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Creating Sustainable Income through the Cashew Nuts Value Chain (Evidence from Ghana)

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A R T I C L E I N F O

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A B S T R A C T

The study assessed the actors along the Cashew value chain and their influence in making the income derived from cashew sustainable. Primary data for the study were collected from 210 actors using a structured questionnaire. The gross margin and the Herfindahl-Hirschman Index (HHI) were used to determine the revenue margin and market competitiveness (concentration) among the various actors along the cashew value chain. The results revealed that most of the actors were male and had between 6-10 years of experience in cashew production. Also, the actors' resort to loans in financing their operations was an interest rate of 24%. Producers had the lowest net margin on revenue of 16.95%, and they indicated that fluctuation in pricing and bushfires were challenges faced in production. Purchasing clerks pointed out that inadequate storage facilities and the high cost of transportation were their challenges. Moreover, processors indicated that lack of government support, high interest on loans, and low demand for processed cashew nuts were their challenges. According to cashew nuts exporters, their significant challenges are high cost of transport and high cost of storage facilities. Furthermore, the Herfindahl-Hirschman index showed that the cashew industry in the study area was highly concentrated. The study recommended that government efforts should be focused on developing a cashew Development Board to enhance marketing and price regulation.

Introduction

Agriculture is the backbone for broad-based economic growth, poverty reduction, and food security in Sub-Saharan Africa (SSA) and other parts the world (Fileccia, 2017). Between 2000 and 2007, it contributed an average of 39.5% to Ghana's Gross Domestic Product (GDP) and employed about 55% of the country's population (ISSER 2008). Unfortunately, agriculture alone can no longer provide a reliable livelihood for the growing population in Ghana. Alternative or additional income-generating income families who can no longer support their livelihood from the land alone (Practical Action, 2013).

Cashew is popularly known as the "gold mine of the wasteland", a fast-growing drought-resistant crop (Dinakara Adiga and Kalaivanan, 2013) and primarily used for afforestation projects or as a fire protection barrier around forest demarcations (Goujon *et al.*, 1973). Cashew is a fast-growing, hardy, and drought-resistant multipurpose tree species cultivated in many tropical countries. It is one of the most well-known

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species for its nut globally, although all parts of the tree are functional. It is an important tropical tree crop and has a lot of potential in terms of international trade. Cashew is a well-known agroforestry species that produces fruits when they are about four years old, and maximum production is from 10 to 30 years. The cashew tree produces approximately 0.25 metric tons of cashew nuts per hectare, whereas the dwarf tree type produces more than a ton of cashew nuts per hectare. The Portuguese introduced the cashew tree, which originated in Brazil, to Mozambique and then India in the sixteenth century to reduce coastal erosion. Cashew was spread within these countries with the aid of elephants that ate the cashew fruit and the attached nut, which was too hard to digest and was then later expelled with the droppings. As a result, cashew plantations were developed, and the tree spread to several countries in Africa, Asia, and Latin America later in the nineteenth century.

Manual techniques used in processing cashew started in India in the first half of the twentieth century. Azam-Ali and Judge, (2001) reported that processed cashews are exported to the wealthy western markets, particularly the United States. In the 1960s, producers of cashew nuts in East Africa began to process nuts domestically rather than send them to India for processing, bears them more income from the sale of both processed nuts and the extracted cashew nut shell liquid (Azam-Ali and Judge, 2001). India is currently leading the production in in-shell or raw cashew nuts, followed by Ivory Coast, Brazil, and Vietnam. Processing (shelling, peeling, and grading) is dominated by India and Vietnam, which process 52% and 30% of their production, respectively (Heinrich, 2012). 90% and 80% of West and East African Cashew are exported to India and Vietnam for processing and then exported to more developed countries where the kernels are roasted and packaged (Heinrich, 2012).

African Cashew initiative (ACi) reported in their study that cashew production has expanded significantly in major producing countries, including Africa, as world demand for kernels has increased at about 7% annually over the last ten years. In addition, the need for cashew nuts has grown significantly in India, where consumption has doubled between 2001 and 2010 (Heinrich, 2012). It is estimated that the cashew sub-sector can contribute to economic growth by generating over 200,000 permanent and seasonal jobs, particularly for farm labourers and intermediaries (MoFA 2008). Hence a lot of researches has been done on cashew. Research on the socio-economic importance and potential of Cashew mainly plays a vital role in improving household incomes as nuts are sold in the lean season when no other crops are available.

Similarly, Sarpong (2011) researched the role of the cashew industry in local economic development and its effects on the economy in the Brong Ahafo Region. However, most of these researches concentrate on cashew profitability and its potential for over-taking cocoa in the international market. The socio-economic importance of cashew is also highlighted, forgetting the role of actors and their influence and challenges in the value chain. In line with this, the study seeks to research the various actors along the cashew nuts value chain and their influences in making the income derived from cashew sustainable in the Jaman North District of Ghana.

Economic importance of cashew crop

Jaffee, (1994) introduced cashew as an important tropical crop that he refers to as the "poor man's crop, rich man's food," and is grown for its nuts. Cashew is a multipurpose tree species with every part of the crop useful to man. Cashew nut shell liquid is an important raw material in the paint and wood industry. According to Orwa *et al.,* (2009) the cashew balm found in the pericarp has numerous potentials for industrial and medical applications. Ascorbic acid, carotenoid pigments, and a host of other chemicals significant for human health are found in cashew apples. Edoga *et al.*, (2006) identified cashew waste as the ideal medium for pectinase enzyme production for *Aspergillus foetidus*. Also, cashew apple and gum extract act as an effective

repellent against leaf-feeding pests of vegetables, and tannin extracts from cashew are used in the leather industry (Edoga *et al.*, 2006).

