzania encounter numerous obstacles in establishing both backward and forward market linkages, which are essential for enhancing crop productivity and securing income (Beroud and Awokuse, 2025). Backward linkages such as access to improved seed varieties and agricultural inputs play a critical role in boosting production volumes while managing input costs (Zozimo et al., 2023). Conversely, Rugeiyamu et al. (2024) emphasized that effective forward market linkages are key to the successful marketing of sunflower seeds, whether sold in raw or processed form. The income stability of smallholder farmers largely hinges on the seamless integration and performance of both backward and forward market systems (Molela, 2017). Within Tanza-

nia’s sunflower industry, the forward market includes the trade of raw oilseeds, refined edible oil as the primary product, and oil-cake as a by-product (Recha and Demissie, 2023). Among these, unprocessed sunflower seeds dominate market activity, accounting for at least 80% of all transactions, as reported by Mchopa (2025) and George (2020).

Under the existing government framework, all cash crops in Tanzania were mandated to be traded through the Agricultural Commodity Exchange (ACX), the Warehouse Receipt System (WRS), or a hybrid model combining both platforms (Ngendahayo and Nayak, 2024; Narayanan et al., 2024). These systems, designed to strengthen forward market linkages, aimed to empower smallholder farmers by facilitating access to concessionary loans backed by their stored produce and connecting them with reliable buyers (Narayanan et al.,

2024). Crucially, this initiative sought to protect farmers from exploitation by unauthorized intermediaries who often use inaccurate weighing equipment and offer unfair prices (Molela, 2017). Additionally, ACX and WRS provided collective platforms for farmers to unify their voices and enhance their bargaining power regarding pricing and timing of sales (Gunawan et al., 2024). Despite these benefits, existing literature lacks clarity on whether these systems adequately support smallholder sunflower farmers who prefer to market processed products rather than raw seeds.

Previous researches, including studies by Nyamandege et al. (2024) and Shao et al. (2023), identified several areas for enhancing the performance of Tanzania's agricultural trading systems, particularly the Warehouse Receipt System (WRS). To improve operational efficiency, these studies recommended greater transparency and inclusivity such as integrating informal small and medium enterprises (SMEs) through innovations like blockchain technology. Nazzala (2023) further highlighted the importance of warehouse infrastructure and leadership quality as critical factors influencing system effectiveness.

However, these recommendations primarily focused on facilitating the trade of unprocessed sunflower seeds and did not address challenges faced by smallholder farmers engaged in marketing processed sunflower products. This study, therefore, assessed the income generated by farmers involved in both raw seed and value-added sunflower product businesses. The overarching objective was to determine whether smallholder farmers should continue trading unprocessed sunflower seeds or whether the existing systems require upgrading to support the inclusion of processed products in formal trading platforms.

LITERATURE REVIEW

Sunflower Agribusiness in Tanzania

The sunflower trade in Tanzania is regulated by the Cereals and Other Produce Board (CPB), which was established under the Grain and Mixed Crops Act of 2009. One of CPB's key responsibilities is safeguarding the commercial interests of smallholder sunflower farmers by facilitating reliable forward market connections (United Republic of Tanzania [URT, 2022]). The board functions similarly to other regulatory bodies overseeing major cash crops such as cashew nuts, tobacco, sisal, coffee, cotton, and tea (Lukurugu et al., 2022; Louhichi, Ricome and Paloma, 2022). In an effort to broaden the scope of sunflower agribusiness, the government introduced the Sunflower Sector Development Strategy 2016–2020, which aimed to incorporate sunflower oil and cake into the portfolio of traded products. Despite these efforts, the strategy fell short of expectations, as seed trading remained the predominant activity among smallholder farmers (Erasmus and Kaungal, 2024).

Smallholder farmers in Tanzania often prioritize trading sunflower seeds over engaging in value-added sunflower product businesses due to pressing cash needs (Kimaro and Nnko, 2024). Additionally, limited awareness about the bene-

fits of value addition and financial analysis contributes to their continued focus on seed sales (Rugeiyamu et al., 2024). Many farmers perceive little distinction between trading seeds, oil, and cake, which further discourages diversification. The scarcity of processing facilities in rural areas and the high costs associated with accessing them also play a significant role in farmers' preference for unprocessed seed trading (Molela and Kira, 2025; Isinika and Jeckoniah, 2021). A recent study examined income disparities between farmers involved in seed trading versus those dealing in processed sunflower products. Its findings are crucial for guiding policymakers to enhance sunflower product markets by reforming or upgrading existing systems such as the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS).

