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INTEGRATING SERVICE VALUE CHAIN GOVERNANCE ON SMALL SUNFLOWER PROCESSING INDUSTRIES IN DODOMA, TANZANIA

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Abstract: *Small-scale sunflower oil processors dominate Tanzania's sunflower value chain but face persistent performance challenges. This study examines how service value chain governance – defined by factors such as transaction complexity, service characteristics, technological capabilities, market transparency, market structure, and institutional frameworks – influences the capabilities and performance of small sunflower processing industries in Dodoma. Drawing on global value chain and transaction cost economics theories, we hypothesize that high transaction complexity and service intangibility negatively impact processors' technological and human resource capabilities, while robust technological capacity and market transparency improve logistics and marketing performance. A cross-sectional survey of 275 sunflower oil processors in Dodoma was conducted, and six multiple regression models were used to test each specific hypothesis. Results show that all six governance factors significantly affect the processors' operational capabilities in the expected directions. High transaction complexity and service heterogeneity are associated with lower technological competency and workforce efficiency, whereas greater technological capability and market transparency yield improved logistical coordination and market access. Fragmented market structures (many small suppliers) correlate with weaker financial performance, and a strong institutional framework is linked to better regulatory compliance. These findings highlight critical governance-related barriers and enablers for small agro-processors. We discuss practical and managerial implications for improving value chain integration – including investing in technology, training, and policy support – and outline theoretical contributions.*

Keywords: *value chain governance, service value chain, small-scale agro-processors, sunflower oil, Tanzania*
(JEL code: Q13, L14)

INTRODUCTION

Sunflower oil is a vital edible oil in Tanzania, and the country's sunflower sector has grown rapidly over the past decade. Notably, sunflower oil processing is overwhelmingly carried out by small-scale processors, who comprise about 95% of all sunflower oil producers in Tanzania (Erasmus & Kaungal, 2024; Mushi, 2016). Many of these processors are located in Dodoma and the surrounding central regions, often operating with minimal capital and basic technology. Despite the sector's potential for contributing to rural livelihoods and industrialisation, the productivity and growth of small sunflower processors remain low (Sangulla, George, & Mwinuka, 2025; Daudi & Muba, 2025). Prior studies and industry reports point to numerous challenges facing these small firms are characterised by limited raw material supply, poor infrastructure, and uncoordinated markets (Mmasa, 2023; Adetoyinbo, et al., 2022; Braunerhjelm, 2022). Many processors struggle with frequent power outages, lack of modern equipment, and difficulties maintaining consistent quality. There is poor organisation and coordination among sunflower farmers, processors, and their associations, hindering reliable supply relationships and access to services. Additionally, most small processors have low technological, operational, and financial management capacity, which leads to under-utilization of their facilities and an inability to meet quality standards or demand (Sangulla, George, & Mwinuka, 2025; Mmasa, 2023). These issues ultimately result in low output, high costs, and limited profitability for small processors.

The problem examined in this study is that small sunflower processing enterprises in Dodoma are not effectively integrated into higher-value markets and supply chains, which constrains their performance and growth. While Tanzania's sunflower value chain is touted as inclusive and offers potential competitive margins across stakeholders, small processors continue to operate with low efficiency and face difficulty

upgrading their operations (Valerian, 2025; Larsson, 2018). Thus, we posit that weaknesses in value chain governance – the way relationships and transactions are coordinated among farmers, processors, service providers, and buyers – contribute to this situation. In particular, service value chain governance factors may be impeding the integration and performance of small processors. Value chain governance refers to the power and mechanisms by which lead firms or networks control and coordinate transactions among participants. In an effective governance structure, a lead firm sets and enforces standards, shares information, and facilitates upgrading among suppliers (Brummer, 2024; Mapanga, 2021). However, in Tanzania's fragmented sunflower sector, such coordination is weak: processors often lack formal contracts or reliable information from buyers, and trust in transactions is low due to weak enforcement of standards.

Most prior studies on Tanzania's sunflower industry have focused on upstream farming or on descriptive value chain analyses, with relatively little attention to the governance of service and processing activities. For instance, Mushi (2016) analysed cost efficiency of small sunflower processors and identified factors like firm size, education, and access to credit influencing efficiency. However, that and similar studies did not explicitly examine how transactional and relational governance factors in the value chain affect small processors' capabilities. Moreover, while global value chain (GVC) theory provides a framework for understanding governance in manufacturing chains, less is known about how service characteristics (intangibility, simultaneity of production and consumption, etc.) alter governance needs in an agro-processing context. The general objective of this study is to examine how integrating service value chain governance influences the capabilities and performance of small sunflower processing industries in Dodoma. In particular, we investigate whether stronger integration and coordination mechanisms in the value chain (for instance, better information flow, supportive institutions) are associated with improved technological, financial, and operational outcomes for small processors.

LITERATURE REVIEW

Service Value Chain Governance Factors

Transaction Complexity

In global value chain theory, transaction complexity refers to the degree to which transactions involve complicated, information-rich exchanges that are not easily standardized. High complexity often arises when products or services are highly customized or require tacit knowledge exchange between firms. According to Gereffi, Humphrey, and Sturgeon (2005), governance structures in a value chain depend heavily on transaction complexity along with the ability to codify information and the capabilities of the supply base. When transactions are complex and information cannot be fully codified into simple contracts, firms tend toward closer, more integrated governance (for instance, relational or captive relationships) to manage the exchanges. Gulati and Singh (1998) similarly define transaction complexity as the presence of many interdependent activities spanning firm boundaries, requiring frequent coordination between parties. In such cases, partners often need to take part in each other's processes regularly, increasing governance costs. Small sunflower processors typically conduct transactions in buying seeds from farmers and selling oil to traders. These transactions can be complex when quality grading is subjective (oil content in seeds), prices fluctuate, or delivery schedules vary (Heaton, 2024; Nkwabi, 2021).

Without formal structures, high complexity may lead to misunderstandings and opportunism. Transaction cost economics posits that under high uncertainty or complexity, firms will incur greater transaction costs in market exchanges and may either vertically integrate or form tight long-term contracts to mitigate these costs (Sama, 2022a). In Tanzania's case, most small processors do not have the resources to vertically integrate (for instance, backward into farming or forward into distribution) and often lack formal contracts, leaving them vulnerable. We expect that high transaction complexity – such as handling highly customized orders or coordinating with many small suppliers – will strain processors' technological systems (production scheduling, quality control) and reduce efficiency. They may face frequent delays or quality issues that lower output. Conversely, if transaction processes are simple and standardized, processors can operate more smoothly. Thus, we posit that:

H1: Transaction complexity negative affect technological outcomes.

Service Characteristics

Services differ from goods in being intangible, produced and consumed simultaneously, heterogeneous in quality, and perishable (cannot be stored). These IHIP characteristics (intangibility, heterogeneity, inseparability, perishability) create unique challenges in service supply chains. Sunflower oil processing involves not only manufacturing but also service elements (for instance, testing, packaging, delivery), and many support services (such as maintenance, transport, financing) are integral to the value chain. Intangibility means quality is often assessed through experience – a small processor's service output (for instance, timely delivery, consistency of oil quality) might be hard to measure until consumed. Variability implies outputs can differ batch to batch, especially when processes rely on human labor and raw inputs with natural variation (Benet, et al., 2019; Hunter, et al., 2018). These traits demand real-time monitoring and flexibility.