Telascrêa *et al.*, (2014) reported in their study that Cashew Nut Shell Liquid (CNSL) is used to produce fungicides, herbicides, lubricants, lightweight plastics, composite panels suitable for partitions and flush doors. CNSL is also used as a pesticide against termites in timber, and the bark gum is repellent to insects (Duke, 1983). Florian, (2014) reported that the bark of cashew is believed to have antihypertensive and blood-glucose-lowering potential. Additionally, the kernel oil can serve as a mechanical and chemical antidote for irritant poisons. Cashew nut is surrounded by a double shell (kernel) containing an allergenic phenolic resin, anacardic acid, and a potent skin irritant. Anacardic acid is the by-product of cashew processing for medicinal uses. The kernel contains 7.6-16% moisture, 18-24% protein, 43-57% fat, and 19-21% carbohydrates (Florian, 2014). Cashew apple juice exhibits anti-scorbutic property. Juice of cashew apple is also used as a diuretic in the treatment of kidney diseases and cholera. The shell oil is a mild purgative for the expulsion of hookworm, for cracks in the feet, warts, and leprous sores.

Cashew development in Ghana

In 1998, the Ministry of Food and Agriculture (MOFA) commissioned and funded a study to investigate the status of the cashew industry regarding the potential production areas and levels, performance, and problems hindering the development of the industry. The findings from the study showed that cashew production could generate significant additional income for the rural population and contributes to poverty reduction, which is in line with Sustainable Development Goal 1. Also, the government of Ghana in 2003 requested the African Development Bank (AfDB) to finance a six-year development project in five regions at the cost of US$ 13.32 million. The cashew development project aimed to increase production by doubling the then 18,000 ha under cultivation and expanding Cashew processing at the village level. The project facilitated an integrated and coordinated approach to the development of the cashew industry. Until then, only a few isolated attempts had been made by individuals, government agencies, and NGOs to promote the cashew sector in Ghana.

The cashew sub-sector is estimated to contribute to pro-poor economic growth by generating over 200,000 permanent and seasonal jobs, particularly for farm labourers and intermediaries (MOFA, 2008). In addition, the marketing, distribution, and processing of raw cashew nuts (RCN) offer more than 5000 permanent and seasonal jobs annually in the cashew industry (MoFA, 2008).

Cashew is grown as a cash crop in the coastal belt (Central, Greater Accra, and Volta Regions), the transitional belt (north of Ashanti, Brong-Ahafo), and the guinea savannah belt (Northern, Upper West, and East regions). It was estimated 3.24 million ha of suitable land is available for cashew cultivation in the country (MoFA, 2008). Since 2003, the Cashew Development Project (CDP) has been ensuring the availability of improved planting materials or farm inputs, access to extension services, credit facilities for the establishment of new cashew farms. Also, to enhance the efficiency of cashew marketing in Ghana, Cashew Processors and Exporters Association (CAPEAG) was formed. The association trains its members on quality standards by appropriating grades and standards, spearheaded by the USAID TIPCEE project with support from MOFA-CDP and other stakeholders.

Income generation activities from cashew value chain

There are prospects to increase cashew production and processing for both local consumption and export even though Ghana is a late developer of cashew crop. Production of raw cashew nuts increased from 6,338 tonnes in 2003 to 34,633.88 tonnes in 2006; 23,616.40 tonnes in 2007 and 81,190.47 tonnes in 2008 (ISSER, 2008). In 2006, Ghana exported 47,000 metric tonnes

of raw nuts and earned about US$ 23 million. This Fig. is considered small when compared with world excess demand for 430,000 metric tonnes of raw nuts valued at US$270 million and growing at a rate of 5-8% per annum (MoFA, 2008). In 2008, the Ghana Export Promotion Authority expressed optimism of reaping a significant increase in cashew export income, targeting over US$250 million from the international trade of the commodity. Along the cashew value chain, various income-generating activities can improve the income of the various actors along the chain. Women are hired by cashew farmers during harvest and are paid for collecting the cashew fruit (Heinrich, 2012). To some young people, day labour could be an important source of income that enabled young people to continue their education (Kielland and Tovo, 2006). Also, transport operators are engaged in the transporting of cashew nuts.

Concept of value chain analysis

Globalisation has drawn much attention to itself, along with an increasingly common marketplace and linking global industries. The supply chain is now more global-based (Chopra and Meindl 2007). The growing field of studies in economic geography and related disciplines has evolved, which deals with the production, trade, and consumption of goods (Oro and Pritchard, 2011). Hence, the globalisation of production has generated considerable interest in analysing international trade in cashew from value chains.

Value Chain was used by Michael Porter in his book "Competitive Advantage, Creating and Sustaining Superior Performance" in 1985 to describe the activities within and around an organisation and relate them to an analysis of the organisation's competitive strength. Therefore, it evaluates which value each activity adds to the organisation's products or services. This idea was built upon the insight that an organisation is more than a random compilation of machinery, equipment, people, and money. Only if these things are arranged into systems and systematic activities make it possible to produce something for which customers are willing to pay the price. Porter and Kramer (1985) distinguish between primary activities and support activities. Primary activities are directly concerned with the creation or delivery of a product or service. Accordingly, can be grouped into five main areas: inbound logistics, operations, and outbound logistics, marketing, and services. The primary activities are linked to support activities that help to improve their effectiveness and efficiency. Procurement, technology development, human resource management, and infrastructure make up the support activities. Just like how a product passes through the value chain before it reaches its final consumers, the same way the cashew also goes through its value chain before it comes to its final consumer.