Forward Market Linkages

Forward market linkages are vital to the growth of small-scale agribusinesses in Tanzania, as they enable farmers to access markets that would otherwise be out of reach for individuals, while also lowering transaction costs (Andre, 2023). These markets are primarily designed to accommodate farmer groups rather than individual producers, whose output often falls short of meeting buyer requirements (Isinika and Jeckoniah, 2021). Among the most prevalent farmer organizations in Tanzania are Agricultural Marketing Cooperative Societies (AMCOS), which have been central to the implementation of key systems such as the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS) within the framework of forward market linkages (Molela, 2017).

Tanzania Agricultural Commodity Exchange (ACX) Market

Established in 2014 through a public-private partnership (PPP), the Tanzania Mercantile Exchange (TMX) operates with a 49% stake held by the public sector and 51% by private entities (Magambo, 2024; Molela, 2017). TMX was founded to manage and regulate commodity exchange markets across the country, with a particular focus on agricultural commodities (Kanyangemu, Kundu and Athwal, 2019). To enhance transparency and ensure equitable pricing in agribusiness, a dedicated trading window for agricultural products was introduced, aiming to modernize market operations and improve access to reliable market information (Mgole and Yunxian, 2021).

Tripath et al. (2023) highlighted that the Warehouse Receipt System (WRS) posed challenges for smallholder farmers due to price instability and unfavorable marketing strategies. Their study found that high marketing costs significantly reduced the fairness of farm gate prices for producers. Additional barriers such as limited bargaining power, constrained market competition, and inadequate access to market information further undermined the effectiveness of the WRS (Robbins et al., 2008). In response to these issues, transitioning to a modernized agricultural commodity exchange market was deemed essential, aligning with the strategic direction outlined in the 10 pillars of the Kilimo Kwanza initiative (URT, 2022).

Agricultural commodities in Tanzania are traded through

two primary mechanisms at the commodity exchange market: the spot contract market and the derivative contract market (Kaura and Rajput, 2024). These systems incorporate collateral management strategies to safeguard the interests of trading parties, particularly buyers (Gundogdu, 2023). For farmers, the commodity exchange market plays a vital role in hedging against price fluctuations, as derivative contracts allow for price forecasting to mitigate volatility risks (Chowdhury and Bhuiya, 2023). At present, the Tanzania Mercantile Exchange (TMX) primarily facilitates trade in unprocessed sunflower seeds alongside other cash crops. A recent study evaluated the additional benefits farmers could gain from this system and recommended a structural review to better accommodate expanded trading opportunities.

Warehouse Receipt System (WRS) in Tanzania

The Warehouse Receipt System (WRS) in Tanzania is regulated by the Warehouse Receipt Regulatory Board (WRRB), established under the Warehouse Receipts Act of 2005. Its operations are guided by the Tanzania Cooperative Development Commission (TCDC) in partnership with the Tanzania Mercantile Exchange (TMX), which restricts direct purchases of cash crops from smallholder farmers (Nyamandege et al., 2024). Buyers must register their purchase intentions online through TMX, which organizes weekly electronic auctions based on inventory reports submitted by WRRB (Narayanan et al., 2024). Smallholder farmers consolidate their produce through their respective Agricultural Marketing Cooperative Societies (AMCOS), which then deliver the goods to cooperative union warehouses. These inventory records are shared with TMX, and following the auctions, TMX issues release orders to buyers for stock collection from the designated warehouses (URT, 2021).

The Warehouse Receipt System (WRS) was primarily designed to empower smallholder farmers by strengthening their collective bargaining power over produce pricing (Nangemeta, 2022). Once their goods are delivered to cooperative union warehouses, farmers receive receipts that can serve as collateral for loans from approved financial institutions (Molela, 2017). A key motivation behind the establishment of WRS was to curb illegal trade practices by unlicensed intermediaries who exploited farmers' financial vulnerabilities (Kapuya et al., 2024). However, despite its benefits, the system did not accommodate the trade of value-added sunflower products such as processed oil and cake. The existing frameworks of TMX and WRS were tailored to support transactions involving raw sunflower seeds, indicating a need for structural reforms to facilitate the inclusion of processed sunflower goods and other cash crops.

