

Overlapping Value Chain Roles and Market Support Gaps Among Shea Nilotica Actors in Northern Uganda. Implications for Market-Oriented Extension

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Abstract: *Market participation does not guarantee that rural actors have the information, skills and coordination needed for informed exchange. The study examined value chain roles and market support gaps among 266 shea actors in Arilo Sub County, Yumbe district. Descriptive statistics, selected association tests and two exploratory logistic models were used. Producer, processor and seller roles overlapped substantially, with 31% reporting all three. Women were more likely than men to report processor and seller roles. Half of respondents lacked current market information, 93% reported no organization supporting shea marketing, 79 lacked processing training and 72% lacked production finance. Seller role reporting was associated with higher odds of no current market information (OR 3.03, 95% CI 1.71 to 5.38, $p < 0.001$). Lack of market information was associated with higher odds of reported income insufficiency (OR 3.84, 95% CI 1.82 to 8.10, $p < 0.001$). The findings support actor-function-based, market-oriented extension without establishing causal and commercialization depth.*

Keywords: Shea nilotica, market-oriented extension, market information, actor role overlap, farmer organization

INTRODUCTION

Agriculture extension in market oriented rural economies cannot be reduced to the transfer of production recommendations. Smallholder farmers and other rural actors often combine production, processing, storage and selling while navigating uncertain prices, limited liquidity, uncertain buyer relationships and weak services access. Advisory systems therefore increasingly perform facilitation, capacity-strengthening and coordination functions in addition to technical communication (Birner *et al.*, 2009; Rivera and Sulaiman, 2009; Faure, Desjeux and Gasselin, 2012). The practical question is not whether actors enter a commodity market, but whether the information, skills and institutional support surrounding that participation enable informed decisions.

Market participation is not equivalent to secure or advantageous market access. Fixed and proportional transaction costs can influence whether agricultural households sell, buy or remain outside markets (Key, Sadoulet and Janvry, 2000). Participation is also conditioned by household assets, liquidity, risk, information constraints and the institutional and physical market environment (Barrett, 2008). Market access is multidimensional: alternative indicators of physical access, market agent presence, and

service availability may vary independently and should not be collapsed into a single assumption for commercial integration (Chamberlin and Jayne, 2013). Participation in selling alone is consequently an incomplete indicator of the quality and depth of market integration (Barrett, 2008; Chamberlin and Jayne, 2013).

Shea provides a useful case through which to examine these problems. Shea products are economically and culturally important across the African shea belt, while much of the published value chain and processing literature focused on West African *Vitellaria paradoxa subsp. paradoxa* systems (Jasaw *et al.*, 2015; Rousseau *et al.*, 2015). Recent work from Ghana has further examined the structure and actor positions within the global shea value chain and the associated policy implications (Opoku – Mensah, 2023). Uganda, however, lies within the East African range of *Vitellaria paradoxa subsp. Nilotica*, where shea tree management and conservation have developed within a distinct local context (Gwali *et al.*, 2012). West African evidence therefore provides an important comparative foundation, but differences in sub species, processing systems, market organization and institutional context mean that its findings cannot be assumed to represent the conditions facing shea actors in northern Uganda.

Against this comparative background, Uganda specific evidence has expanded. Recent studies in northern Uganda have examined the drivers of value addition and product upgrading among collectors, the competitiveness of collectors, traders and processors, and actors' choices among marketing arrangements (Akatwetaba *et al.*, 2023; Akatwetaba, Mugonola, *et al.*, 2024; Akatwetaba, Okello, *et al.*, 2024). These studies show that information, extension, training, credit, association membership and market structure matter. However, they generally analyze actor types as separate categories. They provide less evidence on whether the same surveyed person combines production, processing and selling functions, and on how information, organization, training and finance deficits are patterned around those overlapping roles in the West Nile context.

This paper addresses that narrower question using a cross sectional of 266 shea actors in Arilo Sub County, Yumbe District. It asks: (1) how are producer, processor and seller roles distributed and combined among shea actors; (2) what support conditions are reported across market information, organization, finance, processing and training; and (3) how are role positions, information access, organization and income sufficiency associated within the sample? The paper contributes an actor-function-based diagnosis for market extension. It shows why advisory targeting based on mutually exclusive producer, processor and trader categories may miss the multifunctional roles reported by respondents, and it identifies a specific information disadvantage among sellers. The study does not estimate commercialization depth, causal income effects, profitability, value capture, empowerment and national representativeness.