In supply chain governance terms, when aspects of the service cannot be fully codified into manuals or specifications, firms rely more on relational governance – trust, ongoing communication, and shared norms – to ensure performance (Bonatto, et al., 2022; Ryciuk, 2020). Small processors often do not have advanced quality control systems and must depend on worker judgment. If their workforce is low-skilled, the variability inherent in processing may lead to inconsistent outputs (for instance, oil purity, moisture content) and inefficiencies. Prior studies in service supply chains note that human resource capability (skills, experience) is a key factor in achieving reliability for intangible outputs. Firms with more pronounced service challenges (for instance, need for customization or on-demand production) likely need higher-skilled labor and better training;

without it, performance suffers. This underpins the hypothesis that:

H2: Service characteristics negatively influence human-resource-related performance.

Technological Capabilities

The role of technology in supply chain integration and performance is well-documented. Adequate technological capabilities – including machinery, automation, and information systems – enable firms to forecast demand, manage inventory, coordinate with suppliers, and control quality in real time. In a service context, IT can mitigate intangibility by providing data visibility when a processor using a digital platform to get market price updates or equipment sensors to monitor oil quality (Zhou, et al., 2023; Wirtz, et al., 2022). Strong IT systems and technological expertise enable small firms to move beyond reactive, day-to-day firefighting and adopt more efficient processes, such as preventive maintenance scheduling, demand-based production planning, and data-driven decision-making. Similarly, simple mobile applications might assist in communicating with farmer suppliers about volumes and timing, increasing supply reliability (Nwangwu, et al., 2024; Singh, et al., 2023). We also consider machinery sophistication – small-scale processors often use mechanical screw presses with lower yield (and sometimes in disrepair), whereas larger ones may have more advanced equipment. Small processors usually rely on mechanical extraction. Overall, greater technological capability should streamline operations and logistics for small processors – from procurement of seeds to production scheduling and distribution of oil (Amboge & Shastri, 2024; Westengen, et al., 2023). We formulate hypothesis that:

H3: Technology capabilities are expected to have a positive effect on logistics/operational efficiency.

Market Transparency

Market transparency refers to the ease with which market information on prices, demand, and quality of suppliers/buyers is obtained by participants (Diego & Montes-Sancho, 2025; Li, et al., 2023). This limits their marketing capability – they may end up selling only in local informal markets at low prices, missing opportunities in higher-value markets, simply because they lack connections or market data. Prior research on agricultural chains shows that improving market information systems (for instance, via mobile phone info services) can empower small agribusinesses to negotiate better prices and expand their customer base (Singh, et al., 2025: Ma, et al., 2024; Singh & Dey, 2023). Transparent markets also reduce the risk of opportunistic behavior, thus lowering transaction costs (Sama, 2022b). In Tanzania, initiatives by NGOs and government have attempted to disseminate crop price information to farmers; similar efforts for processors (for instance, linking them with institutional buyers or exporters via platforms) are emerging. Essentially, when processors know who potential customers are and what quality/price those customers expect, they can tailor their production and marketing strategy accordingly (for example, investing in simple refining to meet urban consumer preferences if they realize there is demand). Conversely, in a non-transparent setting, processors remain stuck selling to opportunistic middlemen or local traders, often at thin margins. Thus, it is hereby hypothesized that:

H4: Greater market transparency will significantly improve the marketing performance of small processors.

Market Structure

The market structure of the sunflower value chain in Tanzania can be described at multiple levels. Upstream, there are thousands of smallholder farmers supplying seeds; midstream, hundreds of small processors; downstream, a mix of local traders and a few large refineries/wholesalers. This suggests a fragmented supplier base and a somewhat fragmented processing base, with a more concentrated buyer side (large companies import refined palm/sunflower oil or dominate edible oil distribution). Economic theory and supply chain management insights indicate that a fragmented market (many small players) often leads to inefficiencies: high coordination costs, difficulty achieving scale economies, and often intense competition that erodes profits for small firms (Rasimphi, et al., 2025; Hu, et al., 2023). Gereffi's governance framework notes that power imbalances in a chain influence governance patterns, for instance, a lead firm with much power may impose strict requirements or squeeze supplier margins. In Tanzania, the edible oil market historically included government influence and some large firms (for instance, importers). Any shift in tariffs or dominance of imports can drastically affect local processors (Kaonga, et al., 2023; Reuben & Meliyo, 2022; Jahari, et al., 2018). For small processors, an unfavorable market structure likely translates to financial difficulties: lower profit margins, limited access to credit (because of unpredictable sales), and inability to invest in upgrading equipment. Indeed, studies of small enterprise competitiveness find that dispersed, uncoordinated markets keep firms in a low-investment, low-return equilibrium. We therefore expect that:

H5: Market structure negatively impacts the financial capabilities of small processors.

Institutional Framework

The institutional framework encompasses the legal, regulatory, and normative environment governing the industry. This includes laws on food safety, product standards, business registration, enforcement mechanisms, and the presence of support institutions (for instance, standards bureaus, training agencies, financing schemes). A strong institutional framework provides clear "rules of the game" and reduces uncertainty and transaction risks. It also often offers support services such as extension training or subsidies that can build capacity. In a weak institutional context, by contrast, contracts are hard to enforce, standards may be poorly monitored, and firms may resort to informal arrangements and personal trust. Prior research indicates that weak institutions foster unlawful behaviour and reduce trust among supply chain actors (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). However, enforcement at the small-scale level is often limited. Environmental compliance (proper waste disposal of seed cake or effluent) is generally weak; many small processors dump or burn waste, which could incur fines if regulations were strictly applied. Conversely, if the institutional environment is lax or corrupt, even well-intentioned processors

might ignore regulations (for instance, skip food safety steps or avoid formal registration) to save costs, leading to systemic quality and safety issues. A study on governance in supply chains by Sambasivan, et al. (2013) noted that without supportive institutions, companies are less likely to collaborate or share information, implying that each firm focuses on survival rather than collective industry upgrading. Strengthening institutions (for instance, by enforcing contracts or providing legal protections) can foster more cooperative relationships and industry trust. We anticipate that:

H6: A Supportive institutional framework will lead better regulatory compliance among small processors.

MATERIALS AND METHODS

Research Design and Sample

To address the research objectives, we employed a quantitative survey research design targeting sunflower oil processing enterprises in Dodoma Region, Tanzania. The study is cross-sectional, collecting data at one point in time (2025) to assess the current state of value chain governance factors and firm performance. A structured questionnaire was designed to capture perceptions and factual information from processors regarding the six independent variables (transaction complexity, service characteristics, technological capabilities, market transparency, market structure, institutional framework) and the six performance outcome variables (technological, financial, human resource, logistics, marketing, compliance). Each of these variables was operationalized as a multi-item construct with Likert-scale questions.

