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The Production and Distribution Systems of the Shea Crop in Northern Ghana: A Mixed-Methods Analysis of Value Chains and Sustainability

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Abstract

This paper analyzes the shea value chain of Northern Ghana, from harvesting to marketing, and identifies its inefficiencies, key challenges, and socio-economic dynamics. The study adopts a mixed-methods approach, combining quantitative data from 402 value chain actors across four districts (Tolon/Kumbungu, Fumbisi, Savelugu/Nanton, and Sagnarigu) with a literature review. Variables such as landholding size, yield, education level, harvesting practices, production costs, and distribution satisfaction were analyzed using descriptive statistics, chi-square tests, Fisher's exact test, Pearson correlation, linear regression, and ANOVA. The shea value chain is predominantly female-driven (94.8%) and heavily reliant on manual labor, with limited value addition and low market penetration. Key issues include small landholdings (67.4% ranging from 4–6 hectares), sustainability pressures (69.7% reporting a lack of shea trees), a strong reliance on local markets (78.4%), and high levels of dissatisfaction (68.9%). Significant relationships were found between landholding size and yield (Fisher's exact test = 54.783, $p < 0.001$), production costs and landholding size (ANOVA $F = 3.915$, $p = 0.004$), and yield and harvesting practices ($F = 2.961$, $p = 0.032$). Major constraints include insecure land tenure (71.9%), equipment shortages (42.0%), and limited access to inputs (38.1%). Policy recommendations include land reform, increased investment in infrastructure, strengthening cooperatives, and developing gender-responsive programs.

Keywords: inefficiencies; landholding size; land tenure; yield

Analisis Sistem Produksi dan Distribusi Komoditas Shea di Ghana Utara: Pendekatan Mixed-Methods pada Rantai Nilai dan Keberlanjutan

Abstrak

Artikel ini menganalisis rantai nilai shea di Ghana Utara, mulai dari pemanenan hingga pemasaran, serta mengidentifikasi inefisiensi, tantangan utama, dan dinamika sosial ekonominya. Penelitian ini menggunakan pendekatan metode campuran dengan menggabungkan data kuantitatif dari 402 pelaku rantai nilai di empat distrik, yaitu Tolon/Kumbungu, Fumbisi, Savelugu/Nanton, dan Sagnarigu, serta tinjauan literatur. Variabel yang dianalisis meliputi luas kepemilikan lahan, hasil produksi, tingkat pendidikan, praktik pemanenan, biaya produksi, dan kepuasan terhadap distribusi. Analisis dilakukan menggunakan statistik deskriptif, uji chi-square, uji Fisher's exact test, korelasi Pearson, regresi linier, dan ANOVA.Rantai nilai shea sebagian besar digerakkan oleh perempuan, yaitu sebesar 94,8%, dan sangat bergantung pada tenaga kerja manual, dengan nilai tambah yang masih terbatas serta penetrasi pasar yang rendah. Permasalahan utama mencakup kepemilikan lahan yang kecil, dengan 67,4% responden memiliki lahan seluas 4–6 hektare, tekanan terhadap keberlanjutan karena 69,7% responden melaporkan kurangnya pohon shea, ketergantungan yang kuat pada pasar lokal sebesar 78,4%, serta tingkat ketidakpuasan yang tinggi sebesar 68,9%.Hasil penelitian menunjukkan adanya hubungan yang signifikan antara luas kepemilikan lahan dan hasil produksi berdasarkan Fisher's exact test sebesar 54,783 dengan $p < 0,001$. Hubungan yang signifikan juga ditemukan

antara biaya produksi dan luas kepemilikan lahan berdasarkan ANOVA, dengan nilai F = 3,915 dan p = 0,004, serta antara hasil produksi dan praktik pemanenan, dengan nilai F = 2,961 dan p = 0,032. Kendala utama yang dihadapi meliputi ketidakpastian hak atas lahan sebesar 71,9%, keterbatasan peralatan sebesar 42,0%, dan terbatasnya akses terhadap input produksi sebesar 38,1%. Rekomendasi kebijakan yang diajukan mencakup reformasi lahan, peningkatan investasi infrastruktur, penguatan koperasi, serta pengembangan program yang responsif terhadap isu gender.

