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Economic empowerment among female shea actors: the case of Savelugu District, Ghana

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ABSTRACT

The shea industry is a catalyst for the economic empowerment of women engaged in this sector. However, we do not know the extent to which women actors are economically empowered along this value chain, and the factors impeding their empowerment. Addressing this is crucial to developing policies in advancing the economic empowerment of female shea actors. This study aims to assess the extent to which the shea industry economically empowers female shea actors. We utilized a convergent mixed-methods approach, gathering quantitative data from 384 female shea actors (including producers, collectors, and marketers) and qualitative data from 12 experienced older women in the industry, making an overall sample of 396. The qualitative data underwent thematic analysis, while the quantitative data were subjected to the non-parametric Kruskal-Wallis test to compare the level of economic empowerment among the three groups of shea actors. We found significant differences among the three groups of shea actors (χ^2 (2) = 75.266, p = 0.000). Collectors had a mean rank of 236.60, marketers had a mean rank of 131.24, and producers had a mean rank of 205.31; showing economic empowerment varies among the shea actors. However, they face challenges of inaccessibility to land, finance, and markets, as well as inadequate storage facilities that affect their operations. We recommend that the shea actors join or form groups to increase their access to loans, and control over prices, while development agents (both statutory and non-statutory) must improve access to lands, finance, and storage facilities.

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1. Background

The shea tree, which belongs to the *Sapotaceae* family, is indigenous to the African continent (Jakpa et al., 2018). The tree is commonly found in the wild wooded savannah belts of West and East Africa (Amegah et al., 2019; Chen, 2017). The shea tree with its fruits provides a wide range of uses including oil for cooking, medicine for the treatment of diseases, cosmetics for the skin, cocoa butter equivalents for the production of chocolate, and many more products. According to Borketey-La et al. (2019), about 9.4 million shea trees grow naturally in the northern regions of Ghana. The shea industry thus constitutes one of the major employment avenues that involve large numbers of women aside from food vending, pito making, soap making, and petty trading, justifying the industry's importance as a tool for empowering women. Studies conducted by Abdul-Mumeen et al. (2019), revealed that the shea industry employs about 900,000 women who are normally found in cooperative groups. The most basic benefits this industry offers to women include jobs and income to support their needs and those of their households (Abdul-Mumeen et al., 2019).

According to the Organisation for Economic Co-operation and Development (OECD) cited by Addai (2017), economic empowerment denotes access to and the power to make choices and decisions that

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pertain to the credits or savings possessed by an individual. To Tang (2022), women's economic empowerment entails promoting equal opportunities for women in education, employment, and business ventures, ensuring fair wages, and facilitating their access to financial services, all to achieve gender equality. The achievement of economic empowerment may take the form of education, health, nutrition, or accommodation that positions the individual well enough to fully function within society. Variables such as income, savings, access to and control over the market, raw materials, equipment, capital, credit, and storage facilities are often used to measure the economic empowerment of individuals (Addai, 2017).

In recent times, the shea industry has provided opportunities to women, especially in the fields of economic opportunities and empowerment. Some of the opportunities offered to these women include the ability to earn wages, which improves their social status in society. It has also contributed to the recognition of the financial role played by the wife in the family and subsequently led to changing gender norms and perceptions (Awuviri, 2017). In Ghana, specifically in the northern part, the shea industry is dominated by women and children who help in the collection and processing of shea into nuts for either direct sale or butter on a small scale (Laube, 2015; Mengba et al., 2022). This has, over the years, been a significant livelihood source, especially for women. The study of Tweneboah Kodua et al. (2018) highlighted the significance of the shea industry to the indigenous people of the Upper West Region in Ghana; about a quarter to half of the income of women has increased through their involvement in the shea value chain. According to Mohammed et al. (2016), some of the benefits gained in the shea industry include employment and income, which enable women to afford household needs, allowing them to contribute to decision-making both at the home and community levels. This has, however, not eliminated the challenges that have engulfed the industry, with shea collectors and shea butter producers, who occupy the bottom end of the shea value chain, benefiting less from their efforts.

These aforementioned studies on empowerment, including Arthur (2018), Chen (2017), and Naami and Naami (2019), have made valuable contributions to the understanding of gender dynamics and livelihoods within the context of shea production. However, Naami and Naami's (2019) research predominantly concentrated on gender-based land discrimination and women's limited access to shea processing equipment, lacking a comprehensive exploration of empowerment dimensions. Similarly, Arthur (2018) delved into the impact of value chain interventions on gender relations and livelihoods but specifically honed in on shea actors receiving support from the Netherlands' Development Association Organisation (SNV) and SeKaf Ghana Limited. While these studies provide valuable insights, this current research aims to offer a more comprehensive assessment of economic empowerment among female shea actors, encompassing a broader spectrum of challenges and opportunities along the shea value chain.

Our current knowledge about the shea industry and its potential for women's empowerment indicates that collectors can achieve a substantial 44% profit margin, equivalent to a net income of $162 per MT of kernel. Additionally, there are projections that the shea industry could rival the cocoa industry in Ghana, with shea butter emerging as a promising substitute for cocoa butter (Davrieux et al., 2010). This highlights the shea tree's status as one of the Non-Timber Forest Products (NTFPs) in the country, with significant coverage and the potential to empower a majority of women if strategically exploited (Boffa, 2016). The commercialization of shea nuts in northern Ghana holds particular importance because it provides access to cash during the lean season, a period when households often lack the capital for farming and sufficient food reserves. This suggests that commercializing shea nuts has the potential to alleviate poverty to some extent, offering women an opportunity to improve their livelihoods and escape from poverty (Collins et al., 2014). Moreover, econometric studies on the livelihoods of shea producers in Ghana (Hatskevich et al., 2011; Hatskevich & Essilfie, 2013) paint an optimistic picture of the transformative and poverty-reducing impact of shea commercialization. This perspective is echoed in ecological studies (Moore, 2008; Poudyal, 2011), and similar arguments are commonly found in public and political discourse in northern Ghana.

However, what remains unknown is the extent to which this potential translates into actual economic empowerment for women. While these studies emphasize the positive prospects, they often focus on the optimistic side of the shea industry's impact and have not provided a holistic examination of the challenges that women encounter in participating in and benefiting from the shea value chain. To gain a comprehensive understanding of women's empowerment in the shea industry, future research should

explore the actual extent of their economic empowerment and the barriers they face in pursuit of improved livelihoods (Hatskevich et al., 2011; Hatskevich & Essilfie, 2013).

This study aims to evaluate the degree of economic empowerment experienced by women engaged in the shea industry and to identify the specific factors that hinder their empowerment at different stages of the shea value chain. It is crucial to recognize that empowerment and gender equality are fundamental components of achieving the objectives outlined in Goals 5 and 10 of the post-2015 universal declaration, as articulated in the Sustainable Development Goals (SDGs). Consequently, this research makes a valuable contribution by informing policies and initiatives aimed at empowering women who participate in the shea industry. By shedding light on the challenges and opportunities within the shea value chain, this study can guide interventions that foster gender equality and economic empowerment, ultimately contributing to the broader agenda of sustainable development.

2. Theoretical framework

The main theories underpinning this work are the market-based theory, which argues that commercializing products, such as shea butter, can empower women by providing income-generating opportunities and promoting sustainable development, and Kabeer's (1999) concept of choice, which covers access to resources, agency, and achievement (Williams et al., 2022).