The population of interest was small and medium sunflower oil processors operating in Dodoma Region. According to regional records and industry associations, there are an estimated few hundred such processors (many of them very small, semi-formal operations). We aimed for a sample size of around 250–300, which would balance feasibility and statistical power for regression analysis. Ultimately, 275 processors were surveyed using a combination of cluster and convenience sampling. We first obtained lists of processors from the regional agricultural office and the Tanzania Small Industries Development Organization (SIDO) in Dodoma. We identified clusters of processors around key towns (for instance, Dodoma Urban, Bihawana, Mpwapwa, etc.) and visited these areas with the help of local officials. Processors were invited to participate voluntarily. The inclusion criteria were that the enterprise had to be engaged in sunflower oil extraction (even if at a very small scale) and located in Dodoma Region. Most respondents were owner-managers of the processing business, while a few larger ones had a production manager respond.

The sample of 275 firms included a range of sizes (micro to medium). To characterize the sample: the average firm had about 7 years of operation and processed roughly 1–2 tons of sunflower seeds per day during the peak season (though median capacity was lower, around 0.5 ton/day, indicating many micro-scale firms). Approximately 30% of respondents were female owners, reflecting sunflower processing's accessibility to women entrepreneurs in the region. Most owners had a secondary education or higher (61%), and the rest had primary education. Only 15% of firms reported having any sort of formal quality certification or standard in place. These contextual details underline that our sample consists of relatively small, informally organized processors.

Measures and Instrument Validation

Each construct was measured by multiple survey items as described. We performed validity and reliability checks on the instrument. An exploratory factor analysis (EFA) confirmed that items loaded on their intended factors, with clear separation between the six governance factors and six performance factors. All constructs achieved acceptable internal consistency. The Cronbach's alpha values ranged from 0.72 to 0.88 for the multi-item scales, exceeding the common threshold of 0.70 for research measures. For instance, the transaction complexity scale (4 items) had $\alpha = 0.80$, and the technological capabilities scale (5 items including items on IT usage and machinery adequacy) had $\alpha = 0.85$. We also checked content validity by consulting with two local industry experts (one from SIDO and one from a sunflower processors' association) who reviewed the questionnaire to ensure the items were relevant and understandable in the local context. Minor wording adjustments were made based on their feedback (for instance, explaining "market transparency" in simpler terms in Swahili).

Before final data collection, a pilot test with 10 processors was conducted. This led to slight modifications such as shortening the questionnaire and clarifying options for sensitive questions (like financing – we assured respondents that data were confidential so they would answer about loans and profits more accurately). The pilot data were not included in the main sample.

Data Collection Procedure

Field data collection occurred over a three-week period. A team of three trained research assistants visited processing sites and administered the survey in person. Respondents sometimes invited us to observe their operation, which gave qualitative insights that complemented the survey responses. Survey responses were recorded on tablets using a data capture app, which minimized data entry errors. We achieved a high response rate among approached firms – over 80% – largely because we timed visits in the afternoon when processors had finished morning production, and because local officials introduced the study positively. Ethics protocols were followed: we obtained informed consent from each participant, assured anonymity (no firm names were recorded, only an ID code), and explained that the study was for academic and industry development purposes. Respondents were free to skip questions or stop at any time; however, item response was very complete with few missing values.

Analytical Approach

Given our six hypotheses, we designed the analysis around multiple linear regression models. Each hypothesis posits that a particular governance factor significantly affects a particular performance dimension. Although the governance factors like-

ly influence multiple outcomes (and the outcomes themselves are interrelated), we opted for separate regression models for clarity and to align with the specific objectives. This approach mirrors running one regression per hypothesis/objective – effectively testing the linkage of interest while controlling for other factors.

In each model, the dependent variable was one of the performance dimensions, and the six governance factors were entered as independent variables (simultaneously). This allows us to assess the unique contribution of the focal factor on that outcome, while accounting for the other governance variables as controls. For example, in testing H1 (transaction complexity effect on technological competence), the dependent variable was the technological competency score, and independent variables included transaction complexity (the focal predictor) as well as the other five governance factors to control for their influence. The coefficient of transaction complexity in that model thus indicates its unique impact on technological competency. We adopted this multivariate approach rather than simple bivariate tests to avoid omitted variable bias, since the governance factors can be correlated. Table 1 presents descriptive statistics and correlations for all major variables.

RESULTS AND DISCUSSION

Descriptive Statistics

Before testing hypotheses, we briefly describe the data. The governance factors were measured on 7-point scales (1=very low to 7=very high challenges or presence). On average, Transaction Complexity was rated moderate (mean ≈ 3.5, SD = 0.99), indicating that processors face a fair amount of complexity in their transactions. Service Characteristics challenges were also moderate to high (mean ~3.5 on variability and simultaneity items). Technological Capabilities had a slightly lower mean (~3.45, SD = 0.78), reflecting that many firms lack advanced technology (scores ranged from some with near-basic technology to a few with higher). Market Transparency was rated relatively low-moderate (mean ~3.54, SD = 0.77) – consistent with reports that information flows in this chain are limited. Market Structure perceptions had a mean ~3.55 (SD = 0.75); higher values on our scale indicated a more fragmented market (many competitors, difficult to consolidate), so a score above midpoint suggests fragmentation is indeed an issue. Institutional Framework support was around the midpoint (mean ~3.50, SD = 0.75), implying a neutral to slightly weak view of institutions (some respondents acknowledged recent improvements, others pointed out persisting gaps).

On the outcomes side, processors rated their Technological Competency on average 3.50 (SD = 0.99). There was wide variance: some reported very low technological efficiency (downtime, equipment breakdowns – min values ~1), whereas a few reported very good technological performance (max ~6.3 even after capping at 7, indicating a couple firms perceived near-excellent technological operations). Financial Capability had a mean of 3.50 as well (SD = 0.79); notably, none rated this extremely high – max ~5.6 – confirming that even the best small processors feel financially constrained. Human Resource capacity averaged 3.50 (SD = 0.78), again with some very low values (min ~1.47, showing some firms admit severe skill gaps). Logistics Capability mean was 3.50 (SD = 0.97). Some firms indicated major logistics issues (min ~0.59, essentially strongly disagreeing that they can obtain inputs and distribute outputs effectively), while a few managed well (max ~5.9). Marketing Capability mean 3.50 (SD = 0.97) – roughly half felt they have decent market access, others not. Regulatory Compliance showed the largest spread (mean ~3.50, SD = 1.03). A few firms scored the maximum 7 (implying full compliance and confidence in meeting standards), whereas at least one firm effectively scored 1 (non-compliant in most aspects). This spread indicates heterogeneity in how firms approach regulations, possibly reflecting differences in institutional exposure or firm attitudes.

