

Connecting the chain: Value-chain linkages, governance and market power in Tanzania's sunflower sub-sector

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ABSTRACT

This paper maps the sunflower value chain in Central Tanzania and analyses how linkages, governance arrangements, and market power shape the participation of farmers, processors, traders, consumers, and support institutions. The study used evidence from a mixed-methods value-chain survey conducted in Kondoa, Mpwapwa, Manyoni, and Singida districts. Quantitative data from 379 respondents were analysed using descriptive statistics, cross-tabulations, and actor-based comparisons, while qualitative information from focus group discussions and key informant interviews was used to explain the institutional, market, and coordination issues behind the statistical patterns. The findings show that farmers mainly supplied processors (53.5%) and petty traders (46.5%), while processors sold largely to retailers (41.2%) and households (38.2%). Value addition was concentrated at the processing node, where 88.2% of processors sold both sunflower oil and sunflower cake, whereas all sampled farmers sold raw sunflower seed. Low market price was the most frequently reported marketing constraint, accounting for 42 responses, followed by unreliable markets with 34 responses and undeveloped productive infrastructure with 28 responses. These findings indicate that the chain is commercially active but weakly governed, with farmers having limited influence over prices, processors facing uncertain raw-material supply, and traders often benefiting from superior market information and cash capacity. The paper concludes that sunflower value-chain performance depends on strengthening collective marketing, transparent price setting, quality standards, aggregation, finance, and trust-based coordination among actors. It recommends institutional arrangements that connect production, processing, trading, and consumption more inclusively and competitively.

Keywords: Sunflower Value Chain, Value Chain Mapping, Governance, Interlinkages, Central Tanzania

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INTRODUCTION

Sunflower is an important oilseed crop in Tanzania because it links smallholder livelihoods, domestic edible oil supply, rural employment, and local agro-processing. In Central Tanzania, the crop is widely grown under semi-arid conditions and provides both cash income and edible oil for rural and urban consumers. Its importance has increased because Tanzania continues to prioritise oilseed development as part of agricultural commercialisation, import substitution, and agro-industrial growth (AGRA, 2022; Ministry of Agriculture, 2025; National Bureau of Statistics, 2025; OECD/FAO, 2025; Tanzania Investment Centre, 2025). Recent value chain literature emphasises that agricultural upgrading depends not only on increasing production but also on how actors are linked, how information flows, how standards are enforced, and how power is distributed along the chain. In sunflower markets, farmers depend on seed suppliers, mechanisation providers, traders, and processors, while processors depend on reliable seed volumes, and consumers depend on affordable, safe, and trusted oil products. This interdependence makes value chain mapping a useful tool for identifying the points where coordination failures reduce competitiveness and inclusion (Gereffi *et al.*, 2005; Kaplinsky & Morris, 2001; Vilvert *et al.*, 2018).

The relevance of sunflowers also lies in their capacity to connect agricultural transformation with local industrialisation. When production, aggregation, processing, and marketing function together, sunflowers can reduce dependence on imported edible oils, create rural employment, and support small and medium agro-processing enterprises. However, these benefits are reduced when farmers sell individually, quality standards are unclear, market information is weak, and processors operate below capacity because of uncertain seed supply (Farm Africa, 2022; AMDT, 2023; OECD/FAO, 2024, 2025). At the current stage of Tanzania's agricultural transformation, the sunflower sub-sector deserves closer analytical attention because it sits at the intersection of food security, import substitution, smallholder commercialisation, and rural industrialisation. Stronger sunflower value chain governance can contribute to household income, local processing, animal-feed markets through sunflower cake, and the supply of healthier edible oil products. This makes the crop a strategic entry point for linking agricultural policy, private investment, and inclusive rural development (Nungula *et al.*, 2023; Msemwa & Macha, 2024; Ministry of Agriculture, 2025).

Accordingly, the present analysis treats the sunflower sub-sector as an integrated system in which production, aggregation, processing, marketing and consumption are mutually reinforcing. Where farmers lack finance, processors experience raw-material shortages; where processors lack stable procurement arrangements, farmers face uncertain markets; and where consumers doubt product quality, traders and processors lose market confidence. This systems view is consistent with the agricultural value chain and innovation-systems thinking, which emphasises the interaction of actors, services, institutions, and markets (Porter, 1985; Gereffi *et al.*, 2005; OECD/FAO, 2024). The paper is guided by the argument that sunflower upgrading cannot be achieved by increasing production alone. A more complete upgrading pathway must connect improved input access, stronger farmer organisation, reliable aggregation, predictable processing demand, quality assurance, and consumer confidence. This emphasis is important because value chain performance depends on the ability of actors to coordinate decisions across production, processing, and marketing nodes, especially where smallholders face weak bargaining power and limited market information (Kaplinsky & Morris, 2001; Gereffi *et al.*, 2005; Barrett, 2008; Vilvert *et al.*, 2018).

Value-chain mapping is therefore important because agricultural development depends on the performance of the whole chain rather than production alone. Farmers require seed, land preparation, finance, extension, and storage; processors require raw sunflower seed of acceptable quality; traders require predictable products to distribute; and consumers require affordable and reliable sunflower oil. If one segment is weak, the entire chain underperforms, even where

demand is strong (Barrett, 2008; Jayne *et al.*, 2010; Vilvert *et al.*, 2018; Matekele *et al.*, 2024). This paper uses evidence from Kondoa, Mpwapwa, Manyoni, and Singida to analyse interlinkages and governance dynamics in the sunflower value chain. It contributes to value chain literature by showing how local relationships among farmers, traders, processors, and consumers can support or constrain smallholder inclusion and processing growth. The paper proceeds from theoretical and empirical literature to methodology, findings, discussion, conclusion, and recommendations, thereby maintaining a clear logical movement from the title to the final policy and practice implications (Hawassi *et al.*, 2015; Msemwa & Macha, 2024; Tibamanya & Milanzi, 2024).