Value Chain Integration Theory

This study is grounded in the value chain integration theory, which emphasizes the importance of information flow among stakeholders in the value chain to enable accurate demand forecasting and efficient supply management (Li et al., 2022). It highlights the need for buyers to recognize that smallholder farmers are capable of supplying value-added sunflower prod-

ucts at predetermined rates, provided there is effective prior communication (Tiwari, 2021). Selling processed products such as sunflower oil and cake yields higher income for farmers compared to trading raw seeds alone (Zhang et al., 2021). The theory encourages farmer groups to engage in processing agricultural raw materials, thereby generating sufficient stock to meet market demand while enhancing their collective bargaining power (Li et al., 2022). Furthermore, Freije et al. (2022) argue that the theory promotes innovation in production processes, which supports the adaptation of existing systems to accommodate new product features. Recommendations to revise the operational frameworks of TMX and WRS to include trading of sunflower oil and cake do not necessitate major structural changes. Instead, they call for the integration of new features that preserve the integrity of the original systems. As Belhadi et al. (2024) note, this approach allows for a smooth transition to the updated structure without disrupting the existing setup.

MATERIALS AND METHODS

Primary data for the first specific objective were gathered from a total of 399 smallholder sunflower farmers affiliated with 11 Agricultural Marketing Cooperative Societies (AMCOS), which were deliberately selected from Kondoa and Itigi district councils. Data collection was conducted using semi-structured questionnaires. A simple random probabilistic sampling method was applied to ensure equal representation from each AMCOS, following a cross-sectional survey design. According to the 2022 National Sample Census of Agriculture, the study population consisted of 313,636 household members in Kondoa (Dodoma Region) and 126,136 in Itigi (Singida Region). The sample size was determined using Yamane's formula (1967), as shown below;

$$n = \frac{N}{1 + N * e^2}$$
$$n = \frac{439,772}{1 + 439,772 * 0.05^2} = 399.63$$

The collected data were analyzed using the Gross Margin Analysis (GMA) model to evaluate and compare the income generated by smallholder farmers engaged in trading unprocessed sunflower seeds versus those dealing in processed sunflower products such as oil and cake. This comparative analysis served as the foundation for assessing the profitability of the two business models. The gross margin for each trade was calculated using the following formula:

$$GM_i = (R_i - VC_i) * Q$$

Where; GM_i stands for gross margin for quantity Q
 R_i stands for revenue
 VC_i stands for variable costs

Secondary data for the second specific objective were obtained through a documentary review approach, drawing from institutional sources including the Tanzania Cooperative Development Commission (TCDC), Tanzania Mercantile Exchange (TMX), Warehouse Receipt Regulatory Board

(WRRB), and various Agricultural Marketing Cooperative Societies (AMCOS). The purpose of this review was to gain insights into the operational frameworks of TMX and WRS, specifically in relation to the two sunflower business models unprocessed seeds and value-added products. The analysis was guided by the findings from the first specific objective, ensuring a contextual understanding of how these systems support or limit different forms of sunflower product trading.

RESULTS AND DISCUSSION

Gross Margin from Unprocessed Sunflower Seeds Trading

Most smallholder farmers in Tanzania participate in the

trade of unprocessed sunflower seeds, either by selling directly to buyers or through the Tanzania Mercantile Exchange (TMX) under the Warehouse Receipt System (WRS), in accordance with government regulations. On average, farmers generate a revenue of TZS 900,200.00 per acre, with an estimated production yield of 643.00 kg. According to the data presented, the gross margin from this activity stands at TZS 455,094.60 per acre, translating to approximately TZS 917.49 per kilogram. It’s important to note that this figure represents a basic average and does not account for administrative or fixed costs incurred throughout the farming cycle. These results closely align with the gross margin reported by George (2020) for unprocessed sunflower seed trading.

Table 1: Gross Margins from Processed and Unprocessed Sunflower Seeds Trading

Mean Values (95% Confidence Interval)