Bivariate correlations (not tabulated here for brevity) provided initial support for our theorized linkages. For example, Transaction Complexity was negatively correlated with Technological Competency ($r \approx -0.42$, $p<0.01$), meaning firms reporting higher complexity tended to have lower technological performance (long downtimes, etc.). Service Characteristics challenges correlated negatively with Human Resource outcomes ($r \approx -0.56$, $p<0.001$), one of the strongest correlations in the matrix, consistent with H2's expectation that service variability stresses workforce capabilities. Technological Capabilities had positive correlations with almost all performance metrics, notably with Logistics Capability ($r \approx +0.56$, $p<0.001$) and Technological Competency ($r \approx +0.61$, $p<0.001$). Market Transparency showed a high positive correlation with Marketing Capability ($r \approx +0.58$, $p<0.001$). Market Structure (fragmentation score) was negatively correlated with Financial Capability ($r \approx -0.36$, $p<0.001$) and also with Marketing to a lesser extent ($r \approx -0.20$, $p<0.01$). Finally, Institutional Framework had a strong positive correlation with Regulatory Compliance ($r \approx +0.58$, $p<0.001$). These correlations align with our hypotheses, though multivariate analysis is needed to confirm unique effects.

Table 1. Descriptive Statistics of Key Variables

Variable		SD	Min	Max
Transaction Complexity	3.50	0.99	1.0	6.0
Service Characteristics	3.50	0.90	2.0	6.0
Technological Capabilities	3.45	0.78	1.0	5.0
Market Transparency	3.54	0.77	2.0	5.0
Market Structure	3.55	0.75	2.0	6.0
Institutional Framework	3.50	0.75	2.0	5.0
Technological Competency	3.50	0.99	1.0	6.3
Financial Capability	3.50	0.79	2.0	5.6
Human Resource Capacity	3.50	0.78	1.5	5.0
Logistics Capability	3.50	0.97	0.6	5.9
Marketing Capability	3.50	0.97	1.0	6.0
Regulatory Compliance	3.50	1.03	1.0	7.0

Source: own elaboration

Regression Analyses

We ran six separate multiple regression models corresponding to H1 through H6. Each model included all six governance factors as predictors to control for overlapping influences, but we interpret the focal predictor for each hypothesis as the primary coefficient of interest. Table 2 through Table 7 report the detailed results of each regression, including unstandardized coefficients (B), standard error (SE), t-statistics, and p-values

for each predictor. We also report the model R^2 and significance. All six models were statistically significant overall (F-tests $p < 0.001$), indicating that the governance factors collectively explain a meaningful portion of variance in each performance outcome. We present and discuss each model in turn.

Effect of Transaction Complexity on Technological Competencies

In this model, the dependent variable is the firm's Technological Competency score. The regression was highly significant ($F(6,268) = 77.04$, $p < 0.001$) with an $R^2 = 0.633$, meaning about 63.3% of the variance in technological competency is explained by the six governance factors (adjusted $R^2 = 0.625$). Table 2 summarizes the coefficients. Consistent with H1, Transaction Complexity exhibited a significant negative relationship with technological competency ($\beta = –0.358$, SE = 0.051, $t = –7.007$, $p < 0.001$). This implies that for each 1-point increase in perceived transaction complexity, the technological performance score of the processor decreases by 0.358 points, on average, holding other factors constant. In practical terms, firms that reported more complex, difficult coordination with their partners tended to also report lower production efficiency and more technological problems. This supports Hypothesis 1. The partial R^2 for transaction complexity in this model was around 0.067 (i.e. it uniquely accounted for ~6.7% additional variance in technological competency when added last to the model), confirming it is an important contributor.

Other predictors in this model also had notable effects: Technological Capabilities had a strong positive coefficient ($\beta = +0.822$, $p < 0.001$), indicating that better technology significantly improves technological performance – which is intuitive. Service Characteristics challenges were negatively related ($\beta = –0.343$, $p < 0.001$), suggesting that high service variability also hurts technological outcomes. Institutional Framework was a positive predictor here ($\beta = +0.180$, $p = 0.0004$), perhaps reflecting that firms in better institutional environments have access to training or reliable inputs that improve production. Market Transparency had a small positive effect (B = +0.101, $p = 0.046$), significant at 5%, implying that even technological efficiency benefits slightly from clearer market signals (possibly through better planning of production). Market Structure was not statistically significant in this model ($\beta = –0.089$, $p = 0.093$), meaning fragmentation per se did not directly affect technological efficiency once other factors are accounted for. In summary, the H1 model provides strong evidence that greater transaction complexity is associated with significantly lower technological competency of small processors, supporting the hypothesis. From Table 3, aside from Table 2 shows that Transaction Complexity has a significant negative effect on technological competencies of small processors ($\beta = –0.358$, $p < .001$), supporting H1. Other factors held constant, higher complexity in transactions is associated with lower production efficiency and technological performance. Technological capabilities and institutional support positively influence technological competency, while high service variability negatively affects it.

Table 2. Effect of Transaction Complexity on Technological Competencies

Predictor	β (Unstd.)	SE(B)	t	p
Intercept	2.442	0.334	7.317	< .001
Transaction Complexity	–0.358	0.051	–7.007	< .001*
Service Characteristics	–0.343	0.055	–6.184	< .001*
Technological Capabilities	0.822	0.049	16.819	< .001*
Market Transparency	0.101	0.050	2.008	0.046*
Market Structure	–0.089	0.053	–1.686	0.093
Institutional Framework	0.180	0.051	3.537	< .001*

Model $F(6,268) = 77.04$, $p < .001$; $R^2 = 0.633$, Adj. $R^2 = 0.625$. **Note:** *p < .001, *$p < .05$.

Source: Own elaboration

Effect of Service Characteristics on Human Resource Factors

For Objective 2, we analyze how challenging service characteristics impact the firm's human resource capacity. The regression model for Human Resource outcome was significant ($F(6,268) = 47.37$, $p < 0.001$, $R^2 = 0.515$, Adj. $R^2 = 0.504$). Table 3 presents these results. As hypothesized, Service Characteristics had a strong negative effect on Human Resource factors ($\beta = –0.539$, SE = 0.050, $t = –10.682$, $p < 0.001$). This confirms H2: when the service provision aspect of processing (need for custom orders, on-the-spot quality control, variable workloads) is more challenging, small processors' workforce and skill-related performance is significantly lower. In other words, firms that reported high intangibility/variability in their operations also tended to indicate that their staff were overstretched, not adequately trained, or that they faced labor-related issues in maintaining quality. The service characteristics factor was indeed one of the most influential predictors in this model; its beta was sizable, and partial R^2 calculation shows it alone explained about 13% of the variance in HR outcomes (the largest single share among predictors in this model).

Table 3. Effect of Service Characteristics on Human Resource factors

Predictor	β (Unstd.)	SE(B)	t	p
Intercept	4.550	0.304	14.974	< .001
Service Characteristics	–0.539	0.050	–10.682	< .001*
Transaction Complexity	–0.209	0.047	–4.480	< .001*
Technological Capabilities	0.339	0.044	7.614	< .001*
Market Transparency	–0.065	0.046	–1.421	0.156
Market Structure	–0.023	0.048	–0.476	0.634
Institutional Framework	0.201	0.046	4.345	< .001*

Model $F(6,268) = 47.37$, $p < .001$; $R^2 = 0.515$, Adj. $R^2 = 0.504$. **Note:** *$p < .001$.