Despite the growing policy and market attention given to sunflowers in Tanzania, existing studies often emphasise production, technical efficiency, profitability or livelihood effects more than the governance of relationships among farmers, traders, processors, and consumers. The novelty of this paper is that it connects value-chain mapping with actor linkages, market power, and institutional coordination in four major sunflower-producing districts of Central Tanzania. In doing so, it goes beyond identifying actors to explain how information asymmetry, cash constraints, weak aggregation, limited contract enforcement, and uneven bargaining power shape value creation and value capture across the chain. This provides a practical contribution to sunflower upgrading debates by showing where inclusive governance mechanisms are required to transform a commercially active chain into a more competitive and equitable sub-sector (Vilvert *et al.*, 2018; Msemwa & Macha, 2024; Mishra *et al.*, 2024; OECD/FAO, 2025).

THEORETICAL AND EMPIRICAL LITERATURE

Theoretical Literature

The theoretical framing is important because sunflower value chain problems are not caused by one factor alone. The behaviour of farmers, processors, traders, and consumers is shaped by incentives, information, risk, institutions, and infrastructure. A coherent interpretation of sunflower value chain performance, therefore, requires attention to both actor-level decision-making and chain-level coordination (Kaplinsky & Morris, 2001; Gereffi *et al.*, 2005; Porter, 1985). This paper is anchored in value chain governance theory, systems thinking, and collective-action theory. Value-chain governance theory explains how power, information, and coordination shape relationships among input suppliers, farmers, traders, processors, retailers, and consumers. Systems thinking adds that sunflower performance depends on the interaction of production, processing, marketing, finance, quality assurance, and consumption rather than isolated interventions (Gereffi *et al.*, 2005; Kaplinsky & Morris, 2001; OECD/FAO, 2024).

Collective-action theory is equally relevant because smallholder farmers have limited bargaining power when they sell individually. Farmer groups and co-operatives can reduce transaction costs, aggregate produce, improve information flow, and strengthen negotiation with processors and traders. However, collective action produces stronger outcomes when farmer organisations are accountable, market-oriented, and linked to reliable buyers (Markelova *et al.*, 2009; Markelova & Mwangi, 2010; Fischer & Qaim, 2012; Candemir *et al.*, 2021). The three theoretical perspectives are complementary. Value-chain governance explains power and coordination; systems thinking explains interdependence among chain segments; and collective-action theory explains why organised farmer platforms are needed to rebalance negotiations with better-informed actors. Together, these perspectives provide a strong basis for interpreting sunflower production, marketing, processing, and consumption as connected components of one chain (Gereffi *et al.*, 2005; Markelova *et al.*, 2009; Qorri & Felfoldi, 2024).

Empirical Literature

Recent studies show that sunflower profitability, technical efficiency, value chain finance, and livelihood outcomes are shaped by access to reliable inputs, extension services, finance,

markets, and organised relationships. These studies support integrated analysis because constraints identified at the farm level often reappear as raw-material, processing, and marketing constraints elsewhere in the chain (Msafiri *et al.*, 2023; Matekele *et al.*, 2024; Msemwa & Macha, 2024; Tibamanya & Milanzi, 2024). Current agricultural marketing literature also shows that collective action can improve chain performance when it supports aggregation, quality control, and negotiation. However, collective action must be supported by transparent governance, member trust, and viable market opportunities. Therefore, the present paper pays attention not only to the presence of value chain actors but also to the quality of the linkages among them (Markelova *et al.*, 2009; Fischer & Qaim, 2012; Candemir *et al.*, 2021; Qorri & Felfoldi, 2024).

Recent evidence from Tanzania indicates that sunflower continues to attract policy and market attention because of the national edible-oil deficit and the potential for domestic value addition. National statistics and investment profiles show continued interest in oilseed expansion, while market assessments identify weak financing, low productivity, inadequate extension, limited processing quality, and weak farmer-processor linkages as persistent constraints (AGRA, 2022; AMDT, 2023; National Bureau of Statistics, 2025; Tanzania Investment Centre, 2025). Tanzania-specific studies provide direct support for the present analysis. Vilvert *et al.* (2018) show that the sunflower food value chain requires multi-model analysis because production, processing, and market dynamics are interconnected. Matekele *et al.* (2024) demonstrate that farmers' intentions to seek agricultural value chain financing are shaped by perceived benefits, perceived risks, knowledge, and enterprise embeddedness. Msemwa and Macha (2024) show that sunflower value chain activities can influence smallholder livelihoods in Mpwapwa when production, market, and institutional conditions are supportive.

Recent evidence also confirms that sunflower upgrading in Tanzania requires attention to technical efficiency, market collaboration, co-operative organisation and contract governance. Tibamanya and Milanzi (2024) show that technical efficiency among smallholder sunflower farmers in Singida is an important condition for improving production performance, while Matekele *et al.* (2024) show that value-chain finance decisions are shaped by perceived benefits, risks and knowledge. Beyond Tanzania, Mishra *et al.* (2024) demonstrate that collaboration in agricultural value chains can improve smallholder participation where actors share information, coordinate risks and build trust. Christian *et al.* (2024) similarly show that co-operatives can strengthen smallholder participation in agri-food chains when they are functional and market-oriented. Recent Tanzania-focused contract farming literature further shows that literacy, institutional design and fair governance affect whether smallholders benefit from structured buyer relationships (Dogeje *et al.*, 2024; Ndimbo & Haulle, 2024). These findings are consistent with the present study because they show that production performance alone cannot explain value-chain outcomes unless governance, market information, finance and bargaining power are also examined.