The cashew value chain

Cashew consumption is gaining reasonable grounds in the global market. With this trend, it is expected that the demand for cashew kernels will keep growing in emerging markets such as China and India (Srivastava, 2007). Africa is estimated to produce not less than half of global raw cashew nuts (FAOSTAT, 2017). However, the processing of raw cashew nuts into the kernel is estimated to be less than 10% in West Africa (Africa African Cashew Alliance, 2015).

The cashew value chain demonstrates the various stages cashew passes through from production to consumption. The farmer who harvested the nuts and the cashew apple moves through several processors before getting to the final consumer. According to Jekayinfa and Bamgboye (2006), the main products from cashew that are traded on the global market are raw cashew nuts, cashew kernels, and cashew nut shell liquid. After shelling, the cashew nut kernels are traded to wholesalers who distribute the nuts to consumers or additional processing. Also, the cashew value chain involves the production of cashew by farmers and the collection from the farm by collectors to supply to the processing factories. From this, they are exported to other countries. The fresh cashew nuts are dried to

reduce the moisture content to get raw cashew nuts. Next, the shell is removed to produce a cashew kernel.

Actors in the cashew value chain include growers, collectors, wholesalers, purchasing and packing stations, processors, retailers, consumers, and agrochemical sellers. A typical cashew value chain in Ghana is explained in Figure 1 below.

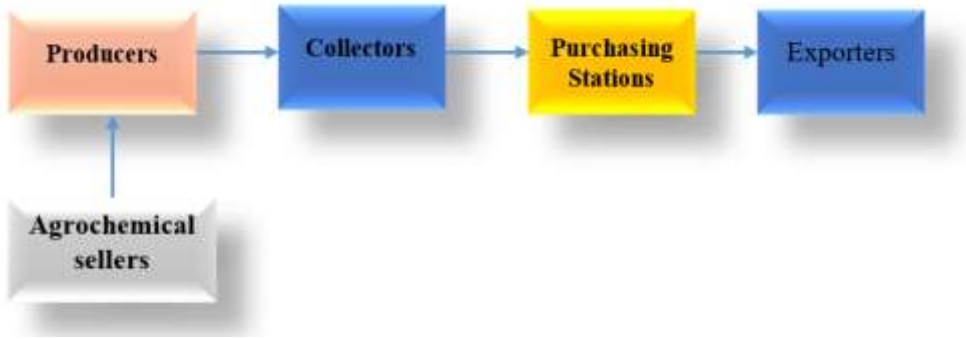

Fig. 1. Cashew value chain in Ghana
Source: Author's construct, 2020

Production of raw cashew nuts in West Africa is mainly done by smallholder farmers (Fitzpatrick, 2019). According to Gilleo *et al.,* (2011) raw cashew nuts are sun-dried before delivering in different sizes to various supply network agents. The dried nuts are filled into jute bags and then stored in ventilated warehouses for further processing at local factories or exported to the global market. Also, value addition comes through harvesting, drying, and packing the nuts in jute bags. After controlling for quality through their agents, the buying agents or exporters dried and re-bag the nuts and shipped them to international buyers.

Cashew value chain in providing sustainable income to farmers

Sustainability is based on a simple principle: everything we need for our survival and well-being depends, either directly or indirectly, on our natural environment (Camp and Heath-Camp, 2015). Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony that permit fulfilling the social, economic, and other requirements of present and future generations (Camp and Heath-Camp, 2015). Sustainability is vital to ensure that we have and will continue to have the water, materials, and resources to protect human health and our environment. Sustainability has got three pillars which are economic, social, and environmental pillars.

Sustainable income provides a family with more than the essential requirement of survival. Sustainable income is described as the income a family needs to cover all its essential needs, have appropriate living standards, and save for the future. Families with sustainable income can improve their living standards over time, actively participate in their communities, build robust support systems, and contribute to their local economy (Tamarack, 2004).

The significance of creating sustainable income has long been recognised. A recent study by USAID into the cashew sector in Ghana indicates that every 1,000 USD of cashew nuts sales generates 120 jobs and about 1,400 USD in additional income for Ghanaian households if the cashew nuts are processed within Ghana. In 2008, raw cashew nuts exports from Ghana contributed 6.1% of GDP and 18.2% of agricultural GDP (Osei, Pandey *et al.,* 2010). Cashew sub-sector is estimated to generate over 200,000 permanent and seasonal jobs, particularly for farm labourers and intermediaries (MoFA, 2008).

Beekeeping is also another income-generating activity that can be integrated cashew production. The cashew apple and the flowers help honey bees, hence creating an additional income-generating potential for

farmers. The bees also play a role in the pollination process of the cashew plant.

Material and Methods

Study area and data collection

The study was conducted in the Jaman North Municipality of the Bono Region of Ghana in 2020. The Jaman North Municipal is one of the twelve (12) Administrative Assemblies in the Bono region, and its capital is Sampa. The Municipal is situated to the western part of the Brong Ahafo Region, which shares borders with Cote d'Ivoire, Tain District to the north through to the eastern part of the district. The location of the municipal along Cote d'Ivoire and Ghana border presents economic opportunities that can improve the lives of inhabitants. The dominant economic activity in the Municipality is Agriculture and employs more than 70% of the labour pool.