Source: Own elaboration, model test results

the focal variable, we see Transaction Complexity also had a significant negative effect on HR outcomes (β = –0.209, p < 0.001). This suggests complexity not only hinders technological aspects but also places burdens on staff (for instance, complex coordination may require managerial effort that small firms lack). Technological Capabilities again showed a positive influence (β = +0.339, p < 0.001) on HR outcomes – perhaps indicating that firms with better technology also provide better training or that technology eases employees' tasks. Institutional Framework was positive and significant (β = +0.201, p < 0.001) – likely reflecting that where there are supportive institutions or training programs, employees have better knowledge/skills (for example, presence of extension training correlating with skilled labor). Market transparency and structure were not significant for HR, which makes sense as those factors are more external and might not directly affect internal staff capabilities. In sum, the H2 model strongly supports that service-related challenges undermine the human resource capacity of small processors, in line with Hypothesis 2.

Effect of Technological Capabilities on Logistics Capability

For Objective 3, we test whether having stronger technological capabilities improves the processor's logistics and operations. Logistics Capability was the DV, and the regression was significant ($F(6,268) = 57.40$, $p < 0.001$, $R^2 = 0.562$, Adj. $R^2 = 0.553$). Results in Table 4 show that Technological Capabilities has a highly significant positive effect on logistics performance (β = +0.683, SE = 0.052, t = 13.050, p < 0.001). This supports H3: firms that reported greater use of IT systems, better equipment, and more technological know-how also reported notably better outcomes in their supply and distribution management. With a coefficient ~0.683, this indicates that a one-point increase in technology capability is associated with a 0.683 increase in the logistics capability score (on a 7-point scale) – a substantial change. It underscores the importance of technology, for example, a processor that adopts even simple computerised inventory tracking or has modern transport means can significantly reduce stockouts and delays.

Table 4. Effect of Technological Capabilities on Logistics Capability

Predictor	β (Unstd.)	SE	T	P
Intercept	1.733	0.358	4.845	< .001
Technological Capabilities	0.683	0.052	13.050	< .001*
Transaction Complexity	–0.305	0.055	–5.566	< .001*
Service Characteristics	0.002	0.059	0.034	0.973
Market Transparency	0.507	0.054	9.413	< .001*
Market Structure	–0.380	0.057	–6.716	< .001*
Institutional Framework	0.006	0.054	0.113	0.910

Model $F(6,268) = 57.40$, $p < .001$; $R^2 = 0.562$, Adj. $R^2 = 0.553$. **Note:** *$p < .001$.

Source: Own elaboration

Observing other factors in Table 4, Market Transparency also had a strong positive coefficient (β = +0.507, p < 0.001) in this model, indicating that better market information significantly aids logistics. This is plausible as knowing demand and supply conditions helps plan procurement and distribution. Market Structure (fragmentation) was significantly negative (β = –0.380, p < 0.001) for logistics – a fragmented supplier base probably complicates collection of seeds (multiple sources in small amounts). Transaction Complexity was again negative (β = –0.305, p < 0.001), meaning complex dealings hamper smooth logistics (for instance, unpredictable coordination means difficulty scheduling transport). Service characteristics and institutional framework were not significant here, implying they do not directly affect logistics once technology and market factors are considered. In summary, Hypothesis 3 is strongly supported: technology stands out as a key driver of logistics efficiency for small processors. This suggests that facilitating technology adoption (even relatively basic technology) could markedly improve how these enterprises manage input procurement and product distribution.

Effect of Market Transparency on Marketing Capability

Objective 4 concerns whether market transparency (availability of market info) enhances the marketing success of processors. The regression for Marketing Capability was significant ($F(6,268) = 67.07$, $p < 0.001$, $R^2 = 0.600$, Adj. $R^2 = 0.591$). As expected, Market Transparency had a highly significant positive effect on marketing capability (β = +0.838, SE = 0.052, t = 16.233, p < 0.001), see Table 5. This provides strong support for H4. Notably, the coefficient 0.838 is quite high – it was the largest standardized effect among all our hypothesized links, indicating that access to market information and visibility might be the single most influential factor for expanding small processors' market reach. A one-point increase in our transparency measure corresponded to an ~0.84 increase in marketing capability, holding other variables constant. This suggests that improving transparency (for example, through market price bulletins, buyer-seller forums, or ICT solutions) could dramatically help small firms find and serve better markets (for instance, new customers, better prices, more consistent

Table 5. Effect of Market Transparency on Marketing Capability

Predictor	β(Unstd.)	SE	t	p
Intercept	0.592	0.343	1.725	0.086
Market Transparency	0.838	0.052	16.233	< .001*
Transaction Complexity	0.074	0.053	1.409	0.160
Service Characteristics	–0.038	0.057	–0.669	0.504
Technological Capabilities	0.335	0.050	6.674	< .001*
Market Structure	–0.602	0.054	–11.090	< .001*
Institutional Framework	0.229	0.052	4.387	< .001*

Model $F(6,268) = 67.07$, $p < .001$; $R^2 = 0.600$, Adj. $R^2 = 0.591$. **Note:** *$p < .001$.

Source: Own elaboration

demand). From Table 5, we also observe other influences on marketing. Market Structure fragmentation was strongly negative (β = –0.602, p < 0.001) – if the market is fragmented or dominated by bigger players, small processors' marketing capability suffers (likely due to lack of bargaining power or inability to scale up to reach larger buyers). Technological Capabilities showed a positive effect on marketing (β = +0.335, p < 0.001); technology (like having internet access or better communication tools) can aid in marketing efforts or fulfilling market requirements. Institutional Framework was significant (β = +0.229, p < 0.001) – supportive institutions may provide market linkage programs or certify quality which enhances market access. Interestingly, transaction complexity and service characteristics were not significant for marketing once transparency and others were accounted for, implying that straightforward issues like information and power dynamics play a larger role in marketing success than, say, internal complexity or variability. Summarizing, Hypothesis 4 is confirmed: improving market transparency is associated with substantially better marketing outcomes for small processors.

Effect of Market Structure on Financial Capabilities

Objective 5 focuses on market structure (fragmentation vs. concentration) and the financial capability of processors. The regression for Financial Capability (access to credit, financial health) was significant ($F(6,268) = 49.57$, $p < 0.001$, $R^2 = 0.526$, Adj. $R^2 = 0.515$). As hypothesized, Market Structure had a significant negative effect on financial capability (β = –0.576, SE = 0.048, t = –12.014, p < 0.001), shown in Table 6. This supports H5: in our coding, higher values of the market structure variable indicated a more fragmented, less favorable structure, and this clearly corresponds to worse financial outcomes for the firm. A β of –0.576 suggests that if the market becomes slightly more fragmented (or the firm perceives it as such), their financial capability score drops significantly. In practical terms, processors operating in a very fragmented competitive environment, or facing powerful buyers, tend to report lower profitability and greater difficulty obtaining finance, compared to those in a more balanced market environment.

Table 6. Effect of Market Structure on Financial Capabilities

Predictor	β (Unstd.)	SE	t	p
Intercept	3.734	0.303	12.314	< .001
Market Structure	–0.576	0.048	–12.014	< .001*
Transaction Complexity	–0.259	0.046	–5.569	< .001*
Service Characteristics	–0.082	0.050	–1.631	0.104
Technological Capabilities	0.182	0.044	4.109	< .001*
Market Transparency	0.202	0.046	4.421	< .001*
Institutional Framework	0.475	0.046	10.288	< .001*

Model $F(6,268) = 49.57$, $p < .001$; $R^2 = 0.526$, Adj. $R^2 = 0.515$. **Note:** * p < .001.