Kata kunci: *hak atas lahan; hasil produksi; inefisiensi; luas kepemilikan lahan*

INTRODUCTION

Shea business is a major source of livelihood for hundreds of thousands of rural women in northern Ghana. Its value chain is an important factor that should be analyzed in detail to develop interventions that can increase its income, economic gains, and overall livelihoods. Climate change, agricultural expansion, and overexploitation of the Shea trees are the main challenges to the population (Issaka et al., 2016). The study is a direct response to the issue of sustainability, as it examines perceptions of resource depletion and existing resource-harvesting practices, thus providing a foundation for suggestions on how the management of the parklands can be applied sustainably.

The industry is characterized by low productivity, a lack of value addition, and limited market access. This study fills a major gap in the literature by statistically examining these related issues (e.g., the correlation between land tenure and yields) to identify the specific leverage points for policy and investment (Opoku-Mensah et al., 2024). Although there are qualitative studies, the current research offers strong quantitative data from 402 actors in four districts, which can be statistically generalized to a profile of the Shea value chain. It empirically verifies or refutes the assumptions of more general theoretical models, such as new institutional economics and value chain analysis, in the specific case of the Ghanaian Shea sector.

Every exchange production process is a systematic aggregation of inputs: land, labor, capital, and entrepreneurship in the production of outputs. This process is deeply entrenched in a particular ecological and socio-economic environment for agricultural products such as Shea. Vitellaria paradoxa, the Shea tree, is a native of the savanna belt of sub-Saharan Africa, and its nuts are an important source of economic and cultural value. Shea trees, found in the natural forest ecosystem of Northern Ghana, have been conserved as part of centuries-old traditional agricultural parkland systems. These scenarios not only provide nuts but also serve as important carbon stores and help increase the resilience of surrounding ecosystems to climate change (Green Climate Fund, 2020).

Shea nut harvesting and processing is largely a women-dominated venture and a lifeline for millions in the area who depend on it for economic self-sufficiency. Nonetheless, this old regime is facing mounting challenges due to global warming, the mechanization of agricultural practices, and the increased demand to use wood to produce charcoal and fuel. These forces threaten the Shea ecosystem and, by default, the livelihoods that rely on it (Green Climate Fund, 2020). Any agro-commodity system, including the Shea agro-commodity system in Northern Ghana, should be

described in detail by specifying the intersecting processes that link primary inputs to end markets. This requires mapping those production, processing, and distribution elements that comprise its agribusiness value chain.

Several aspects of this system have been researched in the past. In his study of the implementation of permaculture in Tumu, Upper West Ghana, Davis (2018) employed a mixed-method approach, determining the presence of the existing permaculture aspects in the Shea ecosystem, but also pointing out a profound deficit in efficiency within the management of the supply chains. It was discovered that production is usually personalized, done by women in their compounds, and is hampered by inadequate infrastructure. It found that collaborative empowerment and infrastructure upgrades could significantly improve the supply chain (Lehigh University, 2018). Naangmenyele et al. (2023), in their triangulated study of five cooperatives, provides further granularity by carefully quantifying the input-output structure of Shea butter processing. They found that, in a cost-benefit analysis, cooperatives allow for scale, but profitability is low due to high kernel costs and process inefficiencies, and to negative environmental externalities from waste and the use of fuelwood.

The shea industry in Northern Ghana is a vital source of livelihood, primarily for women, and is closely connected to the ecological and socio-economic landscape. The shea crop production and distribution systems, however, face a few major interrelated challenges, posing a threat to their sustainability and the economic well-being of the actors involved. The available literature and initial evidence indicate a low-productivity system with little value addition and unsustainable practices. Some of the major problems are insecure land tenure, lack of modern equipment and improved production methods, limited access to markets, and the prevalence of low-value sales of raw materials. These reasons lead to a low-productivity trap, whereby even established and experienced producers cannot invest in enhancing productivity, receive fair value, or guarantee a healthy future for the shea tree population. Although different researchers have already given factors about this system, there is a necessity to have an in-depth, empirical study that will quantitatively map out the entire value chain, determine the particular inefficiencies and their interaction with each other, and give an overall picture of the systemic obstacles to a more sustainable and equitable Shea industry in Northern Ghana (Alhassan, 2020).

The main objective is to examine the shea value chain in four districts. The specific objectives are to map the production/distribution characteristics, identify inefficiencies, test relationships between variables, and propose policy suggestions such as land reform and cooperatives. This paper fills gaps in the empirical literature using big data, confirming the applicability of theories such as rent in the Ghanaian context. It provides evidence-based interventions in sustainability, women's empowerment, and policy (e.g., infrastructure, gender programs), increasing incomes despite tree losses and low yields. Results guide NGOs, the government, and exporters, promoting the fair development of an important export industry.