The purposive sampling technique was employed to select the various actors (producers, collectors, and purchasing clerks) in the cashew value chain in the Jaman North Municipality. Also, the cluster sampling method was used in grouping the sample population into clusters of producers, collectors, and purchasing clerks in the cashew value chain. A total sample size of two hundred and ten (210) respondents were sampled for this study which consisted of ninety-seven (97) cashew producers (farmers), fifty (50) collectors and forty-seven (47) purchasing clerks, and three (3) processors, ten (10) agrochemicals sellers and three (3) cashew exporters (Table 1). The choice of large sample size was to allow for a comprehensive representation. The sample size for each actor was determined by using the Cochran sample size formula (Cochran 2007).

$$n = \frac{N}{1} + N(a)^2 \quad (1)$$

Where, n = sample size, N = Sample frame, a = precision rate = 0.5, and Confidence level = 0.95

Table 1. Sample size determination

Actors	Sample frame (N)	$N(a)^2$	$1+N(a)^2$	$\frac{N}{1}+N(a)^2$
Producers	126	0.3125	1.305	97
Collectors	57	0.1425	1.1425	50
Purchasing Clerks	54	0.137	1.137	47
Processors	3	0.0075	1.0075	3
Agro Chemicals sellers	10	0.025	1.025	10
Exporters	3	0.0075	1.0075	3
Total	253			210

Source: Author's computation, 2020

A questionnaire was prepared and piloted to remove all ambiguities. The questionnaire mapped out the cashew value chain in the study area and assessed income, challenges, and role cashew play in improving the income of actors along the cashew value chain.

Data analysis

Descriptive statistics (means, frequencies, and percentages) were performed with the SPSS Version 21 software. Also, gross margin was estimated using the following equations:

$$TR = Q \times P \quad (2)$$

$$GM = TR - TVC \quad (3)$$

Where, GM denotes the Gross margin obtained from the production of cashew nuts in Ghana Cedi, TR denotes the total revenue derived from the cashew nuts, TVC denotes the total variable cost of producing cashew nuts, and Q represents the total quantity of cashew nuts in bags. P represents the unit price. The gross margin excluded fixed costs such as setup cost, acquiring any metal equipment used in production and that may be used more than one year. All the costs

employed are direct costs based on output volume (the price of output sold and harvested) and did not consider fixed costs. Furthermore, the Herfindahl-Hirschman Index (HHI) was used to analyse the market competitiveness among the various actors.

Results

Socio-demographic characteristics of respondents

The male respondents (60.4%) were more than their female counterparts (39.6%), which means that majority of males are engaged in the cashew value chain (Table 2). Most (67.7%) of the respondents were 36 years and above, 18.5% between 31 – 35 years, 12.8% between 21 – 25 years, and 1% between 18-20years. On the level of education, 36.2% of them had primary education, 55.7% had high school education (SHS), 2.9% had diploma, 1.9% had bachelor's degrees, and 3.3% had master's degrees (Table 2).

Table 2. Demographic characteristics of respondents

Variables	Frequency	Percentage
Gender		
Male	127	60.4
Female	83	39.6
Total	210	100
Age		
18yrs-20yrs	2	1
21yrs-25yrs	27	12.8
31yrs-35yrs	39	18.5
36yrs and above	142	67.7
Total	210	100
Level of Education		
Primary	76	36.2
SHS	117	55.7
Diploma	6	2.9
Bachelor	4	1.9
Master's	7	3.3
Total	210	100

Source: Computed from survey data, 2020

Various actors

The study mapped the various actors involved in the value chain, 46.2% were producers, 23.8% were collectors, and purchasing clerks were 22.4%, while agrochemicals sellers were 4.8% (Figure 2). Cashew processors and exporters were 1.4%, respectively (Fig. 2). The result indicates that most of the actors in the cashew value chain are producers.

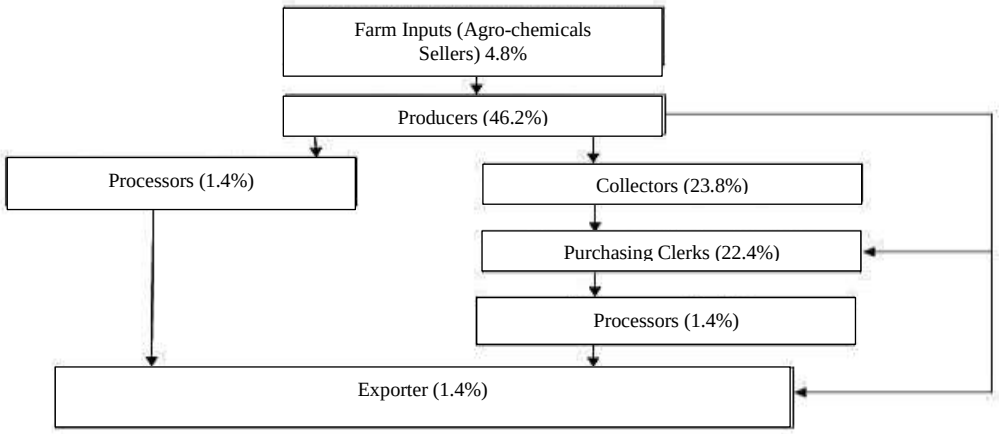

Fig. 2. A schematic illustration of major actors of the Cashew value chain in Jaman North Municipality, Ghana
Source: Author's construct, 2020

Source of finance for the cashew business

The majority (56.6%) of the respondents interviewed in the study area indicated that their source of finance for cashew business is from loans from financial institutions. 34.7% from family and friends, 6.1% from personal savings, and 2.6% from other sources (Table 3).