The market-based theory asserts that the commercialization of shea products can establish a sustainable pathway to empower women economically by creating market opportunities for them to vend their products and generate income. Furthermore, this theory posits that as the demand for shea products escalates, more women will engage in the production and sale of shea products, resulting in heightened economic empowerment among them. In this framework, market dynamics, including supply and demand, wield significant influence in shaping economic outcomes. In the context of shea products, the rising demand for natural and sustainable beauty items has opened up a market niche for shea products, traditionally cultivated and harvested by women in West Africa. Consequently, the commercialization of shea products stands as a potential avenue for empowering women by affording them an income source and enhancing their economic independence.

According to research conducted by the International Trade Centre (ITC) (2016), the majority of shea butter producers in West Africa are women. The study demonstrates that the commercialization of shea products can significantly enhance the livelihoods of these women. Notably, it found that women engaged in the production and marketing of shea products experienced increased incomes and greater involvement in household decision-making (ITC, 2016). Moreover, the commercialization of shea products can contribute to sustainable development by offering women an income source that does not rely on environmentally detrimental activities, such as logging or charcoal production. Furthermore, the commercialization of shea products can also foster conservation efforts by creating economic incentives for the preservation of shea trees, which constitute a valuable resource for local communities.

However, the ability of female shea actors to harness market opportunities and exert control over resources, negotiate favourable terms, and withstand manipulative practices hinges on their empowerment, which, in turn, hinges on their capacity to exercise choice. This necessitates the combination of market-based theory and the concept of choice to underscore the significance of both market dynamics and individual agency in fostering economic empowerment among women in the shea value chain, thereby offering a more holistic approach to addressing gender disparities and poverty reduction.

Kabeer (1999) theorises that one of the most fundamental concepts underpinning empowerment is the concept of choice. This involves the capacity for individuals to make decisions about their lives in situations where they previously lacked this ability, encompassing various aspects like access to resources, personal agency, and accomplishments (Buvinic, 2017; Kabeer, 2005). Proposing the exercise of this capacity to make choices in three ways, the significance of access to resources, agency, and achievements in the process is emphasized. These factors collectively contribute to the capacity to make decisions about lives in situations where such decisions were previously unattainable.

This paper's thesis relies on the idea that women, who have previously been denied the capability to make strategic life decisions, develop this capacity through their engagement in small-scale businesses such as shea nut processing (Addai, 2017). This process-based notion of empowerment stands in stark contrast to the more instrumentalist types of lobbying that have called for the measurement and quantification of empowerment. Resources (broadly conceptualized to include future claims to both human, material, and social resources) (Farnworth et al., 2013; Kumari, 2013); agency (including processes of decision-making in addition to less quantifiable expressions of agency such as negotiation, manipulation, and deception); and achievements are three interrelated dimensions that go into the ability to exercise choice (well-being outcomes). According to Kumari (2013), one of the most important strategies to empower women and address gender inequality is for them to be able to secure land rights. As a consequence, credit and microfinance will significantly contribute to guaranteeing women's economic empowerment, gender equality, poverty reduction, etc. if combined with additional interventions such as technology inputs. Setting objectives and carrying them out are observable behaviours that are implied by the agency. Through the combination of agency and resources, financial emancipation, the freedom to join groups or coalitions, the freedom to make personal decisions, recognition of women's rights, participation, and the recognition of women as development partners and allies in the decision-making process will be realized.

Using the concept of choice, we postulate that for female shea actors to reach their goal of economic empowerment, they must have direct and indirect control over resources, equivalent and proportionate to the levels at which they operate or desire to operate, develop the competency to negotiate better terms for themselves, and withstand and overcome manipulative and deceptive tendencies in their operations. Basic opportunities for disadvantaged people (in this case, female shea actors) will be attained through the process of empowerment, either by those individuals directly or with the support of non-marginalized individuals who share their access to these opportunities. Access to important resources and involvement in community life will lessen isolation and boost the women's competence and confidence as the empowerment process progresses, which will then lead to the development of self-reliance, self-determination, self-rule, and autonomy.

3. Methods and materials

3.1. Study setting

The Savelugu Municipality is located in Ghana's Northern Region and was established in 1988 as a separate entity from the Western Dagomba District Council. It became the Savelugu Municipal Assembly after the formation of the Nanton District. Covering an area of 1,599 square kilometres, it is bordered by the West Mamprusi Municipal, Sagnerigu Municipality, South Karaga, Nanton Districts, and Kumbungu District.

According to Alhassan (2020), the majority of the women population is into shea processing, aside from dawadawa processing, maize, and rice farming (see Figure 1). Shea collection, processing, and marketing remain one of the dominant economic activities reserved for women in the study area. To facilitate the processing of shea nuts, women in the study area, especially shea butter producers are normally found in groups. Some of the groups identified in the study area include the Sokpam, Nasara and Zii bi nyara (Unity is strength) women groups. The benefits received by women working in the group include access to financial aid and social interventions in the form of financial assistance, training and equipment, and sharing of ideas and innovations among others. Some of the corporate groups actively supporting female shea actors in the study area include the Savannah Accelerated Development Authority (SADA) now called Northern Development Authority (NDA), Savelugu Municipal Assembly and the Northern Sector Action on Awareness Center (NORSAAC). However, the major challenges often faced are access to capital and high interest on loans received from microfinance institutions. Exploring the economic empowerment potentials of the shea value chain on female shea actors is imperative in light of these challenges.

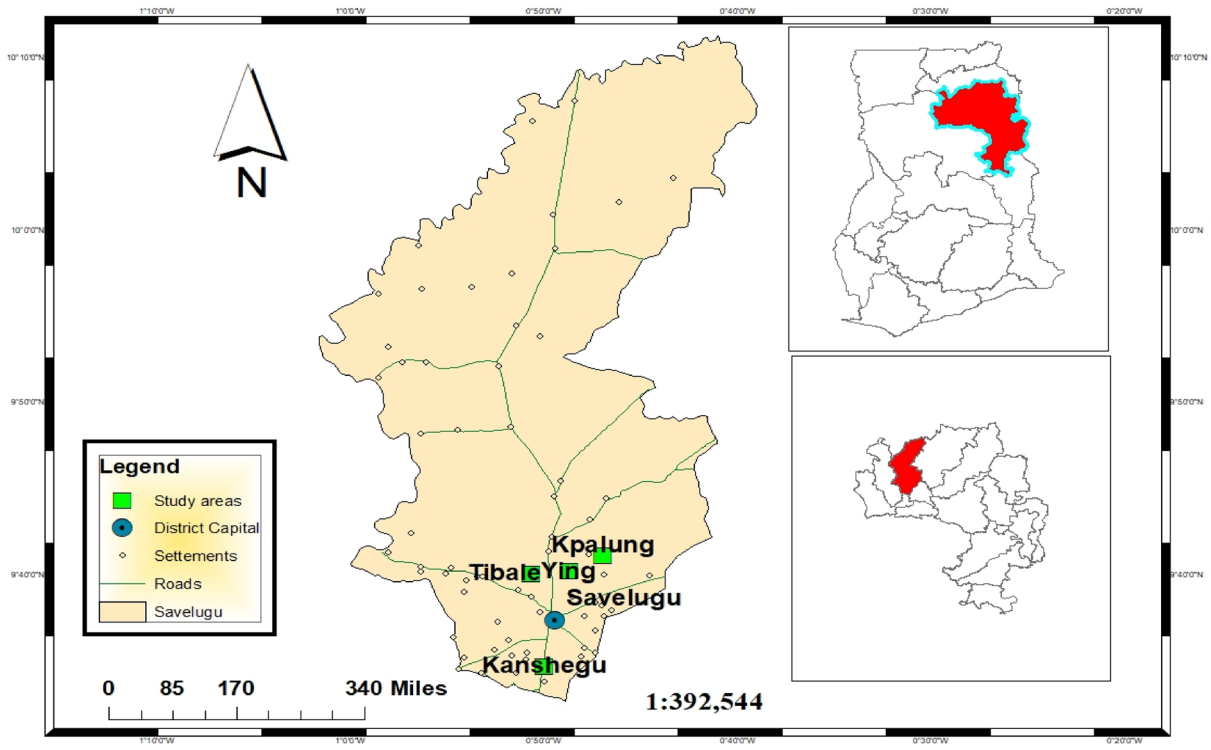

Figure 1. A map of Savelugu District showing the study area.
Adapted from Savelugu Physical Planning Department