THEORETICAL LITERATURE REVIEW

This literature review discusses the shea production and distribution system in Northern Ghana, combining the empirical research, theoretical framework, and gaps. It addresses the ecological grounds, the demographics of actors, practices, challenges, correlations of variables, and policy implications.

Shea Production Systems in Ghana

Shea tree (*Vitellaria paradoxa*) is a native plant of sub-Saharan Africa (Boffa, 2015). It thrives in the Northern, Upper East, Upper West, and Savannah Regions of Ghana in traditional agricultural parklands (Green Climate Fund, 2020). The benefits of these parklands include nuts, carbon sequestration, soil fertility, microclimate control, and biodiversity (Green Climate Fund, 2020). Shea landscapes store ~54 million tons of carbon (Green Climate Fund, 2020). By 2050, climate change can reduce suitable habitat by 30-50 percent (Naughton et al., 2015). LeMay & McMahon (2026). The economy of the United States is heavily dependent on the small and medium-sized enterprises (SMEs). Most employees of SMEs make up the private sector workforce. The percentage of all importing firms is 97%, with SMEs accounting for the majority. These companies require worldwide supply chains to support their business models; thus, they are most affected by changes in trade policies, which Shea entrepreneurs can emulate.

Characteristics and Demographics

Over 90% of nut collection and primary processing are done by women (Mushimiyimana & Buheji, 2024). Shea earnings are 35-60% of the household cash income (UDS, 2019). Producers are largely middle-aged and well-versed in traditional techniques but not highly educated; younger women are moving to towns Davis (2018). More than 70% are not educated, which restricts their access to the market (Opoku – Mensah, 2023).

Conventional harvesting (May- August) consists of picking fallen nuts, which is labor-intensive and causes less damage to trees (Boffa, 2015). The productivity can be increased 30-40%, but it can damage fruits due to the tools (Lehigh University, 2018). Women work on customary tenure (2-5 hectares) on smallholdings, which are frequently mediated by male kin (Tom-Dery et al., 2018). Conventional processing obtains 45-50% butter, 12-15 person-days/100 kg kernels, 1.5-2 kg fuel wood/kg butter and 20-25 liters water/kg butter (Naangmenyele et al., 2023).

Markets are local/rural, district, wholesale (Tamale, Bolgatanga), direct to processors/exporters and joint marketing. Local prices are 30-50% lower (Opoku – Mensah, 2023). Lack of access to better markets is caused by poor roads, insufficient transport, and high costs (Mogale, 2020; Yadav et al., 2022). The prices and information are manipulated by middlemen; cooperatives suggested

(Solidaridad Network, 2022). Incomes can be boosted 200-300 percent with value addition (butter) (Tree Aid, 2025). 2.2 Issues and inefficiencies in the Shea Value Chain.

Women have no rights to plant or to control trees (Green Climate Fund, 2020). Three-quarters of women are insecure due to divorce/widowhood, male-led agricultural growth, and lack of payment for tree-cutting (Awo & Yeboah, 2018). Weak tenure decreases conservation incentives (FAO, 2021). Technology and financial constraints: 15% have mechanical kneaders, less than 10% have better roasters; the rest use mortar/pestle. The yield might be increased by 15-20 percent, and 60-70 percent of the labor might be saved (Naangmenyele et al., 2023). The lack of inputs (bags, containers, gloves, drying places, testing equipment) impacts quality (Solidaridad Network, 2022).

Shea trees have reduced by 15-20 per cent over 20 years; bushfires, land conversion, regeneration deficiency are the threats (Green Climate Fund, 2020). The climate change can reduce the habitat (Naughton et al., 2015). Picking unripe nuts, breaking branches, fire clearing is some of the unsustainable practices Davis (2018). Traditional processing requires 1.5-2 kg fuel wood/kg butter; waste is 60-70% of kernel weight (Naangmenyele et al., 2023).

The producers do not have any price information; the intermediaries take advantage of the asymmetry (Opoku – Mensah, 2023). Transport costs incurred by remote producers are 15-25% sales value and 20-40% lower prices (Tree Aid, 2025). Cooperatives are feeble, unstructured, and badly managed (Davis, 2018; Naangmenyele et al., 2023).

Shea income is usually below minimum wage; Women experience low returns, seasonality, income sharing, and asset deficit (Mushimiyimana & Buheji, 2024). Three out of four women say their husbands make key spending decisions; just a quarter of women have ultimate authority over land use; fewer than one-fifth of women are involved in community natural resource decisions (UDS, 2019).