LITERATURE

Market-oriented advisory services and actor functions

Agricultural advisory systems have shifted from a universal technology-transfer model toward pluralistic arrangements in which public, private and civil-society actors provide technical, organizational and market-related services. Birner *et al.* (2009) frame effective advisory design as a “best fit” problem: service content and delivery should respond to institutional context, actor capacities

and the nature of the innovation challenge. Faure et al. (2012) and Rivera & Sulaiman (2009) similarly place facilitation, learning and coordination within the advisory mandate.

This literature supports market-oriented extension, but it does not justify bundling every possible service into a single intervention. The relevant unresolved question is which functions and constraints coexist among the intended users. In value chains where the same actor produces, processes and sells, service segmentation based on one occupational label may be inaccurate. The present study therefore treats role overlaps as an empirical issue rather than assuming distinct producer, processor and trader populations.

Market participation, transaction costs and information

Smallholder market participation is mediated by fixed and proportional transaction costs, which can influence whether agricultural households sell, buy, remain outside markets (Key, Sadoulet and Janvry, 2000). Broader evidence shows that participation is also conditioned by household assets, liquidity, risk and information constraints and the institutional and physical market environment (Barrett, 2008). Market access is multidimensional: alternative indicators of physical access, market-agent presence and service availability may vary independently and therefore should not be collapsed into a single measure of commercial integration (Chamberlin and Jayne, 2013). Participation in selling alone is consequently an incomplete indicator of quality and depth of market integration (Barrett, 2008; Chamberlin and Jayne, 2013).

One important dimension of this broader market access environment is access to market information. Aker (2010) demonstrated that mobile-phone diffusion reduced spatial price dispersion in Niger, but this finding should not be generalized into an assumption that information access is automatically increases seller income. Reviews of agricultural market information and digital market transformation show that information tools operate through wider institutional, infrastructural and organizational conditions (Nugroho, 2021; Abate *et al.*, 2023). The present paper therefore treats information as an extension-relevant support condition and interprets its association with reported income insufficiency cautiously.

Organization, collective action and coordination

Collective action may help smallholders aggregate output, access information and services and reduce transaction costs (Markelova *et al.*, 2008). Yet organizations differ in governance, incentives and intensity of participation. Fischer & Qaim (2014) show that participation is not uniform, and evidence from Uganda indicates that strengthening producer organizations does not produce automatic and identical market outcomes for all members (Hill *et al.*, 2021).

Organization membership should therefore not be treated as proof of market power and improved welfare. In this study it is used as a limited indicator of coordination infrastructure. Very low membership can reveal a support gap, but the data cannot establish whether forming new groups would succeed, whether existing informal coordination was overlooked and which governance model would be viable.

Gendered role positioning and evidence limits

Shea processing is frequently associated with women's labor in West African studies (Jasaw *et al.*, 2015). However, participation in a downstream activity is not equivalent to control over assets, decision-making or income. Kabeer (1999)'s resource-agency-achievements framework and latest gender-and agricultural scholarship distinguish visible participation from empowerment and benefit distribution (Quisumbing *et al.*, 2015; Doss, 2018).

The present study can therefore identify whether women and men report different chain roles and can derive implications for service targeting. It cannot infer bargaining power, control over shea earnings, time burdens, decision making authority and welfare effects because those constructs were not measured.

Processing capacity and upgrading in shea systems

Processing studies from northern Ghana document labor, water, fuel and equipment demands in shea-butter production (Jasaw *et al.*, 2015; Naangmenyele *et al.*, 2023). Uganda focused research also links information, training, extension access and association membership with value addition and product upgrading among shea collectors (Akatwetaba *et al.*, 2023). Together, these studies indicate that upgrading is a capacity and coordination problem, not merely an equipment deficit.

The transferability of West African evidence must nevertheless be qualified because subspecies, market organization and processing practices differ. The present data identify whether manual methods and training gaps are widespread in the surveyed nilotica setting. They do not estimate the economic return to mechanization, quality improvement, certification and product differentiation.

Analytical angle of the paper

Uganda's shea literature documents tree management and conservation, market potential, value addition, marketing arrangements and actor competitiveness (Akatwetaba *et al.*, 2023)(Akatwetaba, Mugonola, *et al.*, 2024)(Akatwetaba, Okello, *et al.*, 2024)(Gwali *et al.*, 2012). The remaining gap is not simply a shortage of studies. It is limited evidence on how chain functions overlap within respondents and on how extension relevant support deficits are distributed around those overlapping functions in West Nile.