3.2. Research design

A mixed method that allows researchers to collect and analyse both quantitative and qualitative data in a single study was adopted for the study (Creswell, 2012). Specifically, the convergent parallel design, which involves simultaneously conducting the quantitative and qualitative aspects during the same stage of the research process, giving equal weight to each approach, analysing the two parts separately, and combining the results, was employed (Creswell & Plano-Clark, 2011). The use of a mixed-methods approach in the study on economic empowerment among female shea actors in Savelugu District, Ghana, is relevant for several reasons. Firstly, it allows for a comprehensive understanding of the subject matter by integrating both quantitative and qualitative data, enabling a more holistic view of the economic dynamics involved. Secondly, the convergent parallel design employed ensures equal emphasis on both approaches, offering a nuanced exploration that goes beyond the limitations of a singular method. Lastly, this approach enhances the robustness of the study, as findings from quantitative and qualitative analyses can be triangulated, providing a more reliable and well-rounded interpretation of the research outcomes.

3.3. Population and sample size

It was difficult for the researcher to obtain the exact data of women who are into shea collection, processing and marketing in the Savelugu Municipal. For that reason, the formula for calculating an unknown population was adopted by the researcher.

To determine the sample size, the formula $\mathbf{n = (Z)^2/4(e^2)}$ where:

- n = Sample size
- Z = Level of confidence according to the standard normal distribution (for a level of confidence of 95%)
- e = margin of error

Therefore; $\mathbf{n = (1.96)^2/4(0.05)^2}$

$\mathbf{= 384.16}$

$\mathbf{n = 384}$

The study involved a sample of 384 shea actors, proportioned as 154 shea butter producers, with 115 each for shea collectors and shea marketers. This distribution was influenced by the greater accessibility of female shea butter producers compared to their counterparts in collecting and marketing. In addition to the quantitative data, 12 in-depth interviews were conducted to complement the quantitative findings, aligning with a convergent parallel mixed methods design. The 12 interviews were conducted separately from the 384 shea actors involved in the quantitative study, resulting in an overall sample of 396 shea actors. The quantitative component included 384 participants, while the qualitative part comprised 12 participants who met specific admission requirements. The study achieved a 95.04% response rate after incorporating a 5% non-response rate into the initial sample.

3.4. Participants and recruitment procedure

A two-stage sampling approach was employed. At stage one, the purposive sampling technique was adopted in selecting the study area and this was influenced by the dominance of the shea tree, prevalence of economic activities in shea butter processing and trading, rural characteristics as well as accessibility taking into consideration the distance, resources and time at the disposal of the researcher. Specifically, four communities were selected from the district which includes Tibale, Kanshegu Kpalung and Ying (Al-Hassan, 2012; Al-Hassan et al., 2011; Al-Hassan & Abubakari, 2005; Omane, 2014).

At stage two, snowball and purposive sampling were used to recruit the different categories of shea actors. Snowball was used to identify shea collectors because these actors are not clustered in one location and besides, they are difficult to come across. As a result, this created a room where the existing shea collectors recruited future collectors among their acquaintances (Ghaljaie et al., 2017). To avoid the oversampling of a network of peers, exponential discriminative snowball sampling was used. Of this, subjects provided multiple referrals, however, only one new subject was recruited among them. The choice of a new subject is guided by the aim and objectives of the study. Purposive sampling was used to identify shea producers and shea marketers. Shea butter producers and shea marketers because the researcher relies on her judgment. Shea butter producers include women who process the shea nut into shea butter to be sold irrespective of how the shea nut is obtained. Shea marketers also include women who sell either shea nut, butter or both in local markets but are not into collecting and processing the shea fruit into the nut and shea butter.

The research adopted a heterogeneous purposive sampling technique to deliberately select elderly women with a remarkable 30 years or more experience in the shea industry, allowing for a diverse selection of elderly women so that a wide range of perspectives, experiences, and insights are captured (Saunders, 2012). This approach was chosen to complement the quantitative data by capturing rich qualitative insights from seasoned female shea actors. Their extensive experience and perspectives provide valuable context and depth to the quantitative findings, offering a holistic understanding of the economic empowerment dynamics among women in the shea sector in the Savelugu District of Ghana.

'Face-to-face' interviews were conducted with the respondents using semi-structured questionnaires and an interview guide. The semi-structured questionnaires were used to obtain data from the 384 shea actors sampled, while the interview guide was administered to selected elderly women who have been in the shea industry for over 30 years to share their experiences and challenges. The quantitative data collection process involved the utilization of semi-structured questionnaires administered to the sampled 384 shea actors. The questionnaires were carefully designed to include both open-ended and close-ended questions, allowing for a more nuanced understanding of the economic dynamics among shea producers, collectors, and marketers. Trained enumerators conducted face-to-face interviews with each participant, ensuring standardized administration of the questionnaires and facilitating the collection of comprehensive data on various aspects of their involvement in the shea industry. Semi-structured questionnaires and face-to-face interviews were employed as participants required assistance in completing the questionnaire due to potential literacy challenges.

Table 1. Construct rating for economic empowerment.

	Rating variables	Rating time	Min	Max
Economic Empowerment	Average income: (Bishop, 2012) Income spending: (Bishop, 2012) Savings: (Bishop, 2012) Access to and control over assets: (Bishop, 2012; Bishop & Bowman, 2014) Access to social interventions: (Taylor & Pereznieto, 2014)	Low Moderate	10 25	24 39

The variables in the study were developed and measured in line with the theories and the conceptual framework underlying the study. To ensure the validity and accuracy of the study, we meticulously examined each variable. Additionally, we conducted a pretest among 10 women in the Savelugu-Kanshegu community. Corrections were promptly made to questions that lacked clarity during the pilot study, resulting in clear and unambiguous questions. In exploring the intricate dynamics of economic, social, and political empowerment among female shea collectors in Ghana, a comprehensive questionnaire was designed to gather nuanced insights into their lives. The questionnaire, organized into sections, delves into the 'characteristics of female shea collectors', their 'economic empowerment', 'social empowerment', and 'political empowerment'. Questions range from demographic details such as age, marital status, and education to economic factors like expenses in shea processing and income generation. The survey also probes into social aspects, unravelling roles in the family, decision-making participation, and perceptions of freedom. Lastly, the questionnaire explores political empowerment, encompassing community involvement, leadership experiences, and participation in advocacy groups. The tailored questions aim to provide a holistic understanding of the challenges and opportunities faced by female shea collectors in Ghana.

Between October 2021 and January 2022, the first author and three research assistants, all with extensive experience in qualitative data collection and a deep understanding of the research context and setting, conducted data collection. They audio-recorded the interviews and took field notes while ensuring adherence to ethical principles concerning consent and confidentiality throughout the study. In that regard, throughout the research process, the study maintained a strong commitment to ethical standards, including obtaining informed consent from participants and safeguarding the confidentiality of their information.