Gaps in the Literature and the Study Contribution

Most studies are qualitative or small-scale (Davis, 2018; Naangmenyele et al., 2023). This research four districts in Northern Ghana, with 402 Shea actors been utilized. Earlier studies have addressed single issues related to women's empowerment. This study has included the production and distribution system, as well as its sustainability. The previous studies have not comprehensively integrated empirical findings with relevant economic and management theories.

RESEARCH METHODS

This paper was a mixed study that integrated primary quantitative survey findings from 402 participants with qualitative findings from a secondary literature review and discussions with four regulatory officers. The quantitative element characterized the features, practices, and relationships among variables (e.g., landholding-yields, harvesting-yields), whereas the qualitative element added context and triangulation (Irianto et al., 2026).

The sample was disproportionally/purposely chosen to collect data on the value chain actor's shea (harvesters, processors, distributors, group leaders) in four districts (Tolon/Kumbungu, Fumbisi, Savulugu/Nantong, Sagnarigu) in the season of 2025-2026. Inclusion criteria were active participation, 18 years of age, and informed consent; exclusion criteria included non-participants, underage, and individuals who could not complete surveys. The size of the sample (n=402) was calculated based on the formula used by Yamane to calculate the population of 480,000 shea farmers with a non-response. The sampling procedure was disproportionate, involving purposive selection of districts, identification of communities through extension officers, and convenience sampling of willing participants (Etikan et al., 2016). The criteria used in including the respondents in the study were that, they had to be actively engaged in the shea value chain (one as harvesters, processors, distributors, or group leaders) in the chosen four districts of Northern Ghana, in the 2025-2026 harvesting season. The subjects were required to be 18 years old and to sign an informed consent. The research excluded those not directly involved in shea-related activities, those under 18 years, and those who could neither participate in the survey interview nor provide complete information to the researcher.

SPSS was used in quantitative analysis in three steps: (1) descriptive statistics (frequency, percentages) to profile the respondents; (2) bivariate tests (chi-square/Fisher Exact) to determine the association between land yields (Uyanto, 2009). Assumption breaches were supported by Fisher's Exact and Levene tests; reliability was supported by structured survey heart questionnaires.

Strict ethical guidelines to keep participants informed about the study's goals, ensuring they could join voluntarily and withdraw at any time without facing any negative consequences. Everyone gave their informed consent, and we took steps to anonymize the data to protect personal identities. The structured questionnaire, which was delivered through survey heart, was designed to be non-intrusive and kept everything confidential.

RESULTS AND DISCUSSION

Descriptive Statistics

The industry is predominantly women-dominated (94.8%), reflecting the traditional role of women in shea nut processing in rural West Africa. The results of this study are in line with Davis (2018) the fact that women's participation is higher. The workforce is largely composed of mature and middle-aged individuals, with 80.1% aged between 36 and 55 years. Younger workers (18–35 years) account for 18.4%, while older individuals (56 years and above) represent only 1.5% of the workforce.

The literacy level among participants is extremely low, with 75.1% having no formal education and only 1.5% attaining tertiary education. This indicates a strong reliance on traditional knowledge rather than formal agribusiness expertise, as shown in Table 1.

Table 1. Demographic Profile

Characteristic	Category	Frequency	Percentage
Gender	Female	381	94.8
	Male	21	5.2
Age	18-25 years	8	2.0
	26-35 years	66	16.4
	36-45 years	227	56.5
	46-55 years	95	23.6
	56-65 years	6	1.5
Education	No formal education	302	75.1
	Primary	68	16.9
	Secondary	26	6.5
	Tertiary	6	1.5
Primary Role	Farmer/Producer	240	59.7
	Processor	101	25.1
	Distributor/Retailer	46	11.4
	Group Leader	7	1.7
	Regulator	8	2.0

Source: Authors' Descriptive Statistical Analysis (2026)

The value chain is primarily grassroots-based, with producers/farmers (59.7%) and processors (25.1%) accounting for the largest shares, followed by traders (11.4%), regulators (2.0%), and group leaders (1.7%). The sample is predominantly composed of rural, middle-aged, and less-educated women engaged in farming and processing activities (Elias & Arora-Jonsson, 2017). This suggests the need for gender-specific training programs and mechanization initiatives to improve efficiency and productivity.