The analytical framework therefore links four observable domains: respondent level role overlap, market information, coordination through organization, and processing and financial capacity. Income sufficiency is used as an exploratory outcome. The framework diagnoses constrained market participation; it does not measure the degree of commercialization.

METHODOLOGY

Study design and setting

The study used a cross-sectional survey design to examine role participation, information, training, organizational, production and processing conditions among shea actors. The design supports descriptive analysis and selected sample level-associations. It does not support causal inference, impact evaluation and national extrapolation. The questionnaire recorded respondent-level roles and attributes but did not collect dyadic information exchange and service delivery ties. Social network analysis was therefore not applicable to the available data; the logistic models' estimations between respondents' characteristics and outcomes rather than network structure.

The survey covered respondents engaged in shea related activities in Arilo Sub County, Yumbe district, West Nile region, Uganda. Shea forms part of mixed rural livelihood and land landscape systems in the area (Odoi *et al.*, 2020).

Sampling and participants

The initial farmer lists obtained from the UBOS 2024 report contained 808 farmers across the three target parishes: Lulurunga in 185, 400 in Joke, and 223 in Tuliki (UBOS, 2024). Validation conducted in Arilo Sub County office and Local council reduced the list to 582 eligible farmers, who constituted the final sample frame. Using Yamane's finite formula with a 5% margin of error, the required sample size was calculated as 237.07 and rounded up to 238 respondents.

Respondents were selected using fractional interval systematic random sampling (Mostafa and Ahmad, 2018). The interval was calculated as $k=582/238=2.445378$. After generating a random start r in Microsoft excel, the position of the j th selected farmer was determined as $s_j=[r+(j-1)k] +1$, for $j=1, \dots, 238$. The fractional interval remained without rounding, resulting in affixed sample of 238 farmers and an equal selection probability of $238/582=0.4089$ for each farmer.

Data collection

Data were collected using a structured, interview administered questionnaire covering demographic characteristics, occupational roles within the shea value chain, production and harvesting conditions, access to resources, processing practices, market information, organizational participation, product use, and income sufficiency. This modular structure enabled systematic collection of data on value chain structure, market participation, processing constraints, value addition opportunities, and livelihood-related outcomes. The survey instrument was prepared in English, and research assistants provided oral translation into Aringa during interviews where needed. Each interview lasted approximately 45 to 55 minutes, adhering to established fieldwork guidelines that suggest keeping average household interview times under one hour to maintain data quality and respondent engagement.

The questionnaire was pretested with 20 respondents in Midigo sub county in Yumbe District to assess question clarity, sequencing, interview duration, response options, and interviewer interpretation.

During fieldwork, field supervisors reviewed completed questionnaires daily for completeness, accuracy, and internal consistency, and queries were resolved with interviewers while data collection was still ongoing.

Data analysis

The first analytical stage was descriptive. Frequencies, percentages and role profiles described by respondents, chain participation, production, processing practices, market information, organization, support needs and income sufficiency. Percentages for multi-response items represent the share of cases mentioning an item at least once and do not sum to 100%.

The second analytical layer used selected person chi-square test, Fisher's exact tests for sparse 2 x 2 comparisons and two exploratory binary logistic regression models. Phi was reported as the effect size for 2 x 2 comparisons and Cramer's V where appropriate.

For Model 1, the dependent variable was coded 1 when respondents reported no access to current market information and 0 when they reported current or sometimes unreliable access. For model 2, the dependent variable was coded 1 when respondents reported that shea was not sufficient for household needs and 0 when they reported that it was sufficient. Role indicators were non-exclusive; coefficients represent adjusted associations holding other reported roles constant. They are not comparisons between mutually exclusive actor categories and do not identify causal effects.

Model 1 used 264 complete cases and had a maximum predictor VIF of 1.27, and Hosmer-Lemeshow test, $\chi^2 (7) = 5.21$, $p = 0.634$. Model 2 used 253 complete cases and had a maximum predictor VIF of 1.31, and Hosmer-Lemeshow test, $\chi^2 (8) = 8.45$, $p = 0.390$. These diagnoses do not establish causal validity.