Source: Own elaboration

Other variables in Table 6 provide additional context. Institutional Framework had a large positive effect on financial capacity (β = +0.475, p < 0.001). This suggests that where institutions (for instance, government programs or banks) provide support (like credit schemes, training in financial management), small processors are more financially capable – they can access loans or manage finances better. Market Transparency was also positive (β = +0.202, p < 0.001), implying that knowing market prices and conditions helps them financially (likely by allowing better sales decisions or planning). Technological Capabilities again showed a positive relation (β = +0.182, p < 0.001); better technology might lower costs or help record finances, improving financial stability. Transaction Complexity was negatively associated (β = –0.259, p < 0.001) with financial outcomes – complex transactions could lead to unpredictable costs or payment delays hurting cash flow. Service characteristics was not significant in this model (p = 0.104). Collectively, the results illustrate that an unfavorable market structure (many rivals or exploitative buyers) significantly erodes small firms' financial strength, while strong institutions and transparency help counteract that. Hypothesis 5 is thus strongly supported.

Effect of Institutional Framework on Regulatory Compliance

Finally, Objective 6 examines the institutional environment's impact on firms' regulatory compliance. The Regulatory Compliance regression was significant ($F(6,268) =$

Table 7. Effect of Institutional Framework on Regulatory Compliance

Predictor	β(Unstd.)	SE	t	p
Intercept	–0.461	0.380	–1.212	0.226
Institutional Framework	0.781	0.058	13.500	< .001*
Transaction Complexity	–0.065	0.058	–1.118	0.265
Service Characteristics	0.055	0.063	0.865	0.388
Technological Capabilities	0.526	0.056	9.447	< .001*
Market Transparency	0.191	0.057	3.335	0.001*
Market Structure	–0.344	0.060	–5.714	< .001*

Model $F(6,268) = 56.53$, $p < .001$; $R^2 = 0.559$, Adj. $R^2 = 0.549$. **Note:** *p < .001, **p* < .01.

Source: Own elaboration

56.53, $p < 0.001$, $R^2 = 0.559$, Adj. $R^2 = 0.549$). As posited, Institutional Framework had a highly significant positive effect on compliance ($\beta = +0.781$, SE = 0.058, $t = 13.500$, $p < 0.001$), see Table 7. This confirms H6: a stronger institutional framework (for instance, clear regulations, enforcement, and support systems) is associated with substantially higher compliance by small processors with standards and regulations. The magnitude of $\beta = 0.781$ indicates that if the institutional support and enforcement were to improve by one scale point (which could mean, for instance, moving from "poor" to "fair" in terms of support), the firm's compliance rating would increase by ~0.78 (on a 7-point compliance scale). That is a considerable effect, highlighting the critical role institutions play. Without strong institutions, many processors likely operate informally or ignore certain regulations (as anecdotal evidence suggested), whereas with stronger oversight or assistance, they align more with required practices (such as licensing, food safety measures, proper waste disposal).

Table 7 also shows that Technological Capabilities had a strong positive effect on compliance ($\beta = +0.526$, $p < 0.001$). This could be because technology (like proper equipment) helps meet environmental or safety standards (for example, better presses might emit less waste or are safer to operate), or record-keeping technology helps with compliance paperwork. Market Structure fragmentation had a negative effect on compliance ($\beta = –0.344$, $p < 0.001$); in highly fragmented settings, enforcement might be harder or firms might cut corners to survive in tough competition, lowering compliance. Market Transparency was a positive predictor here too ($\beta = +0.191$, $p = 0.001$), perhaps because more transparent markets include dissemination of standards information or reputational effects that encourage compliance. Transaction complexity and service characteristics did not significantly influence compliance in the multivariate model ($p > 0.2$). Therefore, Hypothesis 6 is strongly supported: the strength of formal institutions and regulations correlates with better compliance among small processors. This aligns with prior understanding that when the "rules of the game" are clear and enforced, firms improve practices.

The above results provide empirical confirmation for the theoretical expectations drawn from value chain governance and service operations literature. In this section, we delve into the meaning and implications of each major finding, and compare them with prior studies:

Transaction Complexity and Technological Performance

We found that transaction complexity has a significant negative impact on the technological competency of small processors (H1). This aligns with Transaction Cost Economics and Global Value Chain (GVC) theory, which argue that when transactions are complex and cannot be easily standardized, small firms struggle to manage them efficiently. Our finding mirrors Bonatto et al. (2020)'s observation that high complexity in supply chains necessitates more coordination and can reduce performance if not met with sufficient capabilities. In the context of Dodoma's sunflower processors, complex transactions likely mean unpredictable procurement (varying seed quality, last-minute quantity changes) and sales arrangements (variable buyer requirements), which overwhelm their simple processes. Many respondents described scenarios such as having to coordinate with dozens of smallholder farmers for seeds or negotiate quality issues with buyers on the fly – leading to delays and frequent machine stoppages to adjust production. The significant coefficient for transaction complexity suggests that simplifying transactions or giving processors better tools to handle complexity (for instance, standardized contracts or intermediary aggregation of seeds) could directly improve their technological efficiency. This finding reinforces the argument for relational governance mechanisms in high-complexity contexts: since small firms cannot reduce complexity on their own, forming closer relationships (or using intermediaries) might mitigate its adverse effects (Heaton, 2024; Nkwabi, 2021). It also suggests a policy implication – interventions that streamline the purchasing process (such as establishing contract farming or cooperative buying) could yield technological efficiency gains for processors by reducing uncertainty in the production schedule.

Service Characteristics and Human Resources

The negative effect of challenging service characteristics on human resource capacity (H2) underscores how the inherent nature of service operations can strain small enterprises. The intangibility and variability of sunflower processing services (especially the need to ensure product quality in real time, and manage simultaneous production and inspection) require a skilled and adaptable workforce. Our data showed that where service demands were high (for instance, frequent product adjustments, on-demand production runs), firms reported their staff were not able to cope well – reflecting lower labor productivity or skill adequacy. This finding resonates with general services management theory which emphasizes training and employee flexibility for service quality, often framed by the heterogeneity of service output that demands human judgment. It also complements Mushi's (2016) observation that education level of processors correlated with efficiency – in our results, the need for knowledgeable staff becomes even more critical under high service complexity. The strong magnitude of this effect ($\beta\_std \approx –0.46$) suggests that interventions focusing on capacity building – for instance, technological training programs for operators on quality management, or hiring skilled supervisors – could substantially improve performance for firms where variability is unavoidable (Bonatto, et al., 2022; Ryciuk, 2020).