Table 3. Source of finance of the various actors of the Cashew value chain.

Source of Finances	Producer	Collector	Purchasing clerks	Agro chemicals sellers	Processors	Exporters	Total
Personal saving	6	1	3	1	1	1	13 (6.1%)
Loan	50	5	48	10	3	3	119 (56.6%)
Family & friends	40	2	15	10	3	3	73 (34.7%)
Others	1	0	1	1	1	1	5 (2.6%)
Total	97	8	67	22	8	8	210

Source: Computed from survey data, 2020

Schedule of Interest rate of financial institutions in Sampa

The majority (50.42%) of the actors indicated a 24% interest rate from Suma Rural Bank, 33.61% of actors stated a 23% interest rate from Nafana Rural Bank, and 15.97% of them indicated a 22.75% interest rate on loan from GCB Bank. This result shows that most actors in the cashew value chain finance their operations from loans taken from rural banks (Table 4).

Table 4. The interest rate of financial institutions in Sampa

Name of Banks	Interest rates	No. of actors	Percentage
Nafana Rural Bank	23%	40	33.61
Suma Rural Bank	24%	60	50.42
GCB Bank	22.75%	19	15.97
Total		119	100.00

Source: Computed from survey data, 2020

On experience in the Cashew business, the majority (61.40%) of the actors had between 6-10years, 29% between 1-5 years, and 7.6% between 11-15years. Moreover, only 2% of the actors interviewed have 20yrs and above experience in the Cashew business (Table 5).

Table 5. Average level of experience in the business

The average level of experience in the business	Frequency	Percentage
1-5yrs	61	29
6-10yrs	129	61.40
11-15yrs	16	7.6
20yrs and above	4	2
Total	210	100

Source: Computed from survey data, 2020

Producer responses to its activities in the cashew value chain

Out of the 97 farmers interviewed, 41.2% indicated that they have less than 20 acres of cashew farm, 15.5% have between 21-30 acres, 26.8% have between 31-40 acres, 7.2% have between 41-50 acres, and 9.3% have between 51-60 acres. The results on the average number of bags of cashew nuts collected per acre showed that 43.3% of the producers had four bags, 25.8% had five bags, 21.6% had three bags, 7.2% had two bags, and 2.1% had six bags. Also, on the total cost incurred by producers along the cashew value chain, the majority (50.5%) of the respondents spend between GH¢ 4000-GH¢ 7000, 34% of them spend between GH¢1000-GH¢4000, and 15.5% spend above GH¢ 7000. In addition, 58.8% of the producers indicated that they supply cashew nuts to purchasing clerks bi-weekly basis. At the same time, the weekly and monthly supplies of cashew nuts from producers were 20.6%, respectively. On storage facility, 85.5% of the respondents indicated that they have storage facility whiles 14.5% stated no. Furthermore, most (36.1%) of the producers suggested selling between 1-10 bags per season, 15.4% sell between 11-20 bags, 18.5% sell between 21-30 bags and 3-40 bags respectively, and 11.5% sells above 41 bags. These results are summarised in Table 6.

Table 6. Producers responses to its activities in the cashew value chain

Farmer responses	**Frequency (*f*)**	**Percentage (*%*)**
Size of your cashew farm		
Less 20 acres	40	41.2
21-30 acres	15	15.5
31-40 acres	26	26.8
41-50 acres	7	7.2
51-60 acres	9	9.3
Total	**97**	**100**
Average number of bags of cashew nuts collected per acre		
2	7	7.2
3	21	21.6
4	42	43.3
5	25	25.8
6	2	2.1
Total	**97**	**100**
Total cost incurred by producers along the cashew value chain (GH¢)		
1,000 - 4,000	33	34

4,000 - 7,000	49	50.5
7,000 and above	15	15.5
Total	**97**	**100**
How regular is the supply of cashew nuts		
Weekly	20	20.6
Bi-Weekly	57	58.8
Monthly	20	20.6
Total	**97**	**100**
Whether the farmer has a storage facility		
Yes	83	85.5
No	14	14.5
Total	**97**	**100**
Average number of cashew bags sold per season as a producer		
1-10bags	35	36.1
11-20bags	15	15.4
21-30bags	18	18.5
31-40bags	18	18.5
41bags and above	11	11.5
Total	**97**	**100**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Collectors' responses to its activities in the cashew value chain

The majority (54%) of the respondents collect between 6-10 buckets of cashew nuts in a day. 10% of them collect between 1-5 buckets, 14% between 11-15 buckets, 16% between 16-20 buckets, and 6% above 21 buckets in a day (Table 7). Cashew nut collectors quoted different prices for collecting a bucket of Cashew nuts, ranging from GH¢3.00 to GH¢6.00. Most (70%) of them stated GH¢5.00, 18% quoted GH¢3, 10% quoted GH¢ 4 while 2% quoted GH¢1. On the average number of buckets collected in a season, 70% indicated that they collect between 101-150 buckets, 12% indicated between 151-200, 4% indicated between 251-300, and 2% above 301. Furthermore, 6% of the respondents collect between 50-100 and 201-250 buckets in a season, respectively (Table 7).