RESULTS

Respondent characteristics and role overlap

The sample includes 266 respondents. Women accounted for 56% of the respondents and men for 44%. Married respondents accounted for 90%, and 89% reported primary education or less. Mean age was 39.4 years (SD 16.9; range 18-90), and median household size was 6 (Table 1). This profile indicates that the survey captured mainly adult rural respondents with limit formal schooling, a factor relevant for interpreting advisory communication, market information and training needs.

Table 1. Sample characteristics, n=266

Characteristic	Value	Percent
Female	150	56.4
Male	116	43.6
Married	240	90.2
Primary education or less	236	88.7
Mean age, years	39.4	SD=15.9; range=18-90
Median household size	6	

Producer roles were reported by 83% of respondents, processor roles by 53% and seller roles by 42%. Role overlaps were substantial: 37% were producers only and 31% reported producer, processor, and seller roles. The remaining profiles are shown in Figure 1.

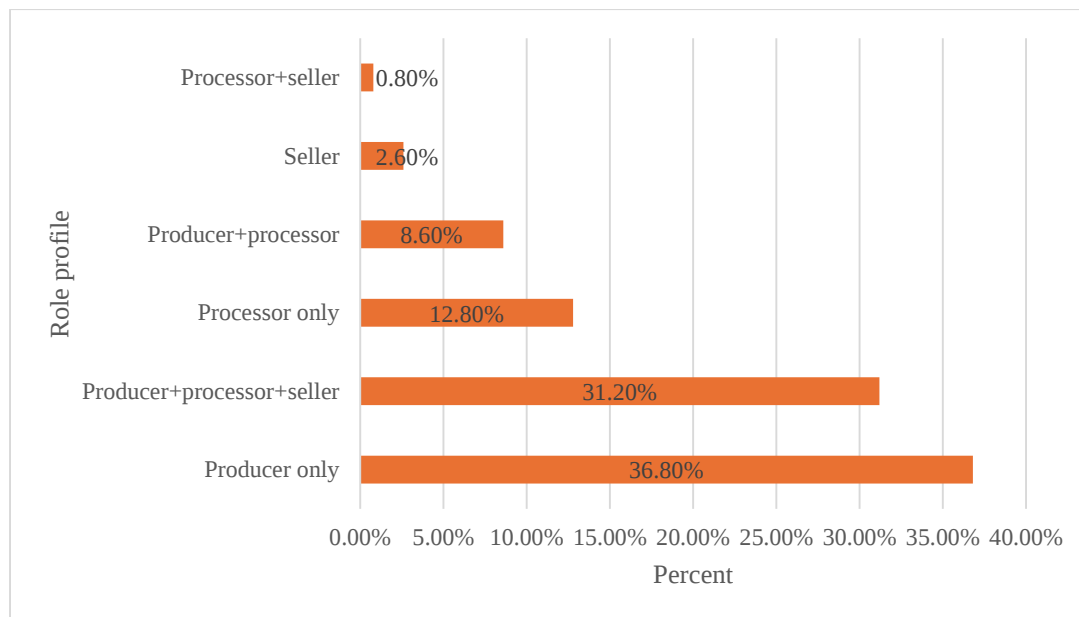


Figure 1. Role profile

Note. Role indicators are non-exclusive, while role profiles are mutually exclusive.

Gendered role positioning

Women were more likely than men to report processor roles (62.7% versus 41.4%; $\chi^2(1)=11.07$, $p=0.001$, $\phi=0.204$) and seller roles (48.7% versus 32.8%; $\chi^2(1)=6.17$, $p=0.013$, $\phi=0.152$) (Table 2). These are sample level differences in role positioning, not measures of empowerment and benefits control.

Table 2. Selected sex differences in role participation

Role	Percent		$\chi^2(1)$	P value	Effect size
	Female	Male			
Processor role reported	62.7	41.4	11.07	0.001	$\phi=0.204$
Seller role report	48.7	32.8	6.17	0.013	$\phi=0.152$

Production, harvesting and support needs

Among valid responses on tree origin, 59.3% reported that trees grew on their own and 34% reported both grown and naturally occurring trees. Self-reported ownership of land where shea trees were located was 70%. No access to production finance was reported by 72%.

The leading production challenge was climate or weather stress (40%), followed by limited access to quality seedlings (21%), financial limitations (14%), pests and diseases (12%) and inadequate training (12%). The support requested included financial assistance (53%), training in improved production methods (47%), and better tools and equipment (40%). Collection outside the respondents' own farm was reported by 64%. 72% reporting no access to production finance answered an access status question, whereas 14% mentioning financial limitations selected a prioritized production challenge; the two percentages therefore describe different constructs and denominators (Figures 2&3 and Table 3).