3.5. Analytical framework

As stated by Kabeer (1999), in measuring the economic empowerment of women, key variables to consider include income, savings, benefits from social interventions, access to and control over the market, raw materials, equipment, capital, credit and storage facilities. As shown in Table 1, each response was assigned a score which was summed and rated. A sum of 10 to 24 was considered low economic empowerment, between 25 and 39 equates moderate economic empowerment and between 40 and 60 equates high economic empowerment. Kruskal Wallis test was also used to present the significant difference in the economic empowerment between shea collectors, shea butter producers and shea marketers. Thematic analysis took precedence in the examination of qualitative data, primarily consisting of participants' quotations. This analysis was conducted following the well-established approach developed by Clarke and Braun (2021). It involved a systematic process of coding and identifying recurring themes within the dataset. Initially, the researchers familiarized themselves with the data, generated initial codes, and then collated these codes into potential themes (Clarke & Braun, 2021). These themes were further refined through a process of reviewing and defining their boundaries, and the final themes were named and organized to provide a comprehensive and structured understanding of the qualitative data collected in the study.

4. Results

4.1. Characteristics of the female shea actors

Table 2 shows details of the demographic characteristics of shea collectors, marketers and producers. The majority of the respondents (47.8% of collectors, 63.5% of marketers and 60.4% of producers) were in

Table 2. Demography of respondents.

		Collectors		Marketers		Producers	
	Type	Frequency	Percent	Frequency	Percent	Frequency	Percent
Age in years	16-30	55	47.8	39	33.9	26	16.9
	31-45	55	47.8	73	63.5	93	60.4
	46-60	5	4.4	3	2.6	34	22.1
	66 and above	0	0	0	0	1	0.6
Total		115	100	115	100	154	100
Marital Status	Single	8	7	1	0.9	3	1.9
	Cohabitating	2	1.7	2	1.7	0	0
	Married	103	89.6	112	97.4	148	96.1
	Widow	2	1.7	0	0	3	1.9
Total		115	100	115	100	154	100
Religion	Christianity	3	2.6	0	0	0	0
	Islamic	111	96.5	115	100	154	100
	Traditionalist	1	0.9	0	0	0	0
Total		115	100	115	100	154	100
Ethnic Group	Guan	1	0.9	0	0	1	0.6
	Mole Dagbani	113	98.2	115	100	153	99.4
	Others	1	0.9	0	0	0	0
Total		115	100	115	100	154	100
Level of Education	Basic	17	14.8	18	15.7	42	27.3
	Secondary/Vocational	0	0	0	0	6	3.9
	No Formal Education	98	85.2	97	84.3	106	68.8
Total		115	100	115	100	154	100
Household Size	1-5	2	1.7	19	16.5	0	0
	6-10	47	40.9	45	39.1	49	31.8
	11 and more	66	57.4	51	44.3	105	68.2
Total		115	100	115	100	154	100

the age group 31- 45 years. A very large proportion of the respondents were married: 89.6% of collectors, 97.4% of marketers and 96.1% of producers. With regards to the religious distribution, 96.5% of the collectors were Muslims while 100% of producers and marketers were Muslims. Referring to their ethnic background, 100% of marketers, 98.3% of collectors and 99.4% of producers belong to the Mole-Dagbani ethnic group. Of the respondents interviewed, 85.2%, 84.3% and 68.8% of collectors, marketers and producers respectively had no form of formal education. Again, for collectors and marketers, percentage of 14.8% and 15.7% respectively had basic education. With producers, 27.3% had had basic education and 3.9% had had secondary/vocational education. Of the respondents interviewed, 40.9%, 39.1% and 31.8% of collectors, marketers and producers respectively have households with sizes 6 or more. The majority of the respondents (57.4% of collectors, 44.3% of marketers and 68.2% of producers) have large household sizes of 11 or more.

4.2. Output and income of the female shea actors

Of the 103 shea collectors who did collect shea nuts in the lean season, an average quantity of 230.78 Kg was reported, representing an average income of $88.92 (≥ $20.80 ≤ $288.00). With a mean output of 389.78 Kg and an average income of $124.69, all marketers obtained output in the lean season, notwithstanding the significant output (≥ 100 Kg ≤ 1000 Kg) and income (≥ $35.20 ≤ $400.00) differentials. Again, we found that producers (151 out of the 154) produced an average output of 217.75 Kg, translating into an average income of $99.50 during the lean season. In the peak season, collectors made an average output of 522.18 Kg, marketers (819.15 Kg) and producers (590.78 Kg), translating into average incomes of $218.67 (collectors), $267.76 (marketers), and $277.40 (producers). We also found that all respondents obtained output and income in the peak season as opposed to the lean season, in which some shea actors made no income (see Table 3).

4.3. Economic empowerment among the shea actors

4.3.1. Benefits of income among female shea actors

The well-being and socioeconomic advancement of families, communities, and nations depend on the empowerment of women. Women may realize their greatest potential when they live healthy, contented,

Table 3. Quantity and income made among shea actors.

Type		Average Quantity in Kg (Lean Season)	Average income (Lean Season)		Average Quantity in Kg (Peak Season)	Average Income (Peak Season)	
			GHS	USD		GHS	USD
Collectors	Count	103	103		115	115	
	Mean	230.78	555.73	88.92	522.18	1366.67	218.67
	Std	98.62	258.53	41.36	235.34	579.05	92.65
	Min	50	130	20.80	180	460	73.60
	Max	710	1800	288.00	1200	2100	336.00
Marketers	Count	115	115		115	115	
	Mean	389.78	779.33	124.69	819.15	1673.5	267.76
	Std	167.54	398.5	63.76	208.5	444.62	71.14
	Min	100	220	35.20	98	1200	192.00
	Max	1000	2500	400.00	1600	3500	560.00
Producers	Count	151	151		154	154	
	Mean	217.75	621.85	99.50	590.78	1733.77	277.40
	Std	83.06	251.17	40.19	152.14	396.01	63.36
	Min	90	200	32.00	200	700	112.00
	Max	450	1300	208.00	1100	2800	448.00

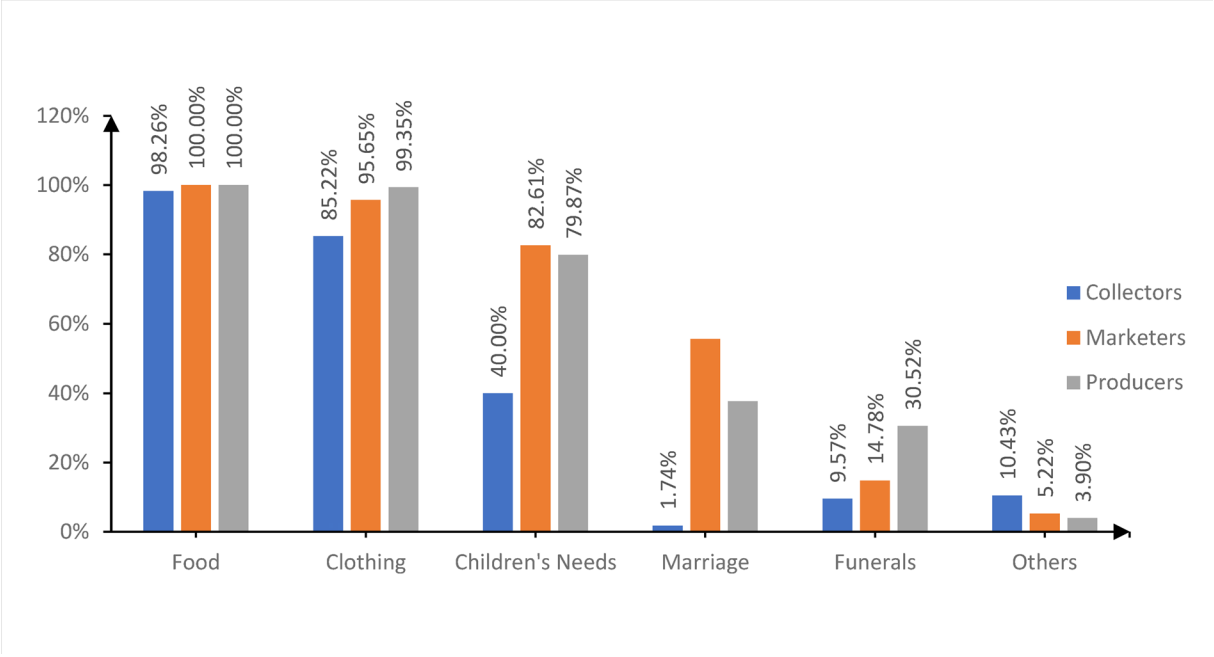

Figure 2. Needs covered by shea actors.