Details	Unprocessed Seeds	Edible Oil	Seed Cake	Value added
	<i>n</i> = 317	<i>n</i> = 82	<i>n</i> = 82	<i>n</i> = 82
REVENUE	(100%)	(33.33%)	(66.67%)	(100%)
Yields (Kg/l/acre)	643.00	112.50	225.00	337.50
Price (TZS/kg/l))	1,400.00	5,200.00	700.00	5,900.00
Total Revenue/acre	900,200.00	585,000.00	157,500.00	742,500.00
PRODUCTION COST				
Input seeds (TZS/acre)	14,456.00	4,199.58	8,400.42	12,600
Farm prepartion (TZS/acre)	38,443.71	12,258.56	24,520.79	36,779.35
First weeding (TZS/acre	39,456.95	13,882.63	27,769.44	41,652.07
Second weeding (TZS/acre	10,629.14	3,285.09	6,571.18	9,856.27
Booster (TZS/acre)	3,576.16	1,481.83	2,964.11	4,445.94
Manure/ Fertilizer (TZS/acre)	62,450.33	21,950.41	43,907.41	65,857.82
Sowing (TZS/acre)	22,549.27	8,049.99	16,102.39	24,152.38
Chemical application /acre	7,523.58	2,395.18	4,791.09	7,186.27
Bird scaring (TZS/acre)	28,537.80	9,511.65	19,026.15	28,537.80
Harvesting (TZS/acre)	58,443.71	20,054.66	40,115.34	60,170
Processing (TZS/acre)	0.00	14,998.50	30,001.50	45,000.00
Packaging (Sacks/Gallons)	9,185.71	11,000.00	2,500.00	11,000.00
Cess (TZS)	10,000.00	3,333.00	6,667.00	10,000.00
Transport	5,000.00	1,666.50	3,333.50	5,000.00
Total PC	310,252.36	128,067.59	236,670.31	362,237.90
Unit Revenue (TZS/Kg/l)	1,400.00	5,200.00	700.00	5,900.00
Unit Overheads (TZS/KG/l)	482.51	357.73	715.57	1,073.30
Unit GM (TZS/Kg/l)	917.49	4,842.27	-15.57	4,826.70
GM per acre (TZS/acre)	455,094.60	2,401,862.74	-7,721.76	2,394,140.98

Source: Authors (2025)

Gross Margin from Processed Sunflower Oil and Cake Trading

Processed sunflower oil trading is the second most common sunflower-related agribusiness in Tanzania, following the trade of unprocessed sunflower seeds. According to Mchopa (2025) and George (2020), only about 20% of harvested sun-

flower seeds are processed into products such as edible oil. As indicated in the referenced data, farmers involved in this value-added activity earn an average gross margin of TZS 2,401,862.74 per acre, or approximately TZS 4,842.27 per kilogram. This figure excludes any additional income from by-products like seed cake. Notably, this gross margin is 5.28

times higher than that earned from selling unprocessed sunflower seeds. However, it is important to recognize that this is a preliminary estimate that does not factor in administrative or fixed costs associated with farm operations.

Given that sunflower seed oil is typically traded alongside seed cake as a by-product, the actual gross margin from processed sunflower products amounts to TZS 2,394,140.98 per acre. However, most smallholder farmers lack the financial capacity to own processing equipment. As a result, they compensate processors either by paying a fee of TZS 128.57 per kilogram in cash or by relinquishing the seed cake as an in-kind payment. This arrangement reflects the economic constraints faced by farmers and underscores the need for accessible processing infrastructure to maximize returns from value-added sunflower products. The sunflower seed cake business is relatively uncommon among smallholder farmers in Tanzania, primarily because it tends to be unprofitable when pursued as a standalone venture. Data indicates that farmers incur a loss of TZS 7,721.76 per acre when trading seed cake as a by-product. However, this loss is typically offset by the revenue generated from the sale of sunflower seed oil, which serves as the main product. Most farmers who do not practice animal husbandry often opt to leave the seed cake with processors as an in-kind payment for oil extraction services. The economic viability of seed cake could improve significantly if farmers were able to further process it into finished products such as shoe-shine polish, brake pads, or mosquito repellent. Such value addition would not only diversify income streams but also enhance the overall profitability of sunflower agribusiness.

Upgrading the Operations of Tanzania Agricultural Commodity Exchange Market under the Warehouse Receipt System Scheme

The existing structure of Tanzania’s agricultural commodity exchange market does not accommodate the trading of value-added products such as processed sunflower oil and seed cake. Findings from this study indicate that smallholder farmers earn significantly lower gross margins TZS 455,094.60 per acre from trading unprocessed sunflower seeds, compared to a much higher margin of TZS 2,394,140.98 per acre from processed sunflower products. Despite this disparity, the current framework involving the Tanzania Mercantile Exchange (TMX), Agricultural Commodity Exchange (ACX), and Warehouse Receipt System (WRS) lacks provisions for trading processed goods. To address this gap, the study recommends upgrading the system to include processing facilities at the AMCOS level, where farmers are organized. Recognizing that individual smallholder farmers often lack the financial capacity to own processing equipment, the proposed model encourages collective ownership and operation of processing machines through farmer groups. This approach would enable broader participation in value-added agribusiness and unlock higher income potential for rural producers.