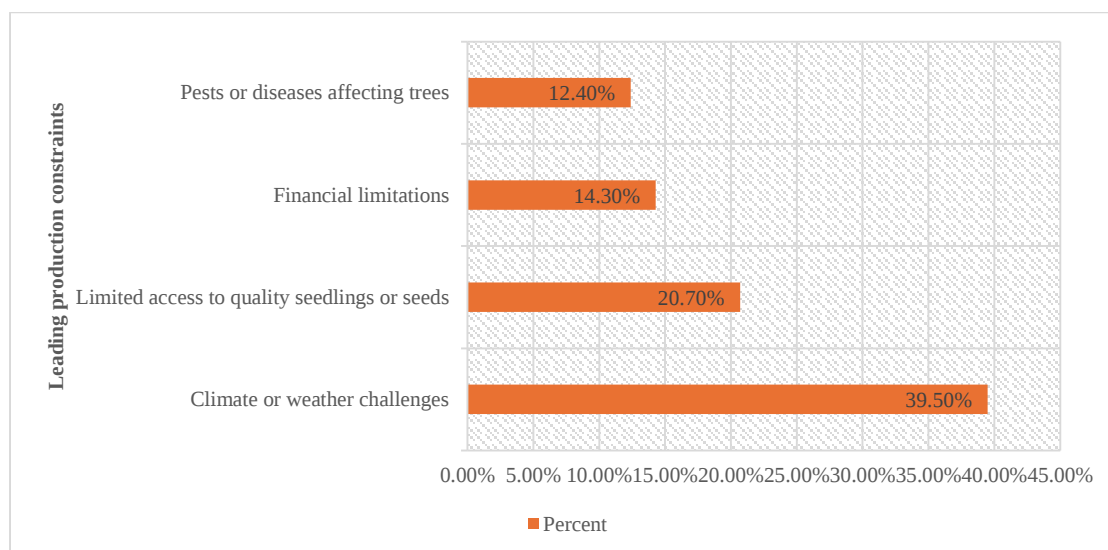


Figure 2. Leading production constraints

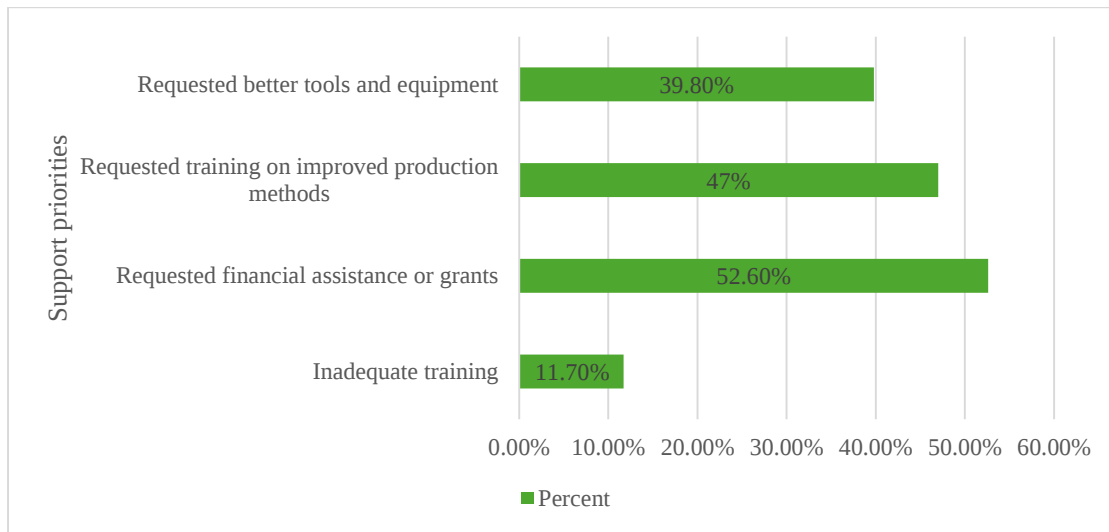


Figure 3. Support priorities

Note. Multiple response items were aggregated as mentioned at least once. Percentages do not sum to 100