and fruitful lives, raising happier, healthier children and contributing their talents to the workforce. In addition to lowering household poverty, boosting economic development and production, and improving efficiency, it supports women's capacity to protect their rights and well-being. Given that we examined the impact of access to income on the women's ability to meet their needs. From Figure 2, nearly all the respondents were able to meet their feeding or nutritional and clothing needs, with the highest indices found among shea producers (100% for food and 99.35% for clothing) and marketers (100% for food and 95.65% for clothing). Although ranking third among the three categories of shea actors, the shea collectors' 98.26% and 85.22% to meet their food and clothing needs respectively show significant impacts. Meeting their children's needs collectors (40%), marketers (82.61%), and producers (79.87%). Other needs that were met by the shea actors include social needs such as participating in funerals and enabling them to create their families of procreation, through financial support to their husbands. The women also expressed passionately, how income from the shea business afforded them respect from their partners. One of the respondents interviewed noted how she gained respect from her husband and could now influence household decisions.

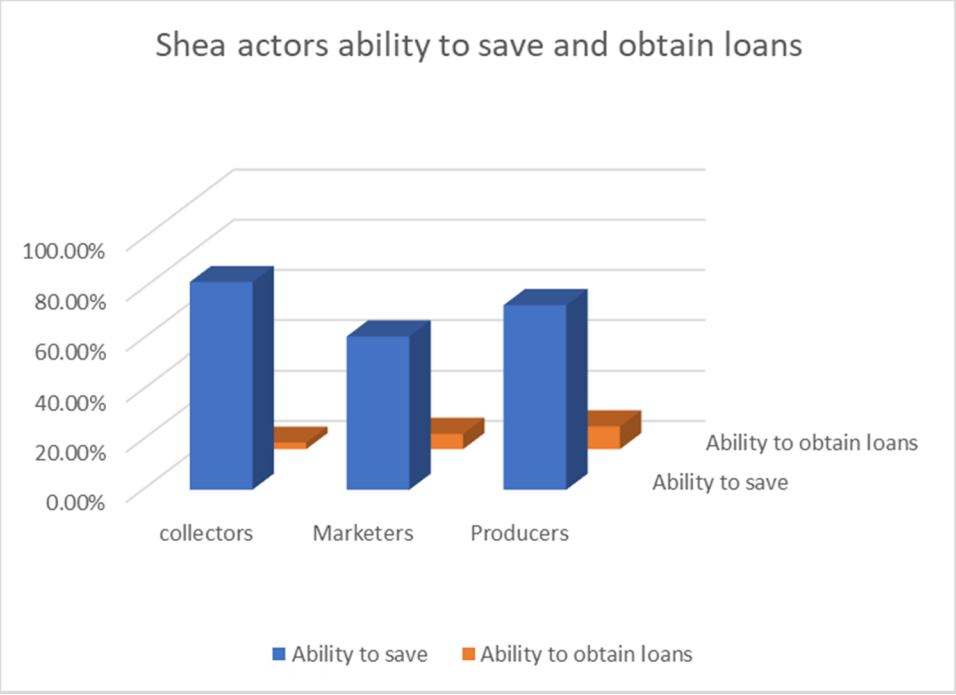

Figure 3. Ability to save and access loans among the female shea actors.

> I now earn income and my husband respects me a lot. Aside from helping my family financially, I have become bold and more confident, especially when I am in public. I am now the representative of the girl child education advocate supported by the Northern Sector Action on Awareness Center (NORSAAC). [A 45-year-old shea producer]

4.3.2. Impacts of economic empowerment on savings and access to loans

Savings and access to loans are causes and consequences of economic empowerment. As such, any attempt at fully understanding the economic empowerment potentials of the shea industry on the shea actors cannot exclude these variables. Results on the variables among the shea actors are presented in Figure 3. Among the shea collectors, 82.6% were able to save (constituting the highest savings rate among the shea actors) 73.4% for the shea producers and 60.9% for the shea marketers. Overall, the savings rate among the shea actors is more than 60%, which is significant. However, a small proportion of the shea actors (2.6% for shea collectors, 6.1% for shea marketers and 9.1% for shea producers) were able to obtain loans for investment in their businesses. Although access to loans was generally low among the shea actors, shea collectors reported the least access to loans, while shea producers had the highest rate of access to loans.

4.3.3. Extent of economic empowerment

With a potential for improvement, economic empowerment can be measured on a continuum scale. We developed a three-scale measure of low, moderate and high to depict the extent of economic empowerment among the shea actors. Referring to Figure 4, we found moderate empowerment among 85.2% of the shea collectors, and moderate empowerment among 31.3% of the shea marketers and 63% of the shea producers. The highest rate of low economic empowerment (67.8%) was reported by the shea marketers, with the highest rate of high economic empowerment (5.8%) reported by the shea producers. Overall, the study reports moderate empowerment among the various shea actors, with the highest rate found among the shea collectors, and the lowest rate found among shea marketers.

We employed an alternative method to the one-way ANOVA, the non-parametric Kruskal-Wallis test. Utilizing a dependent variable that is measured on at least an ordinal level (economic empowerment), the

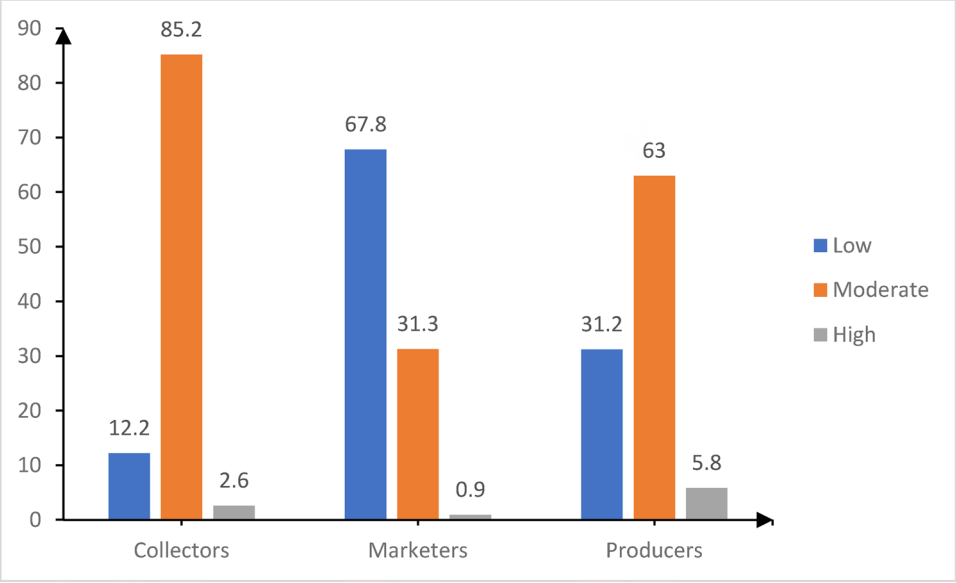

Figure 4. Levels of economic empowerment among the female shea actors.