Technological Capabilities and Logistics Efficiency

Perhaps one of the clearest results was the powerful positive impact of technological capabilities on logistics performance (H3). This is highly consistent with numerous studies on supply chain integration that identify technology as a key enabler of coordination and efficiency. Our analysis shows that technology's effect remains strong even when controlling for other factors like market transparency or structure,

indicating it has an intrinsic value in making operations efficient. This finding ties into the broader discussion of digitalization in agribusiness; it provides micro-level evidence that digital tools and mechanization can bridge coordination gaps in fragmented chains. It aligns with Zhou et al. (2024) who confirmed that digital capabilities enhance supply chain integration and performance in manufacturing. For Tanzanian policymakers and development agencies, this underscores the importance of programs that facilitate technology adoption among small processors – whether through subsidies for modern equipment (presses, filtering machines) or training on using software and mobile applications for inventory and delivery management. This indicates that technological upgrades have spillover benefits across multiple performance areas – a new machine can increase throughput (technological), reduce wastage (compliance), and ease distribution planning (logistics) (Nwangwu, et al., 2024; Singh, et al., 2023). Thus, investing in technology might be the single most leverageable strategy for boosting small processor integration.

Market Transparency and Marketing Performance

The analysis strongly confirmed that increased market transparency is linked to significantly better marketing capability (H4). This finding echoes the fundamental economic principle that information asymmetry hurts market efficiency (Akerlof's "lemons" problem) and that reducing it (increasing transparency) improves outcomes for sellers and buyers. Small processors often operate in an information-poor environment. Those who had higher transparency (through market linkages, info services, or personal networks) were able to find more buyers, get better prices, or adjust their products to market needs, thereby expanding their market access and stability. This result parallels evidence from other value chains: for instance, studies in other Tanzanian sectors have noted that farmers or SMEs with access to price information via mobile phones achieved higher incomes than those without. Our study extends that concept into the processing segment, demonstrating quantitatively that lack of market information is a major barrier for processors trying to move beyond local markets (Diego & Montes-Sancho, 2025; Li, et al., 2023). Many respondents who scored low on marketing capability admitted they only sell in local markets because they "do not know where else to sell" or fear not getting paid by unknown buyers. This underscores a need for improving transparency through, for instance, creating market forums, trade fairs, or digital marketplaces connecting processors to bulk buyers (for instance, large wholesalers, retailers, or even export markets). The huge effect size for transparency (partial $R^2 \sim 0.34$) suggests that simply giving processors reliable information on prices and potential customers can increase their confidence to engage with new markets and negotiate better – ultimately driving growth (Singh, et al., 2025: Ma, et al., 2023).

Market Structure and Financial Performance

The negative association between a fragmented market structure and processors' financial capability (H5) supports the narrative that structural conditions in the sunflower value chain are not favoring small processors. When a market has many small players and possibly a few dominant actors (either large importers or big processing firms in other regions), small processors face both intense competition and weak bargaining power. Our finding resonates with Porter's Five Forces concept, where an industry with many rivals and powerful buyers will have lower profitability for individual firms. The data suggest that in areas with numerous processors (a fragmentation scenario common in Dodoma), profit margins are squeezed – potentially due to price wars or oversupply. Similarly, if they are dealing with powerful middlemen or wholesalers who dictate prices, small firms cannot earn enough to strengthen their finances or invest in growth. This situation is somewhat similar to the captive governance in GVC terms, where small suppliers are captive to big buyers and operate at thin margins (Rasimphi, et al., 2025; Hu, et al., 2023). Our result extends that concept: in this chain, the captor might not even be a single lead firm but the structural circumstance of too many small actors. A direct outcome we observe is limited access to credit – many small processors reported they cannot get bank loans due to irregular revenues and lack of collateral, which ties back to their low profitability and informal status. The policy implication is two-fold: encourage consolidation or cooperation among small processors to increase their collective market power (for instance, via cooperatives or cluster associations that can do collective marketing), and address distortions like cheap imported oils or buyer cartels that tilt the market against small local processors. Interestingly, institutional framework had a very strong positive effect on financial capability, meaning where the government or NGOs provided financial training or credit facilities (like guarantee schemes), processors had better financial outcomes (Diego & Montes-Sancho, 2025; Li, et al., 2023). This indicates that even if market structure is inherently difficult to change in short term (one can't easily reduce competitor count), improving institutional support can mitigate its impact by giving small firms tools to survive (loans, etc.). Nonetheless, over the long term, some rationalization of the processing sector may be needed – possibly moving smaller ones into networks or value addition niches, while others scale up – to achieve sustainable financial viability.

Institutional Framework and Compliance

Our finding that a robust institutional framework leads to higher regulatory compliance (H6) is intuitive yet crucial. It suggests that the presence of strong governance at the macro level begets better governance at the micro (firm) level. In regions or periods where the government actively enforces quality standards and provides support for compliance (like training on hygiene or partial grants for safety equipment), small processors adhere significantly more to regulations. For example, we learned that in sub-areas where the Tanzania Food and Drugs Authority (FDA) conducted inspections, processors made investments in stainless steel tanks and proper labeling to avoid penalties – those respondents scored higher on compliance. In contrast, in areas with little oversight, some processors admitted to not having any food safety certification or to discharging waste improperly. The positive effect of institutional strength is in line with Sam-

basivan et al. (2013), who noted that weak institutions breed non-compliance and mistrust. Our evidence shows the flip side: strong institutions breed compliance and likely trust. This has theoretical implications too – it supports the idea from New Institutional Economics that institutions lower transaction costs and promote mutually beneficial behavior (here compliance can be seen as a cooperative behavior for the greater supply chain good of quality assurance). Another angle is that strong institutions might foster informal norms of professionalism; if an industry sees enforcement regularly, over time complying becomes part of the business norms (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). Our result therefore encourages policymakers to strengthen institutional outreach – for instance, regularise inspections, offer certification programs (with incentives for those who comply), and educate processors about regulations. Over time, this could upgrade the whole industry's standard and open up higher-value markets (like urban supermarkets that require certified oil).

Practical Implications

For policymakers and development agencies in Tanzania (and similar contexts), this study underscores specific areas to focus on to strengthen small agro-processing industries. Since transaction complexity harms performance, establishing coordination mechanisms can help. This could involve promoting contract farming or aggregator models where an intermediary (for instance, a cooperative or lead firm) organises the supply from many farmers to processors, simplifying procurement. The government could facilitate template contracts or a digital trading platform for sunflower seeds, reducing uncertainty for processors. The negative impact of complexity suggests that efforts at value chain coordination (such as forming cluster networks or introducing supply chain management training for processors) would increase efficiency.

The human resource constraints highlighted by our results imply that investing in human capital is critical. Programs to train processor owners and workers in operations management, quality control, and equipment maintenance would directly address the service heterogeneity challenge. For instance, SIDO or NGOs could run workshops on best practices in small-scale oil processing (covering how to handle variable seed inputs, how to maintain consistent quality). Additionally, incorporating basic business and negotiation skills in training could empower processors to cope better with market dealings (thus indirectly reducing perceived complexity and improving financial outcomes). Essentially, strengthening skills and knowledge at the processor level is a practical way to improve integration.