Table 2. Production System Characteristics

Parameter	Category	Frequency	Percentage
Harvesting Method	Using tools	194	48.3
	Manual picking	187	46.5
	Semi-cultivation	5	1.2
	Plantation	16	4.0
Land Holding Size	1-3 hectares	55	13.7
	4-6 hectares	271	67.4
	7-9 hectares	69	17.2
	9-11 hectares	6	1.5
	>12 hectares	1	0.2
Annual Yields	1-2 MT	105	26.1
	2-3 MT	247	61.4
	3-4 MT	47	11.7
	4-5 MT	2	0.5
	>5 MT	1	0.2
Production Cost	<500 GhC	12	3.0
	500-1000 GhC	130	32.3
	1000-2000 GhC	230	57.2
	>2000 GhC	30	7.5

Source: Authors' Descriptive Statistical Analysis (2026)

Table 2 shows that tool-based picking (48.3%) slightly surpasses manual picking (46.5%), together accounting for 94.8% of the harvesting methods used. In contrast, semi-cultivation (1.2%) and plantation farming (4.0%) remain uncommon. This trend indicates a gradual shift toward mechanization in response to labor shortages (Takeshima & Liu, 2020). Meanwhile, small to medium-scale farms dominate the sector, with 67.4% of farms ranging from 4–6 hectares and 17.2% ranging from 7–9 hectares. Larger farms (>9 hectares) account for less than 2% of the total, limiting the potential for economies of scale. Agricultural landholdings are larger than in developing countries, including Indonesia, where the agricultural sector is predominantly characterized by smallholder farmers with relatively limited land areas (Lowder et al., 2016).

Intermediate production output dominates the sector, with 61.4% of respondents producing 2–3 MT and 26.1% producing 1–2 MT, together accounting for 87.5% of total production levels. High production levels (>3 MT) are relatively limited, representing only 12.4% of respondents, indicating a low prevalence of high-intensity production systems.

Mid-range earnings also predominate, with 57.2% earning between 1000–2000 GhC and 32.3% earning between 500–1000 GhC, together accounting for 89.5% of respondents. Only a small proportion reported low earnings (<500 GhC: 3%) or high earnings (>2000 GhC: 7.5%). This suggests that the business operates within a relatively narrow profit margin and may be vulnerable to increases in input costs. Overall, shea production combines traditional practices with emerging technologies on predominantly medium-scale farms with moderate incomes. Ghanaian agribusiness, therefore, has significant potential for large-scale mechanization, yield improvement, and cost-efficiency incentives to enhance long-term sustainability (Abdul-Mumeen et al., 2019).

Table 3 shows that fresh nuts (37.1%), dried kernels (30.1%), and semi-processed products (23.1%) are the predominant product forms in the value chain. However, the proportion of fully value-added products remains low (9.7%), indicating limited participation in higher-value stages of the value chain and restricting revenue generation. Regarding transportation, hired tricycles are the primary mode of transport (47.3%), followed by bicycles/motorbikes (26.6%), head loading (13.4%), trucks (10.9%), and buyer pickup services (1.7%). The findings of this study are consistent with those of Opoku-Mensah et al. (2024), who found that the majority of actors in Northern Ghana continue to operate in low-value-added activities, particularly the sale of raw shea nuts and dried kernels, while participation in advanced processing stages remains limited.

In terms of market reach, local markets dominate distribution channels (78.4%), while town/municipal markets (46.3%) and regional markets (43.0%) also play significant roles. In contrast, participation in national (12.7%) and export markets (7.0%) remains relatively low, reflecting the localized nature of trade and limiting access to high-value buyers. These findings are consistent with Opoku-Mensah et al. (2024), who found that the majority of shea actors in Northern Ghana continue to face constraints in market upgrading due to low quality standardization, limited access to market information, weak linkages with major buyers, and inadequate processing capacity.

Table 3. Distribution System Characteristics

Parameter	Category	Frequency	Percentage
	Fresh nuts	149	37.1
Form of Sale	Dried kernel	93	23.1
	Semi-processed	121	30.1
	Fully processed	39	9.7
	Head load	54	13.4
Transportation	Bicycle/Motorbike	107	26.6
	Hired tricycle	190	47.3
	Hired truck	44	10.9
	Buyer pickup	7	1.7
	Local market	315	78.4
	Town/Municipal	186	46.3
Market Place	Regional market	173	43.0
	National buyer	51	12.7
	Export company	28	7.0
Channel	Very dissatisfied	140	34.8
Satisfaction	Dissatisfied	137	34.1
	Neutral	27	6.7
	Satisfied	66	16.4
	Very satisfied	32	8.0

Source: Descriptive Statistical Analysis (2026)

Regarding satisfaction, many respondents reported dissatisfaction: 34.8% were very dissatisfied, and 34.1% were dissatisfied, for a combined dissatisfaction rate of 68.9%. In contrast, only 24.4% reported being satisfied or very satisfied. This finding indicates systemic challenges within the sector, including low prices, inadequate infrastructure, and exploitation by middlemen (Bup et al., 2014).