Table 3. Leading production constraints and support services

Comparison	n	Test	p-value	Effect size	Interpretive note
Sex x processor role	266	$\chi^2(1)=11.07$	0.001	$\phi=0.204$	Women 62.7%; men 41.4%
Sex x seller role	266	$\chi^2(1)=6.17$	0.013	$\phi=0.152$	Women 48.7%; men 32.8%
Seller role x no current market information	266	$\chi^2(1)=13.91$	<0.001	$\phi=0.229$	Sellers 64.0%; non-sellers 40.0%
Processor role x organization membership	264	Fisher's exact	0.001	$\phi=0.184$	Processors 2.1%; non-processors 12.2%
Seller role x organization membership	264	Fisher's exact	0.026	$\phi=0.124$	Sellers 2.7%; non-sellers 9.8%
No market information x income insufficiency	257	$\chi^2(1)=6.08$	0.014	$\phi=0.154$	No information 85.3%; some access 71.9%

Processing capacity and training

Traditional manual processing accounted for 99% of valid responses, and 94% reported traditional processing methods. 79% reported no processing training.

Market information, organization and income sufficiency

Half of respondents reported no access to current market information, and 93% reported no organization supporting shea product marketing. 48% of respondents rated demand as high and 47% rated demand as moderate. Shea income was insufficient for household needs among 78% respondents.

Sellers were more likely than non-sellers to report no current market information (64 verses 40%; $\chi^2(1) = 13.91$, $p < 0.001$, $\phi = 0.229$). Organization membership was reported by 2% of the processors compared with 12% of non-processors (Fisher's exact $p = 0.001$, $\phi = 0.184$), and by 3% of the sellers compared with 10% of non-sellers (Fisher's exact $p = 0.026$, $\phi = 0.124$). Income insufficiency was more common among respondents with no market information than among those with some access (85% verses 72%; $\chi^2(1) = 6.08$, $p = 0.014$, $\phi = 0.154$ (Table 4).

Table 4. Selected bivariate association tests

Comparison	n	Test	p value	Effect size	Interpretive note
Sex x processor role	266	$\chi^2(1) = 11.07$	0.001	$\phi = 0.204$	Women 62.7%; men 41.4%
Sex x seller role	266	$\chi^2(1) = 6.17$	0.013	$\phi = 0.152$	Women 48.7%; men 32.8%
Seller role x no current market information	266	$\chi^2(1) = 13.91$	<0.001	$\phi = 0.229$	Sellers 64.0%; non-sellers 40.0%
Processor role x organization membership	264	Fisher's exact	0.001	$\phi = 0.184$	Processors 2.1%; non-processors 12.2%
Seller role x organization membership	264	Fisher's exact	0.026	$\phi = 0.124$	Sellers 2.7%; non-sellers 9.8%
No market information x income insufficiency	257	$\chi^2(1) = 6.08$	0.014	$\phi = 0.154$	No information 85.3%; some access 71.9%

Note. Tests are descriptive and sample level. Fisher's exact tests were used for sparse 2 by 2 comparisons involving organization membership.

Exploratory logistic regression

The exploratory logistic models sharpened the descriptive pattern (Table 5). In model 1, seller role reporting was associated with higher odds of no access to current market information (OR 3.03, 95% CI 1.71 to 5.38, $p < 0.001$). Processor role reporting showed weaker evidence of lower odds (OR 0.58, 95% CI 0.32 to 1.04, $p = 0.068$). Sex, education, age group and organization membership were not strongly associated with the lack of market information in the model.

In model 2, no market information was associated with higher odds of reported income sufficient (OR 3.84, 95% CI 1.82 to 8.10, $p = 0.001$). Report a processor role (OR 0.20, 95% CI 0.08 to 0.47, $p < 0.001$),

and seller role reporting (OR 0.45, 95% CI 0.21 to 0.99, $p=0.046$) were associated with lower odds of income insufficiency after adjustment. No strong adjusted association was observed for sex, education, age group or production finance access.