The broader empirical literature also shows that co-operatives and collective action can improve smallholder market participation, but only where member organisations are well governed and connected to reliable buyers. Contract farming can stabilise markets and improve coordination, yet its welfare effects depend on fairness, transparency, and enforcement. These insights are used in the Findings and Discussion section to interpret how sunflower actors experience linkages, market power, and governance in Central Tanzania (Bellemare, 2012; Fischer & Qaim, 2012; Candemir *et al.*, 2021; Kimbi *et al.*, 2024).

METHODOLOGY

Study Area

The study was conducted in Kondoa, Mpwapwa, Manyoni, and Singida districts in Central Tanzania. These districts were selected because sunflowers are an important cash and food crop

in the semi-arid farming systems of the area and because they contain active sunflower farmers, processors, traders, and consumers. Central Tanzania is also relevant to the national edible oil agenda because it remains one of the country's important sunflower production zones (Hawassi *et al.*, 2015; Vilvert *et al.*, 2018; National Bureau of Statistics, 2025). The selection of the four districts provided a strong basis for analysing sunflower because the districts represent different combinations of production intensity, market access, and processing activity. Their semi-arid conditions make sunflowers suitable for livelihood diversification, although rainfall variability, input constraints, and market uncertainty increase production and income risks. The study area, therefore, enabled comparison across local market environments without treating Central Tanzania as a uniform production zone (Nungula *et al.*, 2023; Msemwa & Macha, 2024; Tibamanya & Milanzi, 2024).

Research Design

The study adopted a cross-sectional mixed-methods value chain research design. The design was appropriate because data were collected at one point in time from several actor categories operating within the same commodity chain. It enabled comparison across districts and value chain segments while allowing quantitative survey evidence to be complemented by qualitative explanations from FGDs and KIIs (Creswell & Plano Clark, 2018; Taherdoost, 2016). The mixed-methods design strengthened the validity of the analysis because quantitative data provided measurable patterns, while FGDs and KIIs clarified institutional issues such as price negotiation, market reliability, service delivery, processing constraints, and consumer trust. This approach is suitable where numerical findings require contextual explanation and where actor relationships are central to the research problem (Creswell & Plano Clark, 2018; Braun & Clarke, 2006).

Study Population, Sample Size and Sampling Procedure

The study population comprised major actors in the sunflower value chain, including farmers, processors, traders, and consumers. The quantitative sample was statistically justified using Cochran's formula for large or unknown populations: $n_0 = Z^2pq/e^2$. At a 95% confidence level, $Z = 1.96$; with maximum variability, $p = 0.5$ and $q = 0.5$; and a 5% margin of error, $e = 0.05$. The computation gave $n_0 = (1.96^2 \times 0.5 \times 0.5)/(0.05^2) = 384.16$, approximately 384 respondents (Cochran, 1977; Bartlett *et al.*, 2001).

Although Cochran's formula produced a desired sample of 384 respondents, 379 completed responses were retained for quantitative analysis. The difference of five respondents represented only 1.3% of the computed sample and arose from ordinary field work limitations, including non-response, respondent unavailability, incomplete questionnaires, and the limited number of specialised value chain actors such as processors and traders in some study locations. Survey methodology recognises that computed sample sizes represent planned targets, while achieved samples may differ slightly because of non-response and practical field conditions (Groves, 2006; Groves & Peytcheva, 2008; United Nations, 2005).

The achieved sample was considered adequate because it represented 98.7% of the computed sample, remained very close to the statistical target, and covered all four districts and all major sunflower value chain actor categories. Methodological literature further emphasises that sample adequacy depends not only on numerical size but also on population coverage, data quality, and the extent to which non-response is small and unlikely to distort findings (Krejcie & Morgan, 1970; Bartlett *et al.*, 2001; Groves, 2006).

Table 1. Distribution of sampled respondent categories by district

District	Farmers	Processors	Traders	Consumers	Total
Kondoa	29	6	8	37	80
Mpwapwa	40	7	15	40	102
Manyoni	39	6	8	34	87
Singida	40	15	15	40	110
Total	148	34	46	151	379

Source: Field survey data.

A multi-stage sampling procedure was used. Districts, divisions, wards, and villages were selected purposively based on sunflower production, processing activity, and accessibility. Farmers and consumers were selected using probability-based procedures where sampling lists were available, while processors and traders were selected purposively because they represented specialised and fewer value chain actors (Taherdoost, 2016; United Nations, 2005). This combination was appropriate because the study required both statistical coverage of households and targeted inclusion of actors with specific processing and marketing knowledge. The quantitative survey covered 148 farmers, 34 processors, 46 traders, and 151 consumers, thereby allowing each actor category to contribute evidence to the segment of the sunflower value chain in which it operates (Kaplinsky & Morris, 2001; Creswell & Plano Clark, 2018).

Data Collection

Quantitative data were collected using a structured questionnaire administered to farmers, processors, traders, and consumers in Kondoa, Mpwapwa, Manyoni, and Singida districts. The questionnaire captured actor categories, customer linkages, product forms, marketing channels, value-addition patterns, constraints, and institutional support. Qualitative data were collected through focus group discussions, key informant interviews, and documentary review to provide contextual explanations for the statistical patterns observed in the survey. Eight FGDs were proposed, with two FGDs in each district: one involving female sunflower farmers and another involving male sunflower farmers. Twelve KIIs were proposed with district agricultural and extension officers, processors, traders, input suppliers, and other knowledgeable value chain actors. This design enabled the study to connect numerical evidence with actor experiences on price negotiation, market reliability, credit access, service delivery, processing constraints, and trust (Braun & Clarke, 2006; Creswell & Plano Clark, 2018).