Table 7. Collectors responses to its activities in the cashew value chain

Responses	Frequency	Percentage
How many buckets are you able to collect in a day		
1-5	5	10
6-10	27	54
11-15	7	14
16-20	8	16
21 and above	3	6
Total	**50**	**100**
How much is charged for a bucket collected GH¢?		
3	9	18
4	5	10
5	35	70
6	1	2
Total	**50**	**100**

Averagely how many buckets of cashew nuts do you collect in a season		
50-100	3	6
101-150	35	70
151-200	6	12
201-250	3	6
251-300	2	4
301 and above	1	2
Total	**50**	**100**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Purchasing clerks' responses to its activities in the cashew value chain

The majority (66%) of purchasing clerks buy cashew nuts every week, 8% purchase daily, 4% purchase bi-weekly, 10% purchase every three weeks, while 12% purchase every month (Table 8). More than half of the clerks indicated a bag of cashew nuts costs between GH¢180-GH¢280, 36% of them said a bag of cashew nuts cost between GH¢281-GH¢381, while 8% said a bag of cashew nuts costs more than GH¢585 (Table 8). On average, 70% of clerks indicated that they buy between 10-50 bags of cashew nuts. 20% buy between 51-100, whereas 10% buy more than 100 bags of cashew nuts (Table 8).

Table 8. Purchasing clerks' responses to its activities in the cashew value chain

Responses	Frequency	Percentage
Purchasing Clerks		
How often do you buy cashew nuts in a month		
Daily	4	8
Weekly	33	66
Bi-weekly	2	4
Every three weeks	5	10
Monthly	6	12
Total	**50**	**100**
How much is a bag of cashew nuts? (GH¢)		
180-280	27	54
281-381	18	36
382-482	1	2
585 and above	4	8
Total	50	100
Averagely how many bags do you buy		
10-50 bags	35	70
51-100	10	20
101 and above	5	10
Total	**50**	**100**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

The estimated average net margin of the major actors

The tables below show the estimated average net margin of the actors in the cashew value chain. The results showed that the percentage of net margin on revenue of the producers is 16.95% which is the lowest among all the major actors in the cashew value chain. This indicates that among the actors, producers of cashew nuts suffer the lowest profit margin. See Table 9 to 15.

Table 9. Margin of producer estimated average gross margin for average acres of 15 acres

Item	Acres	Bags of cashew nuts per acre	Total bags of cashew
Cashew	15	4	60
Average Price Per Bag (GH¢)			GH¢ 300.00
Total Income			GH¢18,000.00
Less Expenditure			GH¢
Weeding	15		5,500.00
Collectors			4,320.00
Pruning			1,500.00
Transportation			388.00
Construction of fire belt			2,500.00
weedicides			740.05
Total			**14,948.05**
Net margin			**3,051.95**
% of Profit on Income	$\frac{3051.95}{18000} \times 100$		**16.95%**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 10. Estimate average gross margin of purchasing clerk for 15 acres.

Revenue (commission)	60 Bags (16Kg) at GH¢ 20.00	GH¢ 1,200.00
Less expenditure		
Store rent		210.00
Stool land Levy		100.0
District Assembly levy		150.00
Utilities		143.00
Loading and off-loading		60
Net margin		**537.00**
% of the profit on total commission	$\frac{537.00}{1200} \times 100$	**44.75%**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 11. Average gross margin of collectors for 15 acres.

		Amt (GH¢)
Revenue	600 rubbers at GH¢ 4.00	GH¢ 2,400.00
Expenses		
Feeding	51times × GH¢15.00	765.00
Transports	51 times × GH¢ 6.00	306.00
		1,071.00
Net Margin		**1,329.00**
% of net profit on revenue	$\frac{2604}{4704} \times 100$	**55.40%**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 12. Processor estimated average gross margin.

Item	Qty (16kg per bag)	Unit price (GH¢)	Amount (GH¢)
REVENUE	60 bags	35.00	**33,600.00**
Expenditure			
Raw nuts	60 bags	210.00	12,600.00
Drying	60 bags	2.00	120.00
Streaming	60 bags	5.00	300.00
Cool drying	60 bags	2.00	120.00
Shelling	60 bags	50.00	3,000.00
Ovening	60 bags	5.00	300.00
Grading	60 bags	30.00	1,800.00
Packaging	190 boxes	15.00	2,850.00
Utilities			1,400.00
Fuel			1,000.00
Transport			500,00
Firewood	2 trips	250.00	500.00
Labour	3 peoples	300.00	900.00
Total expenses			**24,490.00**
Net margin			**9,110.00**
% of net profit on revenue	$\frac{9110}{33600} \times 100$		**27.10%**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 13. Exporters estimated average gross margin.

Item	Qty (80kg per bag)	Price (GH¢)	Amt (GH¢)
Revenue	4.8 tonnes	6,480.00	31,104.00
Expenses			
Cashew nuts purchased	60 bags	210.00	12,600.00
Purchasing clerks commission	60 bags	20.00	1,200.00
Transport	4.8 tonnes		750.00
Drying of cashew nuts	60 bags	2.50	150.00
Rebagging	60 bags	1.00	60.00
Loading & off loading	60 bags	1.00	60.00
Casual staff	4 peoples	400	1,600.00
Renting of warehouse			4,500.00
Total expenses			(20,920.00)
Net margin			**10,184.00**
% of net margin on revenue			**32.70%**

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 14. Agrochemical sellers estimated average gross margin.

Item	Qty	Price	Amt (GH¢)
Sales			3,240.00
Expenses			
Purchased of weedicides	15 boxes	150.00	2,250.00
Net margin			990.00
% of net margin on sales			30.55%

Source: Computed from survey data, 2020 Exchange rate $1 = GH¢5.70

Table 15. Overall average gross margin of actors.