Poor transportation systems localized and informal distribution networks, and limited processing activities appear to be the major sources of dissatisfaction. These issues highlight key areas for intervention to strengthen the shea sector and enhance its contribution to rural economies in Ghana.

Understanding the Production System of Shea

The most popular harvesting method is manual picking (48.3%), followed by tools (46.5%). Semi-cultivation (4.0%) and plantation farming (1.2) are hardly practiced. The high usage of manual picking implies that the method is labor-intensive and can be an inefficient method of operation and reduce yields. Encouraging the use of modern harvesting tools may enhance efficiency. The findings of this study are consistent with Pouliot (2012), who explained that shea trees in West Africa are still largely derived from wild parklands and have not yet developed into intensive plantation cultivation systems due to the slow growth of the trees and weak domestic investment.

Most (67.4) of the respondents have a cultivated hectare of 4-6, only 0.2% have a hectare of over 12 hectares. Economies of scale may be limited by smaller landholdings. The efficiency and profitability of land might be improved by promoting collaborative farming or forming land groups. These findings are consistent with Lowder et al. (2016), who found that the agricultural sector in

developing countries is predominantly dominated by smallholder farmers with relatively limited landholdings, thereby constraining the capacity for farm expansion and production modernization.

Most units achieve moderate yields of 2-3 MT, with 247 units falling in this range, far outpacing others and indicating this as the common productivity level. Lower yields (1-2 MT) occur in 105 units, while 3-4 MT appear in 47 units, showing fewer high performers. Very low (4-5 MT) or high (5+ MT) yields are rare, with only 2 and 1 units, respectively. The findings indicate that most production units operate at moderate productivity levels, while only a limited number achieve high yields. This pattern is consistent with previous studies reporting that shea production systems in Northern Ghana are still characterized by relatively low to moderate productivity due to limited mechanization, traditional production methods, and inadequate technological upgrading (Naangmenyele et al., 2023). Similarly, Lovett (2004) noted that small-scale shea actors often face constraints in processing capacity, labor, and access to inputs, thereby limiting the number of high-performing units. The rarity of very high yields may also reflect the continued dependence on naturally occurring shea parklands and low levels of production intensification in West Africa (Pouliot, 2012). These conditions collectively indicate the persistence of productivity and efficiency gaps within the shea value chain (Opoku-Mensah et al., 2024).

Most of the respondents (57.2%) state costs between $1,000 and $ 2,000, which is a moderate investment. The reliance on moderate capital investments highlights the need for financial assistance and access to credit for producers so they can invest in improved techniques and equipment. The findings indicate that most respondents operate with moderate levels of capital investment, suggesting limited financial capacity among the shea value chain actors. This result is consistent with Lovett (2004)that of, who reported that small-scale shea producers in West Africa generally face capital constraints that limit investment in modern processing technologies. Similarly, Alhassan (2020)identified inadequate access to credit and high equipment costs as major barriers affecting shea processors in Northern Ghana. The reliance on moderate capital investments may therefore restrict technological upgrading and production efficiency, as also observed by Naangmenyele et al. (2023). Consequently, improving access to financial assistance and credit facilities could enhance investment capacity and facilitate value chain upgrading among shea producers (Opoku-Mensah et al., 2024).

Understanding the Distribution System of Shea

Most respondents sell fresh nuts (37.1%) and semi-processed butter (30.1%). The dominance of fresh nut sales indicates limited value addition, suggesting significant opportunities to expand processing capacity and increase profit margins. This condition is illustrated in Figure 1.