The documentary review covered the research report and relevant literature on sunflower production, oilseed value chains, smallholder commercialisation, and agricultural markets. Triangulation was applied by linking quantitative tables with evidence from FGDs, KIIs, and documentary sources. This improved the credibility of interpretation and ensured that qualitative findings were used to complement, rather than duplicate, quantitative findings (Braun & Clarke, 2006; Vilvert *et al.*, 2018; Matekele *et al.*, 2024).

Validity and Reliability of the Survey Instrument

The quantitative questionnaire was reviewed before field deployment to ensure that all items reflected the study objectives and the main constructs of the sunflower value chain, including actor linkages, product forms, market access, pricing, constraints, and institutional support. Content validity was improved through expert review and alignment of questions with value-chain literature, the study objectives, and the categories of actors covered in the survey.

The instrument was also pre-tested with respondents who had characteristics similar to the target population. Feedback from the pre-test was used to clarify ambiguous questions, improve the sequencing of items, and remove overlapping questions before full data collection.

Reliability was strengthened using standardised questions, enumerator orientation, common coding procedures, and field supervision. After data collection, the completed questionnaires were screened for consistency, missing values, and logical errors before analysis. Where Likert-type or multi-item questions were used, internal consistency was assessed using reliability procedures appropriate for survey data, and items that weakened coherence were reviewed before final analysis. These steps improved the dependability of the quantitative evidence and reduced measurement errors that could have affected the interpretation of the tables (Taherdoost, 2016; Creswell & Plano Clark, 2018).

Data Analysis

Quantitative data were screened for completeness, consistency, and accuracy before coding and entry into SPSS. The cleaning process involved checking missing responses, removing incomplete questionnaires, verifying district and actor-category totals, and comparing table frequencies with the final cleaned dataset. Descriptive statistics were then generated using frequencies, percentages, and cross-tabulations to compare actors, districts, product forms, customer linkages, and marketing constraints (Taherdoost, 2016; United Nations, 2005).

The quantitative findings were presented in tables to improve clarity, comparability, and logical flow across districts and actor categories. Table 1 presents the distribution of respondents; Table 2 presents customer and forward linkages; Table 3 presents product forms and value addition; Table 4 presents marketing constraints; and Table 5 synthesises interlinkages and upgrading implications. Qualitative information from FGDs and KIIs was analysed thematically and used in the Findings and Discussion section to explain the quantitative patterns shown in the tables (Braun & Clarke, 2006; Creswell & Plano Clark, 2018).

For clarity of presentation, the quantitative analysis was organised around the main value chain questions addressed by the paper. Frequencies were used to show the number of respondents or responses falling under each category, while percentages were used to compare patterns across districts and actor groups. Cross-tabulations helped to relate actor categories to customer linkages, product forms, and marketing constraints, thereby making the tables easier to interpret in relation to the study objectives (Cochran, 1977; Taherdoost, 2016; United Nations, 2005). The qualitative analysis followed a complementary logic. FGD and KII notes were read repeatedly and coded around recurring themes such as price setting, market reliability, storage, buyer behaviour, processing capacity, quality concerns, and institutional support. These themes were then linked to the corresponding quantitative tables so that qualitative findings explained why the numerical patterns occurred instead of being presented as separate findings (Braun & Clarke, 2006; Creswell & Plano Clark, 2018).

Ethical Considerations

The study followed ethical principles of informed participation, confidentiality, and responsible reporting. Respondents were informed about the purpose of the research before participation, and the findings were reported in aggregate form to protect individual identities. These procedures are consistent with standard social research practice where survey and qualitative data are collected from community and market actors (Creswell & Plano Clark, 2018; United Nations, 2005). Ethical reporting was especially important because value chain actors may provide commercially sensitive information about prices, buyers, suppliers, and institutional relationships. For this reason, qualitative evidence was anonymised and linked only to districts or actor categories. This approach protected respondents while allowing the analysis to retain the explanatory value of FGD and KII evidence (Braun & Clarke, 2006; Creswell & Plano Clark, 2018).

FINDINGS AND DISCUSSION

This section presents the empirical findings and their implications for sunflower value chain development in Central Tanzania. The discussion proceeds from customer linkages to product forms, marketing constraints, power relations, and institutional upgrading pathways. Quantitative findings are presented first through tables, while qualitative findings from FGDs and KIIs are integrated to explain the meaning of those statistical patterns (Kaplinsky & Morris, 2001; Gereffi et al., 2005; Braun & Clarke, 2006).

Main Customers and Forward Linkages

Findings in Table 2 show that the sunflower chain operates through several customer routes rather than a single linear channel. Farmers sold to processors and petty traders, processors sold to households and retailers, and traders sold mainly to consumers.

Table 2. Main customers of sunflower products by actor and district

Actor/customer category	Kondoa	Mpwapwa	Singida	Manyoni	Total
Farmers selling to processors	75.0 (03)	66.7 (02)	50.0 (15)	50.0 (03)	53.5 (23)
Farmers selling to petty traders	25.0 (01)	33.3 (01)	50.0 (15)	50.0 (03)	46.5 (20)
Processors selling to households	50.0 (03)	28.6 (02)	33.3 (05)	50.0 (03)	38.2 (13)
Processors selling to retailers	33.3 (02)	42.9 (03)	46.7 (07)	33.3 (02)	41.2 (14)
Traders selling to consumers	62.5 (05)	60.0 (09)	53.3 (08)	62.5 (05)	58.7 (27)

Note: Figures in brackets are frequencies of responses where percentages are presented.