	Producer	Collector	Purchasing clerks	Processor	Agro-Chemical	Exporters
Revenue	18,000.00	2,400.00	1,200.00	33,600.00	3,240.00	31,104.00
Cost	(14,948.05)	(1,071)	(663)	(24,490)	(2,250)	(20,920)
Net margin	3,051.95	1,329	537	9,110	990	10,184
%	16.95%	55.40%	44.75%	27.10%	30.55%	32.70%

Source: Computed from survey data, 2020

Challenges and measures to address the shortfalls among the actors

The study investigated the challenges faced by producers, purchasing clerks, and processors in the cashew business and the measures to overcome the challenges. The results showed that the fluctuation in pricing is the most significant challenge may be faced by producers in the business. This challenge was cited by 52.1% of producers. Other challenges faced by producers were bush fires (28.5%), low agriculture extension services (5%), and poor road networks (4.2%). The measures mentioned by the farmers to address these challenges are prominently government regulation on pricing and government credit facility, respectively cited by 58% and 32% of farmers. These findings are presented in Table 16.

From the perspective of purchasing clerks, inadequate storage facility, as indicated by 52% of the respondents, was a key challenge faced in the cashew business. In addition, about a third of purchasing clerks mentioned the high cost of transport as a challenge faced, while 15.5% cited the high cost of purchasing inputs. Over 60% of the clerks stated the government's provision of a storage facility as a measure to address the challenge. The other measure identified was that the government should subsidise purchasing inputs (39% of the purchasing clerks).

On challenges facing cashew nuts processors, 43.1% of the respondents indicated a lack of government support which was followed by access to credit (28.5%) (Table 16). High interest on credit and low demand for processed food received the endorsement of 14.2% of the processors. On how to overcome these challenges, about 52.9% of the processors indicated that the government should help in the marketing of cashew products. Almost a fourth (29.4%) of them also indicated that the government must subsidise interest on loans. About 17.7% also said the government should help in building storage facilities (Table 16).

Furthermore, high cost of transport, inadequate and high cost of storage facilities, high cost of purchasing inputs, and the unstable exchange rate had 25% of the cashew nuts exporters each (Table 16). 50% of the respondents suggested that the government provide storage facilities and subsidies to producers to help address the challenges, respectively (Table 16).

Table 16. Challenges and measures to overcome the shortfalls of the various actors

Challenges and measures to overcome the shortfalls	Frequency	Percentage
Producers		
Challenges do you face in the cashew value chain as a producer		
Low Agric extension services	6	5
Bush fire	34	28.5
Poor road networks	5	4.2
Fluctuation in pricing and high-interest rate	62	52.1
Theft	12	10.2

Total	**119**	**100**
Measures to overcome the challenges		
Government regulation on prices	29	58
Government credit facility	16	32
Use of tri-cycles for transport	5	10
Total	**50**	**100**
Purchasing clerk		
Challenges		
High cost of transport	36	32.7
Inadequate storage facilities	57	51.8
High cost of purchasing inputs	17	15.5
Total	110	100
Measures		
Provision of storage facilities by government	37	60.6
Government should subsidies purchasing inputs	24	39.4
Total	**61**	**100**
Challenges do you face in the cashew value chain as a processor		
Access to credit	4	28.5
Lack of government support	6	43.1
High interest on available Credit	2	14.2
Low demand for processed product	2	14.2
Total	**14**	**100**
How to overcome these challenges		
Government subsidies loan	5	29.4
Government should help in marketing cashew by-products	9	52.9
Government should help in building silos for storage	3	17.7
Total	**17**	**100**
Challenges faced by exporters		
High cost of transport	3	25
Inadequate and high cost of storage facilities	3	25
High cost of purchasing inputs	3	25
Unstable exchange rate	3	25
Total	**12**	**100**
Measures		
Provision of storage facilities by government	3	50
Government should provide input subsidies to producers	3	50
Total	**6**	**100**

Note: Some frequencies are more than 50 because they are multiple responses.Some of the N is more than 50 because they are multiple responses.Source: Computed from survey data, 2020

Governance relationship along the cashew value chain

The study interviewed respondents' on government relationships with actors in the cashew value chain (Table 17). The overall mean showed that there was an excellent relationship between government and actors in the cashew value chain on pricing the cashew products (M=3.91, SD=0.77), income got from cashew value chain (M=3.85, SD=0.77), government policy on cashew (M=3.71, SD=1.02), influence of actors on your business (M=3.90, SD=4.19), and access to extension services (M=2.83, SD=1.11). Also, others

such as the relation with other actors along the chain (M=3.45, SD =0.86) and road network (M=3.58, SD=1.07) averages were below the overall mean, which indicated that there was no cordial relationship between government and actors in the cashew value chain.

Table 17. Governance relationship along the cashew value chain

Statements	N	Mean	Std. Dev.
	n	*M*	*SD*
Pricing on cashew products	210	3.91	0.77
Income got from cashew value chain	210	3.85	0.77
Government policy on Cashew	210	3.71	1.02
Relation with other actors along the chain	210	3.45	0.86
Influence of actors on your business	210	3.90	4.19
Road network	210	3.58	1.07
Access to extension services	210	2.83	1.11
Overall mean and standard deviation		3.60	1.40

Source: Computed from survey data, 2020

Stakeholders (actors) influence on price

One way to help manage actors is to use Mendelow's Matrix, which allows the researcher to know the actors who can influence and have interest over the pricing of the cashew value chain.