Managerial Implications

For owner-managers of small sunflower processing enterprises (and similarly for managers in other small agro-processing firms), our study highlights key areas to focus on internally, whereby Managers should look for ways to simplify and standardise their operations where possible. This might include establishing standard operating procedures for dealing with suppliers and customers, rather than handling everything ad hoc. For example, a processor could implement a policy to only buy seeds above a certain quality grade and use a consistent pricing formula – this reduces transaction haggling complexity. Simplifying product lines (maybe focusing on a core product or two, instead of many oil varieties or packaging formats) can reduce variability and thus ease pressure on staff and equipment. Managers might initially fear losing business by not customizing for every buyer, but as our findings suggest, the cost of over-complexity is high. It may be beneficial to identify the most profitable segment and streamline around it, improving efficiency and reliability for that market.

Theoretical Implications

This research contributes to several streams of literature and offers theoretical insights which includes the following. Our study bridges global value chain governance theory with service operations in an agro-processing context. We empirically demonstrated that classic GVC factors (transaction complexity, supplier capability – here proxied by technology – and codifiability/information, analogous to transparency) as identified by Gereffi et al. (2005) are highly relevant to performance outcomes of SMEs. We also showed that the unique characteristics of services (IHIP) have tangible performance effects, thereby extending service supply chain theory into an agribusiness domain. The implication is that theories of manufacturing value chain governance need to incorporate service dimensions when applied to contexts like small-scale food processing, where production and service delivery (ensuring product quality, meeting buyer specifications) happen concurrently. Our findings reinforce that relational governance (trust, communication) likely becomes more critical as complexity and service intangibility rise, aligning with relational exchange theory. Future theoretical models of SME value chains should thus explicitly include factors for service complexity and institutional environment to predict performance.

The results highlight that the effectiveness of different governance mechanisms can be contingent on context. For example, we found that institutional framework strength (more formal governance) improves outcomes significantly. This suggests that in environments with weaker formal institutions, firms may rely on informal or relational governance to get by, but at a cost to performance (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). Our study thus empirically supports a contingency view: formal governance (like strong legal systems) provides a foundation for better performance, but in their absence, other governance forms (relational, network-based) must fill the gap albeit less efficiently. This adds nuance to TCE – yes, firms minimize costs by choosing governance forms, but the menu of choices and their costs are shaped by the macro-institutional context. In other words, our findings can inform the literature on institutional voids: small firms in developing markets suffer performance losses due to institutional voids, quantifying those losses and the gains when voids are filled.

CONCLUSION

This research set out to examine the integration of service value chain governance in the context of small sunflower oil processing industries in Dodoma, Tanzania. Through an extensive literature-informed analysis and survey-based empirical study, we demonstrated that key governance factors – transaction complexity, service characteristics, technological capabilities, market transparency, market structure, and institutional framework have significant and substantially impacts on the performance and capacity of small agro-processing firms. Each specific objective was met: we found that excessive transaction complexity and the inherent challenges of service production negatively affect technological and human resource performance; conversely, strong technological capabilities and transparent market information markedly improve logistics and marketing outcomes; a fragmented, uncoordinated market structure impairs financial viability; and a robust institutional environment greatly enhances regulatory compliance and overall governance.

These findings lead to several concluding observations. First, integrating small processing industries into higher value chains is not solely a matter of firm-level effort; it depends on the surrounding ecosystem of governance. Small firms can work hard and be entrepreneurial, but if they lack information, technology, and support, their integration will stall. Conversely, when the ecosystem is improved (through better infrastructure, policy, networks), even small firms can thrive and upgrade. Second, the results underscore the importance of a holistic approach in addressing one or two constraints in isolation (for instance, giving technology without improving market access, or vice versa) may yield limited gains, whereas coordinated improvements across multiple governance dimensions reinforce each other. This is an important consideration for practitioners and theorists alike – the components of value chain governance function as an interconnected system.

In concluding, our study provides evidence that targeted interventions in service value chain governance can meaningfully improve the prospects of small-scale processors. This has positive implications not only for those enterprises' incomes but also for broader economic development goals such as rural industrialization, job creation, and reducing dependency on imports (Tanzania currently imports a portion of edible oil; stronger local processors could replace that with domestic production). The sunflower oil sector in Dodoma, with its numerous small players, exemplifies both the potential and the pitfalls of smallholder-based industries. With the right governance improvements – simplifying transactions, empowering with technology and knowledge, opening market channels, fostering cooperation, and strengthening institutions – these small enterprises can become more competitive, sustainable, and integrated into both national and possibly export markets.

Limitations and Future Research

While our study is comprehensive, it is not without limitations. The data are cross-sectional, which limits our ability to make strong causal inferences. We assumed certain directions based on theory (and these are reasonable), but longitudinal research would be valuable to observe how changes in governance factors lead to performance changes over time. We also relied on self-reported measures, which might introduce bias (though we took steps to assure anonymity and validate responses, there could be some over- or under-statement). Future research could incorporate objective performance data (for instance, actual financial records, production data, compliance audit results) to complement perceptions. Another limitation is generalizability. Our context was specific – sunflower processors in one region. The situation may differ with other products or regions (for instance, areas with different crops or closer to major cities might have different dynamics). We encourage researchers to test our framework in other contexts: for instance, small dairy processing hubs, fruit processing SMEs, or handicraft clusters, to see if these governance factors similarly predict outcomes. It would also be useful to examine larger firms or cooperative societies to compare how governance influences differ by scale.

Future studies might also delve deeper into each factor. For example, transaction complexity could be unpacked into its components (asset specificity, uncertainty, frequency) in a service setting to see which is most problematic. Service characteristics could be studied in terms of how firms attempt to tangibilise or standardize their service to cope – are those who invest in branding or certifications (to tangibilise quality) doing better? Technological capabilities invites research into adoption barriers – qualitatively, why do some processors not adopt technology even when beneficial? Understanding the behavioral or resource constraints there could help design interventions to boost technology uptake. Research could also explore network and relational governance explicitly. Our study hints at the value of associations and trust, but we did not directly measure relational governance (like strength of relationships with suppliers/buyers). Investigating the role of trust and informal networks as mediators or moderators would enrich the governance narrative – perhaps strong informal relationships mitigate some negatives of a weak formal institutional framework, for instance.

Additionally, considering consumer perspective might be interesting: if small processors improve compliance and quality (due to better governance), does that reflect in consumer trust and demand? Essentially, closing the loop of how governance affects not just firm performance but end-market acceptance would be a full value chain analysis. Finally, policy-oriented research can build on our findings by conducting intervention studies – implementing certain improvements (say a market information system in one region but not another as a control) and measuring outcomes, to provide more rigorous evidence of causality. This kind of field experiment could validate many of the relationships we found and convince stakeholders of the ROI (return on investment) of governance interventions.

In general, our study contributes to both knowledge and practice by illuminating the pivotal governance linkages that integrate small firms into larger value chains. It calls on

stakeholders to view small enterprise development not just as an internal enterprise problem, but as a value chain governance challenge that can be addressed through collaborative and systemic solutions. The sunflower processors of Dodoma – and countless similar small firms in developing economies – can prosper if we collectively implement the lessons gleaned: simplify where possible, innovate and inform, cooperate strategically, and strengthen the institutional fabric that holds the chain together.

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