Proposed Process for Trading Processed Sunflower Products

Stage 1: Processing at AMCOS

- Farmers deliver sunflower seeds to their respective Agricultural Marketing Cooperative Societies (AMCOS).
- Seeds are processed into oil and seed cake.
- Since seed cake yields minimal or negative returns when traded independently, it is recommended that farmers use it to cover processing costs either through in-kind payment or as per group agreements.

Stage 2: Transfer to Cooperative Union Warehouse

- AMCOS transfers the processed sunflower oil to the cooperative union’s warehouse for secure storage.
- Farmers receive official receipts as proof of ownership for the stored oil.

Stage 3: Buyer Registration at TMX

- Interested buyers register their intent to purchase processed sunflower oil through the Tanzania Mercantile Exchange (TMX).

- Buyers choose from available contract types, including spot and derivative contracts.

Stage 4: Inventory Reporting

- The cooperative union submits detailed inventory reports to TMX, including quantities of processed oil and ownership records linked to individual farmers.

Stage 5: Electronic Auction

- TMX conducts electronic auctions for the processed oil.
- Winning bidders make payments directly to TMX’s designated bank account.

Stage 6: Stock Collection

- Upon payment confirmation, buyers collect their purchased oil from the cooperative union warehouse.

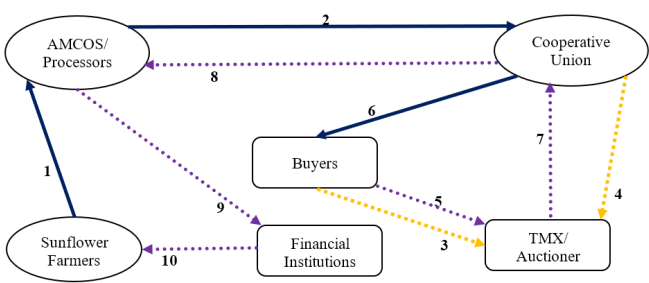
Stage 7: Payment Remittance to Cooperative Union

- TMX transfers the received payments to the cooperative union within five days of the auction.

Stage 8: Disbursement to AMCOS

- Within 24 hours of receiving funds from TMX, the cooperative union disburses payments to the respective AMCOS, which then distribute earnings to individual farmers.

Figure 1: Reviewed ACX under WRS Scheme



Source: Adopted from Molela (2017) and Molela (2025)

Stage 9: Deposit to Farmers’ Bank Accounts

- AMCOS deposits the earnings into individual farmers’ accounts held at consortium affiliated banks.

Stage 10: Fund Collection and Cycle Renewal

- Farmers withdraw their funds, reinvest in the next production cycle, and the process begins again.

CONCLUSION

The significant disparity in gross margins between processed and unprocessed sunflower product trading clearly underscores the need to reassess and strengthen forward market linkages. This study concludes that it is essential to establish an enabling environment that facilitates smallholder farmers' transition from trading raw sunflower seeds to engaging in value-added sunflower product markets. Creating a dedicated trading window for processed agricultural products particularly sunflower oil and seed cake within platforms like TMX, ACX, and WRS is crucial for enhancing the viability and competitiveness of small-scale farming. When farmers are incentivized by the higher returns associated with value addition, they are more likely to reinvest in their operations, adopt improved practices, and expand production. Such growth at the individual farmer level contributes directly to the broader performance of the agricultural sector and, by extension, stimulates national economic development. Supporting this shift through policy reforms, infrastructure investment, and cooperative-based processing models will be key to unlocking the full potential of Tanzania's sunflower value chain.

Based on the findings, it is strongly recommended that policymakers particularly those overseeing financial markets, agriculture, and cooperatives prioritize the upgrading of the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS) to accommodate the trading of processed agricultural products. Such reforms would not only enhance income generation for smallholder farmers but also help eliminate exploitative practices by unlicensed middlemen operating outside formal channels. To support this transition, the Tanzania Cooperative Development Commission (TCDC) should introduce a registration requirement mandating that any AMCOS formed around a specific crop must be equipped with a processing machine for that crop. This policy would facilitate a structural shift, encouraging farmers to move away from selling raw materials and toward engaging in value-added agribusiness. By institutionalizing processing capacity at the cooperative level, farmers can access higher-margin markets, strengthen their bargaining power, and contribute more meaningfully to the growth of Tanzania's agricultural sector.

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