Overall, 53.5% of farmer customer responses involved processors, while 46.5% involved petty traders. This quantitative finding confirms that both direct and indirect marketing channels are important in the sunflower chain. It is consistent with value-chain literature showing that smallholder market participation is shaped by buyer proximity, information, transaction costs, liquidity, and bargaining power (Kaplinsky & Morris, 2001; Gereffi et al., 2005; Barrett, 2008; Markelova et al., 2009). FGDs in Kondoa and Mpwapwa showed that farmers often sell to buyers who are physically present after harvest and able to pay immediately. KIIs with processors in Singida and Manyoni indicated that organised farmer suppliers reduce collection costs and improve the predictability of seed volumes, while scattered production makes direct procurement more expensive.

Product Forms and Value Addition

Findings in Table 3 show that all sampled farmers sold raw sunflower seed, while 88.2% of processors sold both sunflower oil and sunflower cake. This quantitative pattern confirms that farmers remain concentrated at the primary production stage, whereas processors and traders capture additional value through transformation, by-product use, and distribution. The finding is supported by value-chain upgrading literature, which emphasises that higher value capture depends on processing, quality control, market organisation, and scale (Porter, 1985; Kaplinsky & Morris, 2001; Vilvert et al., 2018; Msemwa & Macha, 2024).

Table 3. Main forms of sunflower products sold by different actors

Actor/product form	Kondoa	Mpwapwa	Singida	Manyoni	Total
Farmers: fresh raw sunflower	100.0 (29)	100.0 (40)	100.0 (40)	100.0 (39)	100.0 (148)
Processors: sunflower oil only	16.7 (01)	Nil	Nil	50.0 (03)	11.8 (04)
Processors: cake only	Nil	Nil	Nil	Nil	Nil
Processors: both oil and cake	83.3 (05)	100.0 (07)	100.0 (15)	50.0 (03)	88.2 (30)
Traders: sunflower oil	75.0 (06)	86.7 (13)	73.3 (11)	75.0 (06)	78.3 (36)

Actor/product form	Kondoa	Mpwapwa	Singida	Manyoni	Total
Traders: sunflower cake	25.0 (02)	13.3 (02)	26.7 (04)	25.0 (02)	21.7 (10)

Note: Figures in brackets are frequencies of responses where percentages are presented.

FGDs in Mpwapwa and Manyoni indicated that farmers understand the higher value of processed sunflower oil but lack milling equipment, working capital, and storage facilities. KIIs with processors in Singida and Kondoa revealed that sunflower cake is a valuable by-product linking oil processing to livestock-feed markets, although inconsistent seed quality and limited coordination weaken oil and cake supply reliability.

Marketing Constraints as Governance Problems

Findings in Table 4 reveal that marketing constraints are also governance weaknesses. Low market price was the most frequently reported problem, with 42 responses, followed by unreliable markets with 34 responses, undeveloped productive infrastructure with 28 responses, and inaccessibility of credit with 27 responses. These constraints reflect weak coordination, limited information, low bargaining power, and inadequate market-support services (Gereffi *et al.*, 2005; Barrett, 2008; Matekele *et al.*, 2024). Findings in Table 4 also show district variation in the severity of marketing constraints. Singida recorded the highest number of responses on marketing problems, especially credit constraints and low prices. This suggests that value chain interventions should not assume uniform conditions across Central Tanzania but should respond to district-specific constraints and actor needs (Hawassi *et al.*, 2015; Msemwa & Macha, 2024; Tibamanya & Milanzi, 2024).

Table 4. Problems affecting the marketing of sunflower products by district

Marketing problem	Kondoa	Mpwapwa	Singida	Manyoni	Total responses
Inaccessibility of the credit facility	4	6	13	4	27
Low market price	7	13	14	8	42
Stiff competition from similar products	4	7	10	5	26
Unreliable markets	8	10	11	5	34
High operating costs	4	6	4	4	18
Undeveloped productive infrastructure	5	8	9	6	28
Total responses	32	50	61	32	175

The quantitative distribution of marketing problems confirms that price, market reliability, credit, and infrastructure constraints are mutually reinforcing. Low prices encourage distress selling; distress selling weakens bargaining power; weak bargaining power discourages investment in quality and storage; and limited quality control reduces trust between farmers and processors. This pattern is consistent with literature on smallholder commercialisation, agricultural value-chain finance and market coordination, which shows that price formation, storage, credit access, and institutional trust jointly shape market participation (Barrett, 2008; Jayne *et al.*, 2010; Matekele *et al.*, 2024; Msemwa & Macha, 2024). FGDs in Kondoa and Mpwapwa linked low prices to distress selling immediately after harvest, especially where households lack storage and cash reserves. In Manyoni and Singida, participants reported that price information often reaches traders earlier than farmers, making it difficult for producers to negotiate from an informed

position. KIIs with traders and local officials indicated that unreliable markets are reinforced by weak aggregation, limited credit, and poor storage facilities.

Chain Interlinkages and Power Relations

Findings in Table 5 show that backward and forward linkages exist, but they do not benefit all actors equally. Farmers depend on input suppliers and buyers, processors depend on seed supply and consumers, and traders depend on price margins and transport. These interdependencies create opportunities for coordination but also risks of unequal value capture where information and bargaining power are unevenly distributed (Gereffi *et al.*, 2005; Kaplinsky & Morris, 2001).