Table 5. Explanatory binary logistic regression models for selected outcomes

Predictor	Model 1: No current market information; OR (95% CI), p	Model 2: Income not sufficient; OR (95% CI), p
Seller role	3.03 (1.71 to 5.38), $p<0.001$	0.45 (0.21 to 0.99), $p=0.046$
Processor role	0.58 (0.32 to 1.04), $p=0.068$	0.20 (0.08 to 0.47), $p<0.001$
Female respondent	1.48 (0.86 to 2.56), $p=0.156$	0.75 (0.35 to 1.60), $p=0.455$
Primary education or less	1.04 (0.44 to 2.44), $p=0.937$	1.22 (0.37 to 4.05), $p=0.741$
Age 40 years or older	0.61 (0.35 to 1.05), $p=0.073$	1.40 (0.67 to 2.91), $p=0.367$
Organization membership	0.52 (0.18 to 1.50), $p=0.226$	-
No access to production finance	-	1.15 (0.55 to 2.41), $p=0.718$
No current market information	-	3.84 (1.82 to 8.10), $p<0.001$
n	264	253
Model diagnostics	Max VIF=1.27; Hosmer-Lemeshow χ^2 (7) =5.21, $p=0.634$	Max VIF=1.31; Hosmer-Lemeshow χ^2 (8) =8.45, $p=0.390$

Note. Odds ratios are from binary logistic regression estimated on complete cases. Role indicators are non-exclusive; no coefficients represent adjusted associations holding other reported constants. Diagnostics indicate no obvious multicollinearity or gross lack of fit, but the models remain exploratory and non-causal.

DISCUSSION

The paper's contribution is the actor-function pattern: production, processing, and selling overlap within respondents, while the most market facing function is associated with an information deficit. This combination refines how extension should diagnose service needs. It shifts the unit of targeting from a single actor label to the set of functions a respondent performs.

Role overlap changes the extension targeting problem

The first contribution is evidence that surveyed shea actors cannot be represented adequately as three separate populations. More than four-fifth reported a producer role, over half a processor and more than two-fifth a seller role, while 31 reported all three. Recent northern Uganda studies have productively compared collectors, traders and processors as actor categories (Akatwetaba, Okello, *et al.*, 2024)(Akatwetaba, Mugonola, *et al.*, 2024). The present findings extend that literature by showing that, in this sample, chain functions overlap within the same respondent. The distinction matters

because a person classified only as a producer may also face processing quality and market information constraints.

This pattern supports the “best fit” argument in advisory services research: service content should follow the actual functions and constraints of users rather than a fixed conceptual model (Birner *et al.*, 2009). It also aligns with integrated coordination approaches that connect production, service access and market relations rather than treating them as separate problems (Kilelu, Klerkx and Leeuwis, 2017). The implication is not that every actor should receive every service. It is that extension diagnosis should first establish the respondent’s function portfolio and then target relevant content. The study did not test a bundled advisory model, so effectiveness and cost remain open questions.

Women’s concentration in processing and selling identifies exposure, not empowerment

Women were more likely than men to report processor and seller roles, although the effect sizes were small. The direction is consistent with shea research that places women prominently processing labor and local commercialization (Jasaw *et al.*, 2015). In the Arilo sample, the result indicates that weaknesses in processing training, storage, quality handling, buyer information and price communication may disproportionately affect women because women are more present in those functions.

The findings do not demonstrate empowerment. Participation can coexist with limited control over assets, earnings and decisions, which is why gender scholarship separates resources, agency and achievements (Kabeer, 1999; Quisumbing *et al.*, 2015; Doss, 2018). The defensible implication is service targeting: Women should deliberately reach by downstream advisory content, and future evolutions should measure time use, decision making and income control. Claims that shea commercialization empowers women would be unsupported by the study data.

Sellers’ information disadvantage is the papers strongest distinctive results.

Sellers’ information reporting was associated with three times the odds of lacking current market information after adjustment. This is not a trivial descriptive deficit. Sellers are the actors whose decisions depend directly on price comparisons, buyer identification and timing, yet they were the group most exposed to an information gap. Uganda shea studies already show that information and extension access are associated with value addition and marketing arrangement choices (Akatwetaba *et al.*, 2023) (Akatwetaba, Mugonola, *et al.*, 2024). The present study adds a more specific result: information deprivation is patterned by the selling function itself in this west Nile sample.

The result is consistent with transaction-cost theory, in which search and information costs shape market participation (Barrett, 2008)(Key, Sadoulet and Janvry, 2000) but it does not reveal why sellers lacked information. Possible explanations include reliance on a narrow buyer network, weak communication channels, distance, quality uncertainty and market concentration. Evidence that communication technologies can reduce price dispersion in some agricultural markets (Aker, 2010) does not mean a digital platform would automatically solve the Arilo problem. Digital market reviews stress that services require complimentary institutions, trust and operational scale (Abate *et al.*, 2023).