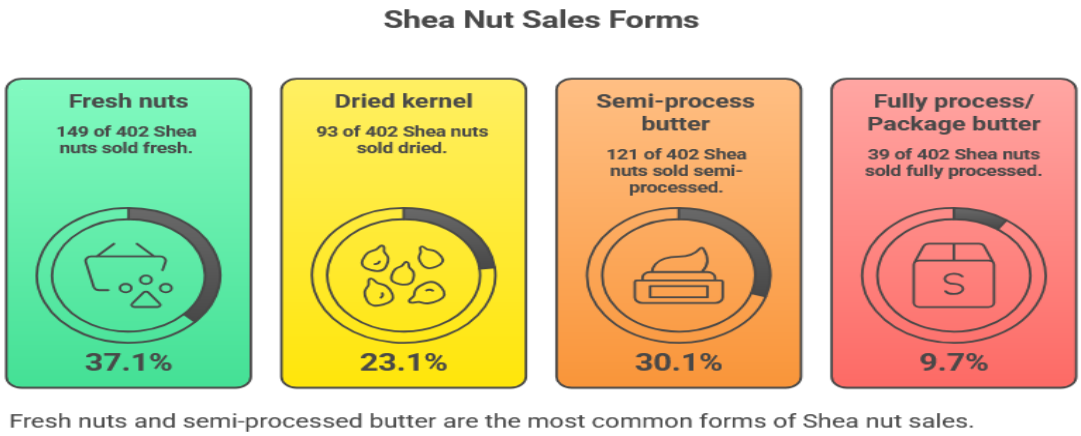

Figure 1. Shea Nuts Sales Forms (*Napkin AI design, 2026)*

The main method of transporting shea products to market centers is the use of hired tricycles, utilized by 47.3% of respondents, followed by bicycles and motorbikes (26.6%). These transportation methods highlight existing logistical challenges that may affect the timely delivery of products to markets and suggest the need for improved infrastructure and more efficient transportation systems. The findings indicate that fresh nuts and semi-processed butter remain the dominant products traded within the shea value chain, reflecting a relatively low level of value addition. This result is consistent with Opoku-Mensah et al. (2024) that of, who found that most shea actors in Northern Ghana continue to engage primarily in low-value-added activities involving raw nuts and semi-processed products. Similarly, Lovett (2004) reported that limited processing capacity and inadequate technological upgrading constrain participation in higher-value markets. The predominance of hired tricycles, bicycles, and motorbikes as modes of transportation further highlights the infrastructural and logistical limitations faced by rural shea producers. Comparable findings were reported by Bup et al. (2014), and Elias & Carney (2007), who noted that inadequate transport infrastructure and reliance on informal logistics systems continue to affect market accessibility and distribution efficiency within the shea industry.

For Shea, the major selling points are local markets (78.4%). Dependence on domestic markets might limit market access and price flexibility; exploring national or regional market opportunities might increase profits.

Sustainability and Its Challenges

The greatest problem is the land tenure system (71.9%), the second is the absence of equipment (42.0%), and the third is the limited access to inputs (38.1%). It is important to address the land tenure system in order to stabilize production. Investment in the equipment and access to inputs is also required to enhance productivity and sustainability, see Table 4.

Table 4. Perception in the Industry

Perception Topic	Response Category	Frequency (n)	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Adaptation to improve farming techniques	1. Strongly Disagree	142	35.3	35.3	35.3
	2. Disagree	133	33.1	33.1	68.4
	3. Neutral	26	6.5	6.5	74.9
	4. Agree	53	13.2	13.2	88.1
	5. Strongly Agree	48	11.9	11.9	100.0
Cultural limit on women participation	1. Strongly Disagree	109	27.1	27.1	27.1
	2. Disagree	162	40.3	40.3	67.4
	3. Neutral	31	7.7	7.7	75.1
	4. Agree	68	16.9	16.9	92.0
	5. Strongly Agree	32	8.0	8.0	100.0
Government or NGOs support	1. Strongly Disagree	134	33.3	33.3	33.3
	2. Disagree	117	29.1	29.1	62.4
	3. Neutral	29	7.2	7.2	69.7
	4. Agree	86	21.4	21.4	91.0
	5. Strongly Agree	36	9.0	9.0	100.0

Source: Descriptive Statistical Analysis of Author (2026)

The most urgent issue is the perceived shortage of shea trees, with 69.9% of respondents reporting that shea trees are not easily available. This poses a direct threat to the long-term sustainability of the industry. The findings indicate that land tenure insecurity remains the most critical challenge affecting the shea industry in Northern Ghana. This result is consistent with (Gilli et al., 2020), who reported that unclear land and tree tenure systems significantly constrain access to shea resources and long-term investment decisions. Similarly, the limited availability of equipment and production inputs supports previous findings that inadequate access to technology continues to reduce productivity and operational efficiency within the shea value chain (Naangmenyele et al., 2023). Furthermore, the reported shortage of shea trees reflects broader sustainability concerns associated with declining parkland resources, land degradation, and insufficient natural regeneration, as previously highlighted by Pouliot (2012) and Elias & Carney (2007). These challenges collectively threaten the long-term sustainability and resilience of the shea industry.