Table 4. Statistical difference in the level of economic empowerment.

Ranks			
	Type	N	Mean Rank
Economic Empowerment	Collectors	115	236.60
	Marketers	115	131.24
	Producers	154	205.31
	Total	**384**	

Table 5. Kruskal-Wallis test of statistical difference in the level of economic empowerment.

Test Statistics	
	Economic Empowerment
Chi-Square	75.266
Df	2
Asymptotic Sig.	0.000

approach was used to compare the three groups or categories of shea actors (producers, collectors and marketers). $\chi^2(2) = 75.266$, $p = 0.000$), with a mean rank of 236.60 for collectors, 131.24 for marketers and 205.31 for producers. This implies that depending on the category of shea actor a female involved in the shea value chain found herself in, differential economic empowerment is expected. Thus, there is no uniformity with regard to the empowerment potential of the actors in the shea value chain (Tables 4 and 5).

4.4. Barriers to women's economic empowerment

The unavailability or inadequacy of resources that make up the building blocks and are used as production factors by individuals to produce commodities and services constitute a barrier to economic empowerment. For different shea actors, several factors constitute barriers to their empowerment. In Table 6, some of these barriers are discussed. For shea collectors, capital (94.8), storage facilities (87.8), land (83.3%), and credit facilities (75.7%) constitute the major barriers to productivity and empowerment. Among shea marketers, credit facilities (100%), capital (99.1%), land (79.1%) and training opportunities were the most dominant challenges. For shea producers, capital (100%), storage facilities (88.3%) lack of training (76.6%) and lack of access to land (62.3%) were the most visible challenges.

Convergent mixed methods design - a one-phase design that collects and analyses both quantitative and qualitative data before comparing the results to determine if the data support or contradict one

Table 6. Factors affecting production level.

	Collectors		Marketers		Producers	
Factors	Frequency	Percent	Frequency	Percent	Frequency	Percent
Land	96	83.8	91	79.1	96	62.3
Capital	109	94.8	114	99.1	154	100
Market	23	20.0	0	0	85	55.2
Credit Facilities	87	75.7	115	100.0	72	46.8
Training	61	53	38	33.0	118	76.6
Storage Facilities	101	87.8	13	11.3	136	88.3
Others	3	2.6	0	0	0	0

another was employed. Having presented the descriptive results on the barriers facing the female shea actors, we blend that with the qualitative data to obtain a better understanding. The qualitative data supports the quantitative results as lack of access to and control over lands, access to credit and capital and access to the market were identified as the major factors that negatively affect their productivity. The quotes in the next paragraphs shed light on these barriers.

> The family of my late husband has taken back the land on which I cultivate shea trees. This has made life difficult for me and my children because I have no land to farm on. Women should be given equal access to land as their male counterparts. [A 52-year-old widow and a shea collector]

> Each day, we are faced with the challenge of access to land. This is in light of the increasing sale of lands by chiefs, thereby reducing the quantity of shea fruit we obtain, since these lands that previously contained shea trees are redeveloped. [A 65-year-old shea collector]

> Unlike before, women now have access to land which is normally leased to them by the chiefs. But before the land is leased to the woman; she must be assisted by a man. This supposed male collateral constitutes a barrier to some of us. [A 55-year-old shea producer]

Beyond the issue of land inaccessibility, the women also reported capital inadequacy and lack of access to the market, especially those in the most remote parts of the district. This affected the number of shea nuts purchased by shea marketers and the purchase of inputs, in the case of capital inadequacy; and the selling or marketing of the shea nuts – in the case of market inaccessibility. These quotes from the participants buttress these points.

> As a shea marketer, I lacked sufficient capital to aid me to purchase in bulk and sell, for higher profits. It is very frustrating when you see shea nuts, but have no money to purchase them. It is like seeing money bypass you, with no control over it. [A 55-year-old shea marketer]

> We are pleading with the banks to give us loans, especially those of us who work in groups. These loans will enable us to produce more shea butter. [A 58-year-old shea producer]

> Women in the Savelugu township get the opportunity to sell their produce and products to the Shebu factory at a higher price while women of us in rural areas do not get the opportunity to sell to this industry directly but through middlemen who buy from us. Often, they are willing to commensurate prices, as transportation to the town is used to under-price our nuts. [A 58-year-old shea producer]

5. Discussion

In this study, we investigated the empowerment potentials of the shea industry among female shea actors in the Savelugu District of Ghana's Northern Region. We found significant differences between the outputs made by the various actors in the lean and peak seasons, translating into marked differences in their earnings between these two periods of the season. Income from their business has helped these women to meet their food and nutritional needs, clothing needs, and cater for their children, particularly in the area of education and health, while participating in and improving their social image. Moderate economic empowerment was reported in this study. Using the Kruskal-Wallis test the statistical difference in the level of economic empowerment among the shea actors was tested. 'Marked' or significant differences were found among the various actors in the shea value chain (producers, collectors and marketers), demonstrating a heterogeneous impact of the shea industry on the empowerment of women.

Regardless of the empowerment potential of the industry, some factors (challenges to land accessibility, inadequate capital and challenges to loan accessibility and access to market problems) were found as barriers hindering the full economic empowerment and financial liberation of the female shea actors.

5.1. The shea industry and economic empowerment

Shea collectors, who earn the least on average during both lean and peak seasons with incomes of GH₵555.73 ($88.92) and GH₵1,366.67 ($218.67), respectively, surpass Ghana's upper poverty line of GHS1,314 per year during the peak season (GSS, 2014). This highlights the challenging economic conditions they face, particularly in the lean season. However, it gives evidence that most women were better off meeting their nutritional and non-nutritional needs as well as raising their standard of living, especially in the peak season. The shea industry serves as one of the tools for promoting poverty reduction and empowering female shea actors (Abdul-Mumeen et al., 2019; Naami & Naami, 2019). Additionally, this result gives evidence that the shea industry is one of the areas one can invest in for more gains, especially in the peak season. This finding is in tandem with the finding of Alhassan (2020), who reported that income obtained by women processing shea butter has enhanced their ability to provide basic needs for themselves and their children. According to Laube (2015), shea fruits serve as a subsidy when things become difficult for women especially at the beginning of the rainy season when there are shortages of food. It was therefore not surprising that the women expressed passionately, how income from the shea industry afforded them respect from their partners. It thus accentuates what Naami and Naami (2019), termed as the lifesaving potential of the industry, as income earned by women in the shea industry becomes a 'life's problem saver', 'home problem solver', 'family problem solver' and 'other people's problem solver'.

The relatively moderate-to-high savings rate reported among the women supports past evidence where the shea industry was identified as playing a significant role in the lives of women living in the rural areas of Northern Ghana by providing them with some form of livelihood diversification, food security, household asset accumulation, employment generation and financial savings (Hatskevich et al., 2014). The OECD defined economic empowerment to include access to and the power to make choices and decisions that pertain to the credits or savings possessed by an individual (Addai, 2017). In other words, one is considered economically empowered when he/she makes economic decisions that enhance his/her income, savings or financial assets (Golla et al., 2011). With a high savings rate among women, there is no denying the fact that economic empowerment has taken place in their lives (Addai, 2017; Bishop, 2012; Golla et al., 2011), offering the opportunity to accumulate enough capital to reinvest in their business or meet their basic needs. To enhance the savings habits of women, further exploration should focus on education and raising awareness. Furthermore, women who are not part of groups and cooperatives should receive advice to encourage their participation in such groups, enabling them to access finances for expanding their ventures or exploring alternative opportunities to support the shea enterprise and improve their livelihoods.