Table 5. Sunflower value-chain interlinkages and upgrading implications

Chain segment	Main actors/linkage role	Quantitative finding	Qualitative complement	Upgrading implication
Input supply	Agro-dealers, seed suppliers, extension and mechanisation providers	Input quality, timing, and affordability affect production reliability (Nungula <i>et al.</i> , 2023; Tibamanya & Milanzi, 2024).	FGDs indicated that late and costly seed supply reduces timely planting and yield confidence.	Strengthen certified seed delivery, extension and mechanisation services.
Production	Smallholder farmers and farmer groups	All sampled farmers sold raw seed, confirming limited farm-level value addition (Kaplinsky & Morris, 2001; Msemwa & Macha, 2024).	FGDs showed that farmers lack storage, capital and collective bulking arrangements.	Improve productivity, storage, farmer organisation and collective marketing.
Aggregation and trade	Petty traders, collectors, transporters and local buyers	Petty traders represented 46.5% of farmer customer responses, showing their aggregation role (Barrett, 2008; Markelova <i>et al.</i> , 2009).	FGDs reported that traders pay quickly but farmers face weak bargaining power.	Promote transparent weighing, price information and aggregation centres.
Processing	Oil millers, processors and farmer-linked processors	Most processors sold both oil and cake, showing that value addition is concentrated after the farm gate (Vilvert <i>et al.</i> , 2018; Farm Africa, 2022).	KIIs noted that inconsistent seed volumes and quality reduce capacity utilisation.	Build farmer-processor contracts, storage and quality-based delivery systems.
Retail and consumption	Retailers, households, feed users and final consumers	Traders mainly handled sunflower oil, while cake served additional feed	KIIs indicated that price, packaging, quality and trust influence consumer choice.	Improve packaging, labelling, certification and

Chain segment	Main actors/linkage role	Quantitative finding	Qualitative complement	Upgrading implication
		markets (OECD/FAO, 2024).		market distribution.
Finance and risk management	Banks, SACCOs, VICOBA, processors and development partners	Credit inaccessibility recorded 27 responses, limiting production, storage and value addition (Matekele et al., 2024).	FGDs showed that the lack of seasonal finance pushes farmers into immediate post-harvest sales.	Develop seasonal value-chain finance linked to bulking and procurement.
Institutional coordination	LGAs, co-operatives, regulators and chain platforms	Low prices, unreliable markets, and weak infrastructure show coordination gaps (Gereffi et al., 2005; Mishra et al., 2024).	KIIs suggested that regular actor dialogue can improve trust, standards and planning.	Create multi-stakeholder platforms for prices, quality and dispute resolution.

Findings in Table 5 further show that governance issues differ by chain segment. Input supply is affected by quality, timing, and affordability; production is affected by productivity and weak price control; aggregation is affected by weighing and price information; processing is affected by raw-seed shortages and quality constraints; and retailing is affected by quality, packaging, and affordability concerns. This confirms that upgrading must address the chain as an integrated system (Porter, 1985; Vilvert et al., 2018; OECD/FAO, 2024). FGDs in Kondoa, Mpwapwa and Manyoni revealed that farmers recognise the importance of value-chain linkages but often experience them as unequal. Participants associated input suppliers with high seed prices and uncertain quality, traders with immediate cash but limited bargaining space, and processors with potential market stability when procurement arrangements are clear. KIIs with processors in Singida and Kondoa indicated that unreliable seed supply, inconsistent quality and weak aggregation raise transaction costs and reduce processing efficiency.

Upgrading Implications for Chain Governance and Coordination

Findings from Tables 2 to 5 show that the sunflower chain in Central Tanzania is connected but insufficiently coordinated. Upgrading should therefore improve the rules, relationships, information flows, and incentives that determine how value is created and shared. This interpretation is supported by value-chain governance literature, which stresses that upgrading depends on coordination, standards, information and power relations among actors (Gereffi et al., 2005; Kaplinsky & Morris, 2001; Vilvert et al., 2018).

Table 6. Upgrading implications for chain governance and coordination

Upgrading area	Quantitative finding addressed	Complementary qualitative finding	Coordination implication
Aggregation and collective marketing	Farmers sold through processors (53.5%) and petty traders (46.5%), indicating multiple market routes.	FGDs showed that dispersed farmers rely on buyers who appear immediately after harvest and pay cash.	Promote bulking centres, co-operative marketing and transparent buyer engagement.

Upgrading area	Quantitative finding addressed	Complementary qualitative finding	Coordination implication
Value addition and product diversification	Processors sold oil and cake, while farmers sold raw seed only.	KIIs with processors confirmed that sunflower cake improves profitability but depends on seed quality and regular volumes.	Link farmers to processing services, quality requirements and fair value-sharing arrangements.
Market information and price transparency	Low market price recorded the highest number of marketing constraint responses.	FGDs indicated that price information often reaches traders before farmers, weakening farmers' negotiation.	Introduce local price information systems, standard weights and open quality grades.
Finance and storage	Credit inaccessibility and undeveloped infrastructure were important constraints.	FGDs and KIIs linked lack of credit and storage with distress selling and weak procurement planning.	Expand seasonal finance, warehouse facilities and processor-linked working capital.

The evidence in Table 6 clarifies that upgrading is a governance issue rather than a single technical intervention. The split between processor and petty-trader channels shows that farmers rely on multiple outlets when liquidity, transport and market information are unevenly distributed. The dominance of raw-seed sales further implies limited farmer participation in processing and value addition. Literature on smallholder market participation and collective action supports this interpretation by showing that better organisation, aggregation, storage and quality control improve farmers' ability to negotiate and capture value (Barrett, 2008; Markelova et al., 2009; Fischer & Qaim, 2012; Candemir et al., 2021). FGDs indicated that farmers usually choose buyers who are present at harvest time, pay immediately and accept small volumes. KIIs with processors showed that reliable procurement is easier where farmers are organised into groups that can bulk seed, observe quality requirements and agree on delivery schedules.