Lack of current market information was also associated with higher odds of reporting that shea income was insufficient for household needs. This association services adjustment, but the outcome is subjective and the design is cross sectional. Information may be a market for broader market exclusion rather than the sole mechanism. Thus, the current market information belongs within the advisory and rural market support agenda and should be evaluated alongside buyer relationships, transport, quality and bargaining conditions.

Organizational absence indicates a coordination deficit, not an automatic cooperative solution.

More than 92% of the respondents reported there was no organization supporting shea marketing, and membership was particularly uncommon among processors and sellers. This finding is consistent with a coordination problem: the downstream actors most exposed to buyers and quality requirements reported little formal organizational support. Collective action literature explains why organizations may help by aggregating products, lowering search costs and linking members to services (Markelova *et al.*, 2008). Evidence from Uganda also shows that producer organizations can improve some dimensions of market access, but performance depends on design, governance and member engagement (Hill *et al.*, 2021).

The data does not justify a blanket recommendation to form groups. Membership was measured narrowly, informal networks were not mapped, and the study did not assess trust, governance, leadership, fees and group performance. A credible extension response would begin with an institutional and governance diagnosis, then test functions such as information sharing, quality assurance, joint transport and buyer linkage. The recommendation is to facilitate viable coordination, not to treat registration of a cooperative as an outcome.

Processing and finance are capacity constraints

Nearly all valid responses indicated traditional manual processing, and most respondents reported no processing training. West African studies document the labor and resource intensity of shea processing and the importance of technical efficiency and process management (Jasaw *et al.*, 2015; Naangmenyele *et al.*, 2023). Uganda research similarity identifies extension, information and association access as correlated of value addition (Akatwetaba *et al.*, 2023). The Arilo evidence therefore fits a broader capability argument: processing support must address skills, quality handling, equipment use and market requirements together.

However, the study did not measure product quality, processing yield, costs, prices and returns. Manual processing is not by itself proof of inefficiency and equipment is not automatically profitable and socially beneficial. The study recommendation is to test practical training, quality control procedures and shared equipment options with explicit monitoring of labor, cost, output quality and benefit distribution.

Access to production finance was also limited descriptively, but finance was not strongly associated with income insufficiency in the adjusted model. By this, I am not calling finance a determinant of income. Instead, this result indicates a widespread service access gap and note that liquidity constraints are theoretically relevant to market repayment risk, seasonality, and viable market outlets.

Finally, nine in ten respondents had primary education or less. While education was not strongly associated with either modelled outcome, it matters for delivery design. Advisory communication that depends mainly on written technical materials may exclude part of the intended audience. Demonstrations, locally accessible language, visual aids, radio, facilitated peer learning, and repeated follow up are reasonable literature informed options.

Implications for Research and Practice

The evidence directly supports three practical adjustments. Agricultural extension diagnosis should record all value chain functions performed by an actor rather than assign one exclusive category. Current market information should be treated as a core advisory function because sellers were especially likely to lack it. Processing training and marketing organization should be treated as major local service gaps.

Other responses are literature informed proposals rather than tested interventions. These include practical demonstration on quality handling, governance-sensitive group facilitation, locally accessible communication channels, buyer linkage services and trials of shared processing equipment. Any pilot should record participation, costs, product quality, prices, labor use, and distribution of benefits. Group registration, equipment distribution and message delivery should not be treated as proof of improved market outcomes.

CONCLUSION

The surveyed shea system was characterized by overlapping respondent roles and weak market support conditions. Production, processing, and selling were frequently combined, while current market information, organizational support, processing training and production finance were limited. Sellers had higher adjusted odds of lacking current market information, and lack of information was associated with income insufficiency.

The paper contributes to Uganda's shea literature by showing why marketed oriented extension should target actor-function portfolios rather than mutually exclusive labels. It does not establish commercialization depth, causal income effects, profitability, value capture, empowerment and national patterns. The findings justify better local diagnosis and carefully evaluated information, training and coordination services. They do not prove that any single intervention will improve income.

Future Research

Future studies should standardize quantity and transaction units, collect prices, costs, margins and buyer data and distinguish market information sources, timeliness and reliability. Experimental designs are needed to test information, training, organization and equipment interventions. Gender analysis should measure decision making, time use, asset control and control over shea income. Research should also compare West Nile and other shea zones and examine informal networks, buyer concentration, quality verification, tree management and ecological trade-offs.

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