According to Aikins and Gbegble (2018), few women apply for loans since doing smallholder farming makes it difficult for them to get loans. The same applies to women in the shea industry. Despite the moderate economic empowerment among the women, their access to loans or ability to obtain loans was significant, with the highest of 9.1% reported by shea producers. The loans were obtained from their partners and other microfinance groups, although they were inadequate. The high cost of borrowing and lack of financial support were the major challenges faced by women in the shea industry. The inability to obtain financing is another significant hindrance for the producers of shea butter. Financial institutions do not lend to unorganized groups of people, which has a significant impact on women's production capacity and prevents direct linkage to the larger domestic market (Naami & Naami, 2019). As a result, they are forced to accept pre-financing agreements from the local buying agents, who use unethical methods to procure kernel and butter from the women processors (Adams et al., 2016; Shitu & Popoola, 2017). For a better and higher impact of the industry on women's economic empowerment, initiatives such as the Microfinance and Small Loans Center (MASLOC) and the Planting for Export and Rural Development (PERD) - a program to boost and diversify Ghana's production and export of tree crops, to move away from the nation's over-reliance on cocoa and toward other tree products including rubber,

coconut, oil palm, cashew coffee, and Shea must provide financial assistance to shea actors to scale up their activities.

While all the earnings of the shea actors in the peak season were above Ghana's upper poverty line of GHS1,314 per year (GSS, 2014), the all earned below the poverty line of GHS1,314 per year during the lean season. Some did not make any income in the lean season as well. Though the shea industry holds many prospects for the well-being and livelihood sustainability of women actors, its relatively low output in the lean season, amidst threats of land redevelopment and inadequate capital for expansion, brings into focus the development of alternative livelihood programmes. Drawing from both the market-based theory and the concept of choice in women's empowerment, the findings highlight that while the shea industry can provide earnings above the poverty line during the peak season, the vulnerability of women actors becomes evident in the lean season, emphasizing the need for alternative livelihood programs. Implementing such programs can not only mitigate the seasonal income disparities but also enhance the economic stability of these women by providing opportunities for higher-yielding livelihood activities, ultimately contributing to poverty reduction and improved well-being. The alternative livelihood programme's goal will be to eliminate poverty and inequality by giving these women access to work opportunities and by helping very vulnerable households transition into sustainable livelihoods and economic stability. By temporarily replacing or augmenting shea value-chain activities with higher-yielding impact livelihood activities that offer better advantages, the vulnerability of these women could be lessened during the lean season. Furthermore, rent from the alternative livelihood activity could be invested in the shea business during the peak season for higher outputs.

5.2. Challenges facing the productivity of the female shea actors

The ability of women to engage in, contribute to, and profit from growth processes in ways that respect their dignity, acknowledge the value of their efforts, and negotiate a more equitable distribution of the benefits of growth is provided by women's economic empowerment. In addition to lowering household poverty, boosting economic development and production, and improving efficiency, it supports their ability to realize their rights and well-being. For women, it represents one of the most effective paths to realizing their potential and advancing their rights. The empowerment of women has, however, not been without barriers, especially when it requires changing societal norms regarding access, use, and control over resources. Moreover, making changes to power dynamics and decision-making influence could destabilize and supposedly render those who benefit from the disempowerment of women somewhat powerless, thus breeding resistance. Challenges relating to finance, access to lands, markets and storage facilities are discussed.

5.2.1. Financial constraints

Inadequate capital and challenges to accessing credit facilities ranked high on the array of barriers to female shea actors' economic empowerment potentials. This is underscored by the 9.1% of the producers, constituting the highest access to credit facilities among the shea actors. The higher access to credit among the shea producers is based on the group operations they often undertake, compared to the collectors and marketers (Naami & Naami, 2019). The low access to credit among female shea actors can be attributed to various factors, including their marginalized status and limited collateral, which often make them ineligible for formal financial institutions. Additionally, the seasonal nature of shea nut processing and the lack of credit products tailored to their needs further hinder their ability to secure financial assistance for business expansion or investment in alternative ventures. Microfinance institution feels more secure in giving loans to institutions than to individuals. This assures them that money given to this institution will be paid back. Nonetheless, less than one in ten of the shea producers have access to credit to expand their operations. It, therefore, explains their lower output in the lean season, as they cannot expand beyond certain limits. The situation is even precarious for the shea collectors and marketers. Access to loans and capital has been the major challenge facing female shea actors and has been documented in the literature (Adams et al., 2016). According to Aikins and Gbegble (2018), few women go for loans because access to loans has been a big challenge to them, especially those in smallholder

farming. This challenge implies that women find it difficult to expand their businesses. The traditional method which is more labour intensive is what they depend on for processing shea nut/butter, affecting the quality and quantity of the product and eventually income. Access to capital and credit in today's financial environment is extremely fragmented, affecting the ability to tap into raw materials and slowing the rate of economic growth and the development of local communities. This emphasizes the need to connect sources of capital to businesses like the shea industry. Crucial support to the production of shea nut and butter is the issue of access to capital.

5.2.2. Land inaccessibility

Access to, rights over and ownership of lands constitute a significant challenge to the female shea actors. The Savelugu District and for that matter the majority of northern Ghana practices a patriarchal social system. Being a patriarchal society, resource ownership is tilted towards men, to the disadvantage of women. The challenges of land accessibility among female shea actors stem from traditional land tenure systems that often prioritize male landownership, limiting women's access to shea tree resources. Additionally, the increasing threats of land redevelopment for other purposes exacerbate these challenges, as women may face displacement from shea tree-rich areas, impacting their livelihoods and the sustainability of the shea industry. This leaves the women vulnerable, almost always requiring male approval and support to have access to lands. Though several land reforms have been undertaken, the situation has not changed significantly, as one of the participants noted that males are required as guarantors for women to obtain lands from chiefs. In the distribution of family lands, women, are often excluded since they are regarded as non-permanent members of their homes who would marry and move out of the family. Women continue to face significant barriers to land access in Africa despite recent advancements in land reform (Njoh & Ananga, 2016). While women continue to perform the majority of the agricultural labour in Africa, the issue of inclusion and gender equality when it comes to land rights is still a significant challenge on the continent and they do not benefit from an equitable, secure system of land tenure (Benjamin et al., 2021; Njoh & Ananga, 2016). Women's social, economic, and political advancement is greatly hampered by a lack of access to land, which furthers gender inequality and places them at the mercy of a largely patriarchal society. However, to increase women's access to land, the land is sometimes given to women as rent (Chen, 2017; Kuusaana et al., 2015). To Kuusaana et al. (2015), women who only have adequate capital can enter this agreement, further inhibiting land access. Women in Africa have suffered as a result of 'modern' development attempts as well as a culture-driven system of land tenure. The complex nature of land issues necessitates connections with many other sectors, including those of education, welfare transfer policies, culture, and the credit system, all of which can be used to create structures or incentives for a system in which women are involved in making decisions about land accessibility.

Beyond the cultural factor of land inaccessibility, deforestation has also threatened the activities of shea producers and collectors alike. Studies have reported deforestation, as a major barrier hindering the productivity of women in the shea industry (Adams et al., 2016; Chen, 2017). According to Adams et al. (2016) deforestation resulting in scarcity of 'shea trees' has become a big challenge to female shea actors. This was supported by McNally (2008) who indicated that bushfires, cutting of shea trees for firewood and poor methods of farming are some of the factors affecting the availability of shea nuts for the shea industry. Limited access to shea fruits not only affects the income of shea collectors but also affects the inputs of shea butter producers and marketers, thereby reducing their income-generating capacity. In light of the devastating impacts of deforestation-induced climate change, afforestation must be vigorously championed to save the shea trees and also reduce the impacts of climate change (which includes the impact on rainfall to support the growth and fruit-bearing potentials of shea trees).