The implication is that chain coordination should be treated as a productive investment. Price information, standard weighing, storage, seasonal finance, and fair procurement agreements can reduce opportunistic behaviour and improve value capture by farmers without weakening the role of traders and processors. This interpretation is supported by recent literature on co-operatives, contract farming and value-chain finance which emphasises trust, enforceable rules and market-oriented organisation (Candemir et al., 2021; Kimbi et al., 2024; Matekele et al., 2024; Qorri & Felfoldi, 2024).

Integrated Interpretation of Value-Chain Linkages

The integrated interpretation is that the sunflower chain is active but weakly coordinated. Quantitative evidence shows functioning product flows, while qualitative evidence explains how trust, information gaps and bargaining asymmetries reduce fair value capture.

Table 7. Integrated interpretation of quantitative and qualitative findings

Quantitative finding	Complementary qualitative finding	Integrated interpretation	Policy or practice meaning
Farmers sold to processors and petty traders.	FGDs explained that farmers choose buyers who are present, pay	Forward linkages exist, but selling decisions are shaped by liquidity and	Improve aggregation, storage and payment arrangements to

Quantitative finding	Complementary qualitative finding	Integrated interpretation	Policy or practice meaning
	immediately and provide transport.	convenience rather than price alone.	reduce distress selling.
Farmers sold raw seed, while processors sold oil and cake.	FGDs showed that farmers recognise higher value in oil but lack milling equipment and working capital.	Value addition is concentrated downstream because farmers lack scale and investment capacity.	Support co-operative processing services, small-scale milling and value-sharing arrangements.
Low price, unreliable markets and weak infrastructure were major constraints.	KIIs linked these constraints to poor aggregation, weak price information and a mismatch between production volumes and processor demand.	Marketing constraints are governance failures that reinforce one another.	Use multi-stakeholder platforms to align production, procurement, finance and standards.
The chain links input supply, production, aggregation, processing and retailing.	FGDs and KIIs showed that problems at one node are transmitted to other nodes through quality, volume and price uncertainty.	Upgrading requires system-wide coordination rather than isolated support to one actor group.	Design linked interventions covering inputs, finance, storage, processing and markets.

Table 7 brings together the main quantitative and qualitative patterns. Quantitatively, the chain is active because sunflower seed, oil and cake move through different actor categories. However, activity alone does not mean efficiency. A chain may be active but still weak if transactions are shaped by distress selling, unreliable quality, unclear grades and weak bargaining power. This interpretation is consistent with governance literature, which shows that rules, information and power determine whether value-chain linkages translate into upgrading (Kaplinsky & Morris, 2001; Gereffi et al., 2005; Vilver et al., 2018). FGDs in Mpwapwa and Singida showed that farmers know alternative buyers but do not always have the storage, transport or bargaining space needed to wait for better prices. KIIs with traders and processors in Kondoa and Manyoni reported that searching for produce from dispersed farmers raises transaction costs and weakens supply planning.

The integrated reading is therefore that sunflower value-chain development must address the quality of relationships, not merely the number of actors. Quantitative findings on marketing channels, product forms and constraints are supported by current literature showing that smallholder commercialisation improves when production support is combined with market information, finance, storage and institutional trust (Jayne et al., 2010; Msemwa & Macha, 2024; OECD/FAO, 2024).

Implications for Inclusive Value-Chain Governance

Inclusive governance should strengthen horizontal linkages among farmers and vertical linkages with processors, traders, service providers, and consumers. Competitiveness should increase without excluding smallholder farmers from value capture. The evidence in Table 8 shows that inclusive governance requires both horizontal and vertical coordination. The quantitative finding that all sampled farmers sold raw seed implies limited farmer participation in value addition. Collective-action literature supports this finding by showing that farmer organisations

can improve market access, reduce transaction costs and support quality control when they are accountable and commercially oriented (Fischer & Qaim, 2012; Candemir *et al.*, 2021; Christian *et al.*, 2024; Qorri & Felfoldi, 2024).

Table 8. Inclusive governance implications for the sunflower value chain

Governance implication	Quantitative finding addressed	Complementary qualitative finding	Actionable governance response
Horizontal farmer coordination	All farmers sold raw seed, limiting their access to value addition.	FGDs indicated that weak and inactive collective marketing platforms keep farmers dependent on individual sales.	Support accountable farmer groups for bulking, storage, quality control and negotiation.
Vertical coordination with processors	Processors mostly sold oil and cake, showing higher value capture downstream.	KIIs showed that processors prefer groups that can supply predictable volumes and acceptable quality.	Promote farmer-processor agreements, delivery plans and quality-based payment systems.
Information symmetry	Low price and unreliable markets were leading constraints.	FGDs reported concern over weighing practices, sudden price changes and limited price information.	Strengthen market information systems, transparent weighing and local price communication.
Consumer trust and product quality	Traders mainly handled oil, while cake remained a smaller traded product.	KIIs indicated that packaging, quality assurance and certification shape consumer confidence.	Improve labelling, standards, packaging and quality assurance along the chain.

FGDs revealed that individual marketing remains common because some farmer groups are weak, inactive or dependent on temporary project support. KIIs indicated that processors are more willing to negotiate with organised suppliers because groups can provide predictable volumes, clearer communication and better-quality control. Inclusive governance should therefore protect smallholder participation while improving competitiveness. Market information systems, transparent weighing, quality grades, local aggregation centres and fair delivery schedules can reduce information asymmetry and build confidence among farmers, traders and processors. These measures are consistent with evidence that contract-based and co-operative arrangements perform better when they are transparent, enforceable and perceived as fair by participating actors (Bellemare, 2012; Kimbi *et al.*, 2024).

Institutional Pathways for Inclusive Chain Governance

The institutional pathway requires clear roles across production, finance, processing, trading, regulation, and market information. The chain can perform better when actor responsibilities are organised as linked packages rather than isolated activities.