Harvesting practices generally lack sustainability. Although 65.1% of respondents practice basic conservation methods, such as protecting shea trees or using natural harvesting techniques, only a small proportion engage in regeneration activities (21.6%) or carbon sequestration practices (8.5%). These limited sustainability efforts may contribute to the increasing scarcity of shea trees. The findings suggest that sustainability practices within the shea value chain remain relatively limited and are largely confined to basic conservation measures. This result is consistent with Pouliot (2012), who reported that most shea producers in West Africa rely primarily on simple tree protection practices rather than long-term sustainability strategies. Similarly, the limited adoption of carbon sequestration practices indicates that the environmental potential of shea-based agroforestry systems remains underutilized, despite their recognized role in climate change mitigation (Bayala et al., 2015).

A critical institutional challenge is the low level of satisfaction with support from government and non-governmental organizations, with 62.4% of respondents rating such support poorly. The lack of institutional assistance may explain the limited adoption of improved farming and sustainable harvesting practices. Due to inadequate support systems, 68.4% of farmers have not adopted improved farming methods. This low adoption rate may be attributed to significant barriers, including limited access to information, insufficient resources, and a lack of trust in new practices.

In contrast, 67.4% of respondents disagreed that cultural barriers hinder women's participation in the shea trade. This suggests that economic and resource-related constraints are more significant barriers than cultural factors. The findings indicate that cultural barriers are not widely perceived as a major constraint to women's participation in the shea trade. Instead, respondents identified economic and resource-related limitations as more significant challenges. This result is consistent with Alhassan (2020) that of Opoku-Mensah et al. (2024), who found that inadequate access to capital, equipment, and market opportunities constitutes the primary obstacle facing women in the shea value chain. However, the findings partially differ from earlier studies Elias & Carney (2007), which emphasized the gendered nature of the shea industry and the structural inequalities affecting women's control over productive resources. The present findings may therefore indicate a gradual shift in the nature of barriers faced by women, from predominantly socio-cultural constraints to more economic and institutional limitations (Zakaria et al., 2021).

Correlation between Land Holding Size and Average Annual Yields

Chi-square tests (Table 5) and Fisher's exact test summary (Table 6) of farm size landholding and annual yields. There is an association between land size categories and yield categories (e.g., larger farms can have different yield patterns). Ideal chi-square assumptions (no small, expected cells, min=80.4-100.5). The chi-square test must have expected frequencies of at least 5 in at least 80% of the cells, and no less than 1 expected frequency.

Table 5. Chi-Square Test

	Size Landholding	Annual Yields
Chi-Square	608.746[a]	852.905[b]
df	4	3
Asymp. Sig.	.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 80.4.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 100.5.

Source: Authors' Statistical Analysis (2026)

The idea here is that the yields are sensitive to the size of the land as indicated by the large correlation. However, the tendency is that land is a key variable, yet yield per hectare is low across all

the categories. Larger/smaller farms have different yield distributions. Farm inputs, probably owing to economies of scale, fit the analysis of agricultural economics.

Table 6. Fisher's Exact Test

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Size Landholding * Annual Yields	402	100.0%	0	0.0%	402	100.0%

Source: Statistical Analysis (2026)

The findings indicate a significant association between landholding size and annual yield categories, suggesting that differences in farm size may influence production outcomes. This result is consistent with previous studies demonstrating that larger landholdings often provide greater opportunities for input utilization, mechanization, and production efficiency (Muyanga & Jayne, 2014). Similarly, Lowder et al. (2016) reported that smallholder farming systems in developing countries often experience productivity limitations due to restricted land access and resource constraints. The observed relationship between farm size and yield patterns further supports findings by Liverpool-Tasie et al. (2020), who highlighted the importance of production assets in improving agricultural productivity and market participation.

CONCLUSION

This study combined different research methods. It uncovered a sector that is predominantly female but struggling with low productivity. On average, those working on 4-6 hectares of land are only producing 2-3 metric tons annually. Most harvesting is done manually or with low-tech methods, and a significant portion of sales occurs locally, yet there's a high level of dissatisfaction among the actors. The main challenges they face include insecure land tenure, a lack of equipment, barriers to accessing inputs, and a scarcity of trees. The study found some significant relationships between landholding size and average annual yields.

Expanding the future research to cover all Northern regions using objective measures like verified yields and tree inventories, along with probability sampling. Dive into causal models, such as structural equations that link tenure, investment, and yields. Also, assess the cost-benefit of various interventions, including cooperatives and technology adoption, as well as the climate impacts, using panel data; examine downstream processors and exporters; and conduct comparative studies with other Shea-producing countries to better paint the picture of the Shea sector in Ghana.

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