5.2.3. Market inaccessibility

Poor access to the market and low pricing has also been noted as a major challenge among female shea actors, hindering their social and economic empowerment. To these women, their location is the main challenge to accessing the market. The problem of poor access to the market and low pricing among female shea actors primarily exists due to their geographical location, which affects their direct access to

the Shebu factory and leaves them reliant on middlemen for selling their products. Additionally, the issue is compounded by limited entrepreneurial skills and traditional marketing methods, leading to exploitation by middlemen and large firms. Women in the Savelugu township get the opportunity to sell their produce and products to the Shebu factory at a higher price while women operating in rural areas do not get the opportunity to sell to this industry directly but middlemen who come to buy from them and normally determine the price of the shea nut/butter. This finding is in tandem with past evidence where poor market access constitutes a challenge for shea actors (Adams et al., 2016; Elias & Arora-Jonsson, 2017; Kanlisi et al., 2014; Yakubu, 2018). This usually leads to a reduction in the profit margin for female shea actors or even sometimes losses. According to Jibreel et al. (2013), poor market access is attributable to women's poor entrepreneurial skills and overdependence on traditional marketing methods. Consequently, these women are exploited by middlemen and large firms who buy the shea products at a very low price. In addition, Drost et al. (2012) noted that the availability of substitutes for shea also influences the low pricing. All these negatively affect the income of rural female shea actors, thus affecting their economic and social empowerment. In line with the Weberian theory of social action (Ringer, 2002), we recommend that more groups and associations are formed by the various shea actors, for instance, producer groups, collector groups and marketer groups to harness their strengths and develop a stronger bargaining front to influence the price. When several agents work concurrently to accomplish a single objective (referred to as a 'group action'), a better and improved outcome is achieved. To address this problem, it is essential to empower female shea actors by forming various groups and associations, such as producer groups, collector groups, and marketer groups, to collectively strengthen their bargaining power and influence pricing. This collaborative group action aligns with the Weberian theory of social action and can lead to improved outcomes for female shea actors in terms of market access and fair pricing.

5.2.4. Storage problems

We found that the lack of prescribed storage facilities for shea products, resulting in post-harvest losses remains a barrier to the growth of the shea industry. As a result, they lack access to adequate storage facilities for keeping butter, processed nuts, and raw nuts gathered. This affects the capacity of the women, particularly those engaged in collecting fresh nuts, processing nuts, and dealing in nuts, to keep the nuts for an extended length of time to wait for better prices. Adams et al. (2016) also reported a similar finding when they found a lack of storage facilities as a challenge for a woman in the shea value chain in the Wa Municipality of Ghana's Upper West Region. The rural shea industry is riled by a myriad of challenges with a lack of storage facilities being one of the main challenges. The gravity of this challenge is explained by the pressure it exerts on the women to sell off their produce earlier in the season. The unavailability and inadequacy of the storage facilities make the shea actors compete for storage. Confronted with the inability to store, the women had to make one of two choices; sell off their produce at prevailing low prices or keep them in the hope of better prices in the future, but often with an increased rate of spoilt nuts due to exposure rain and rodents and insects. Factors such as access and control over the market, raw materials, equipment, capital, credit and storage facilities are often used to measure the economic empowerment of people (Addai, 2017; Golla et al., 2011). To ensure the overall economic empowerment of female shea actors, inputs such as storage facilities should be provided on large scales to enable them to preserve their produce and sell at periods, they deem appropriate. With economic empowerment defined to include autonomy of economic decisions, the inability of women to influence price through the forces of demand and supply could make the empowerment agenda a facade.

6. Limitations of the study

The study explored the extent of economic empowerment among shea producers, collectors and marketers. Several limitations are associated with this study. Firstly, it did not rigorously determine which group of actors had higher economic empowerment, leaving room for further research to pinpoint the most empowered group and the specific factors contributing to their empowerment. We believe that such weakness should be inculcated in future studies to identify where the strongest economic empowerment exists. This knowledge will be important to forming policies to promote the activities of the female shea

actors for a higher empowerment drive. Secondly, the research design may have limitations in addressing the research question and hypothesis adequately, which could potentially affect the validity and reliability of the findings. Thirdly, the sample size and representativeness might not be sufficient to ensure the generalizability of the results to the broader population relevant to the research question. Additionally, potential biases or errors may have been introduced during the data collection process, which could have implications for the validity and reliability of the data. Lastly, the study may not have adequately addressed confounding variables and controls, potentially influencing the study's findings and limiting the interpretation of the results. These limitations should be taken into consideration when interpreting and applying the findings of the study. Further research with a larger and more representative sample and a refined research design is recommended to address these limitations and provide a more comprehensive understanding of women's economic empowerment in the shea value chain.

7. Conclusion

The study investigated the level of economic empowerment among female shea actors in the rural area of Savelugu District and the barriers to their empowerment. Shea collectors, shea butter producers and shea marketers experienced a moderate level of economic empowerment. In both the lean and peak seasons, shea collectors, who earned the least on average, had average incomes of GH₵555.73 ($88.92) and GH₵1,366.67 ($218.67) respectively, with their peak season earnings slightly exceeding Ghana's upper poverty line. However, despite their moderate-to-high savings, the shea collectors faced significant challenges in accessing credit. Despite women recording a high level of economic empowerment, they are still faced with challenges which impede the progress of their businesses. The major challenge faced by female shea actors is the lack of capital to expand their shea businesses and add more value to their products. Other challenges include inadequate access to land, market and storage facilities. These findings underscore the need for a more comprehensive understanding of the nuanced aspects of women's economic empowerment in the shea value chain, recognizing both their moderate levels of empowerment and persistent challenges; and the practical implication suggests the necessity for targeted interventions that provide access to capital, land, markets, and storage facilities to enhance the economic sustainability of female shea actors. The Savelugu Municipal Assembly, Ministry of Local Government and Rural Development, should invest more capital in the 1 District 1 Factory project to solely focus on shea kernel/butter production. Through this initiative, the shea industry could be positioned to fully participate in the shea value chain and leverage opportunities in the African Continental Free Trade Area (AfCFTA). This will facilitate the exportation of shea kernel/butter beyond Ghana's border for improved income. On the part of the women, they should form or join groups to enhance their access to credit and control over prices. Concerning the issue of land ownership and leasing land to female shea actors for shea cultivation, the Ministry of Lands and Natural Resources (MLNR) should engage chiefs and custodians of lands to amend culture to find less complex ways to improve their access, use and control over lands. Future research should focus on identifying the factors contributing to economic empowerment among shea collectors, producers, and marketers in the shea value chain, to enhance their economic well-being.

Ethics approval and consent to participate

The study's purpose was communicated to the participants, and only after receiving their verbal and written consent, did they accept to take part in the study. Participation in the study was purely voluntary, and no identifying or sensitive information was collected because the researchers' top priorities were the dignity, safety, and wellness of the respondents.

Authors' contributions

JTK contributed to the conception and design, acquisition and analysis of data, and manuscript drafting. GA-A contributed to the study conception, design, and proofreading of the manuscript. AKM contributed to the conception and design, acquisition and analysis of data, and manuscript drafting. All the authors read and approved the manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

About the authors

Josephine Thywill Katsekpor is a highly educated professional with a robust research background and broad expertise in social science and spatial analysis. My research interests are focused on women's empowerment, particularly in rural Ghana. In tandem with my commitment to women's empowerment, I am also dedicated to advancing my knowledge of cutting-edge technologies through the integration of machine learning techniques to enhance the effectiveness of early warning systems, which is reflected in my current PhD thesis. Moreover, my research extends to the validation of satellite and reanalysis data, specifically within the domain of streamflow forecasting for flood events in the White Volta basin.

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Data availability statement

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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