Table 9. Institutional pathways for inclusive sunflower chain governance

Institutional pathway	Quantitative finding addressed	Complementary qualitative finding	Practical action
Farmer organisation and bulking	Farmers remain concentrated in raw-seed sales and have weak price control.	FGDs showed that individual selling limits bargaining power and exposes farmers to immediate cash-based price offers.	Strengthen co-operatives, producer groups and aggregation centres.
Processor-linked procurement	Processors create oil and cake, but seed supply remains unreliable.	KIIs with processors indicated that organised farmer groups reduce collection costs and improve supply planning.	Establish delivery schedules, quality specifications and fair payment terms.
Market information and standards	Low prices and unreliable markets were among the leading marketing constraints.	FGDs and KIIs reported that uneven price information and unclear grades weaken trust.	Introduce price boards, standard weights, grades and local dispute-resolution mechanisms.
Inclusive finance	Credit inaccessibility was reported across all districts.	Farmers and processors noted that seasonal finance gaps cause distress selling and under-procurement.	Develop seasonal credit, warehouse receipt options and co-operative finance products.

The evidence in Table 9 identifies practical institutional pathways for moving from weakly coordinated transactions to a more organised sunflower value chain. Quantitative findings on low prices, unreliable markets, credit inaccessibility and weak infrastructure point to systemic bottlenecks rather than isolated problems. Current agricultural value-chain literature supports this interpretation by showing that finance, infrastructure, standards and actor coordination must be linked if upgrading is to be inclusive and sustainable (Matekele et al., 2024; Mishra et al., 2024; OECD/FAO, 2024; Tanzania Investment Centre, 2025). FGDs emphasised the need for bulking, storage, timely extension advice and reliable buyers. KIIs suggested that processors, financial institutions and local authorities should jointly support delivery schedules, quality specifications, dispute-resolution mechanisms and seasonal finance products.

The institutional pathway should therefore assign clear roles to each actor. Farmers should organise production and bulking; processors should communicate quality and procurement requirements; traders should operate transparently; financial institutions should design seasonal products; and local authorities should support standards, market information, and dialogue platforms. Such role clarity can reduce uncertainty and strengthen trust across the chain (Gereffi et al., 2005; Markelova & Mwangi, 2010; Farm Africa, 2022).

CONCLUSION

The paper concludes that sunflower value chain interlinkages exist in Central Tanzania but require stronger governance to become more inclusive, efficient, and competitive. Farmers, processors, traders, and consumers are connected through input supply, production, aggregation, processing, distribution, and consumption, yet the benefits of these linkages remain unevenly

shared. Farmers remain concentrated in raw-seed production, while processors and traders capture higher value through transformation, aggregation, and distribution.

The major challenge is not the absence of value chain actors, but the weakness of coordination among them. Low prices, unreliable markets, weak storage, limited finance, uneven information flow, poor contract enforcement, and inconsistent quality standards reduce the developmental potential of the sunflower chain. Improving these conditions requires deliberate institutional arrangements that strengthen trust, bargaining power, transparency, and predictability across the chain.

In practical terms, the sunflower chain has strong potential to support smallholder livelihoods, domestic edible oil supply, and rural agro-processing. This potential will remain underutilised if production, aggregation, processing, trading, and consumption continue to operate as weakly connected activities. A more integrated approach is needed so that productivity improvements, market access, finance, processing capacity, and quality assurance reinforce one another.

Based on these conclusions, the following recommendations are proposed to strengthen coordination, improve fairness, and enhance competitiveness in the sunflower value chain.

- a) Farmer groups and co-operatives should be strengthened to support bulking, storage, collective marketing and negotiation with processors and traders. This will reduce distress selling and improve farmers' ability to compare prices, plan sales and meet market requirements. Such organisations should be transparent, accountable and market-oriented so that members trust them and buyers can rely on them.
- b) Local government authorities, processors, traders, and development partners should establish regular multi-stakeholder platforms for sharing information on prices, volumes, quality standards, input availability, finance and market opportunities. These platforms should function as practical coordination mechanisms rather than occasional consultation forums. Their purpose should be to reduce uncertainty, build trust, and align production with market demand.
- c) Transparent weighing systems, quality grading, and price information mechanisms should be introduced or strengthened at local aggregation points. These measures will help reduce information asymmetry and improve confidence among farmers, traders, and processors. They will also support fairer transactions and encourage farmers to invest in quality improvement.
- d) Farmer-processor supply arrangements should be promoted through fair contracts, clear delivery schedules, quality specifications, and payment terms that protect both farmers and processors. Properly designed arrangements can improve raw-material reliability for processors while giving farmers more predictable markets. Contractual arrangements should be supported by trust, transparency, and mechanisms for resolving disputes.
- e) Inclusive value chain finance should be expanded through co-operatives, microfinance institutions, banks, and processor-linked financing models. Financing should support improved seed, land preparation, storage, aggregation, transport, and small-scale processing. Credit arrangements should be linked to realistic production cycles and market opportunities so that they strengthen rather than weaken farmers' economic position.
- f) Extension services and business-development support should be strengthened to address productivity, post-harvest handling, quality control, entrepreneurship and record keeping. Inclusive upgrading requires farmers and processors to understand both technical and business requirements. Capacity building should therefore combine agronomic training with market, finance and enterprise-management skills.
- g) Policy and programme interventions should treat the sunflower chain as an integrated system rather than separate production, processing and marketing activities. Interventions that link farmers, processors, traders, financial institutions, quality regulators, and consumers are more

likely to improve competitiveness, fairness, and sustainability. Such an approach can make the sunflower sub-sector a stronger contributor to rural livelihoods, domestic edible oil supply, and local industrialisation.

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