Where,

$$\text{Influence} = \text{Power} \times \text{Interest} \quad (4)$$

From Mendelow's matrix (Table 18) above, the collector has very low interest and weak power to influence the pricing of cashew nuts. The producers have very high interest but have weak power to influence the pricing of cashew nuts, and they may have strong power when they come together as associations. The processors have strong power to influence the prices but have very low interest to influence it. Lastly, purchasing clerks have strong power and very high interest in controlling the pricing of cashew nuts in the value chain.

Table 18. Mandelow Matrix of Actors

		Interest of actors	
		Low	High
Power of Actor	Low	Collector	Producer
	High	Processor	Purchasing clerk/exporter

Source: Computed from survey data, 2020

Market power (Concentration)

$$HHI = X_1^2 + X_2^2 + X_3^2 + X_4^2 + X_5^2 + X_6^2 \quad (5)$$

Where;

X1, X2, X3, X4, X5, and X6 refer to the percentage market share of the various actors in the Cashew nuts industry. The Herfindahl-Hirschman Index Scale ranges from 1 (least concentrated) to 10,000 (most concentrated). HHI of less than 1,500 represents an industry with a low market concentration (Table 19). An HHI ranging from between 1,500 and 2,500 represents moderate concentration. An HHI value of more than 2,500 represents a highly concentrated industry (Table 19). Based on table 19, the HHI is 3,036.01 is higher than 2,500, and therefore, the industry is highly concentrated (Table 19).

The net margin percentages among the four (4) cashew nuts industry firms were determined and ranked. The purchasing clerks were ranked first, followed by exporters, processors, and producers

(Table 20). This result suggested that the purchasing clerk has much power among the four cashew nuts industry firms, second by the exporters. Also, the two actors can influence the Cashew nuts market.

Table 19. Extent of market power (concentration) along the cashew value chains

Actors	Market share	Percentage X%	X^2
Producers	18,000	20.10	404.01
Purchasing Clerk	1,200	1.34	1.80
Collectors	2,400	2.6	6.76
Exporters	31,104	34.70	1,204.09
Agro Chemicals	3,240	3.62	13.10
Processor	33,600	37.50	1,406.25
TOTAL	89,544		3,036.01

Source: Computed from survey data, 2020

Table 20. Four (4) major firm in the industry

	Producer	Purchasing clerks	Processor	Exporters
Revenue	18,000.00	1,200.00	33,600.00	31,104.00
Cost	(14,948.05)	(663)	(24,490)	(20,920)
Net margin	3,051.95	537	9,110	10,184
%	16.95%	44.75%	27.10%	32.70%
Rank major actors	**4**	**1**	**3**	**2**

Source: Computed from survey data, 2020

Discussion

Male respondents were more than their female counterparts; meanwhile, more than 60% of the respondents aged 36 years and above and only 1% of the respondents aged between 18-20years. The level of education indicates that most (55.7%) of the respondents were senior high school (SHS) graduates. Also, the mapping of various actors involved in the value chain reveals that most of them were producers with 6-10 years of experience in the cashew nut business. Producers (farmers) had the lowest net margin on cashew nut revenue of 16.95% among the actors in the value chain. Moreover, producers indicate that fluctuations in pricing and bushfires are the two significant challenges for cashew nuts. Purchasing clerks pointed out that inadequate storage facilities and the high cost of transportation of cashew nuts were their challenges. Processors cited lack of government support, credit, high interest on loans, and low demand for processed food as challenges they conveyed. Cashew nut exporters named high transport costs, inadequate and high cost of storage facilities as the most pressing challenges. Furthermore, the Herfindahl-Hirschman Index (HHI) indicates that the cashew value chain industry is highly concentrated and needs government attention.

Recommendations

The study recommends that policymakers (Government), Non-Governmental Organisations (NGOs), and other relevant stakeholders should formulate policies that encourage and promote the marketing of Cashew and its by-products. Also, Government efforts should be focused on developing a Cashew Development Board to enhance marketing and price regulation, provide storage facilities, and ensure a stable foreign exchange rate.

Conflict of interests

We have no conflict of interest to declare.

References

African Cashew Alliance (2015) African Cashew Alliance Annual Report Accra.

Practical Action (2013) Poor people's energy outlook 2012: Energy for earning a living, Practical Action Publishing.

Azam-Ali S, Judge E (2001) Small-scale cashew nut processing. Coventry (UK): ITDG Schumacher Centre for Technology and Development Bourton on Dunsmore.

Camp WG, Heath-Camp B (2015) Managing our Natural Resources, Nelson Education.

Chopra S, Meindl P (2007) Supply chain management. Strategy, planning and operation. Das summa summarum des management, Springer. 265-275.

Cochran WG (2007) Sampling techniques, John Wiley & Sons.

Dinakara Adiga J, Kalaivanan D (2013) Influence of dwarf rootstocks on growth and vigour of popular cashew cultivars. Journal of Plantation Crops. 41(3), 428-432.

Duke JA (1983) Handbook of energy crops. Centre for New Crops and Plant Products, Purdue University.

Edoga MO, Fadipe L, Edoga RN (2006) Extraction of polyphenols from cashew nut shell. Leonardo Electronic Journal of Practices and Technologies. 9, 107-112.

FAOSTAT (2017) Agriculture Organization of the United Nations Database. The agricultural production. http://www. apps. fao. org. Accessed on 20 June 2021.

Fileccia T (2017) GMOs: A good but battered means for sustainable production intensification. International Journal of Horticultural Science and Technology. 4(1), 1-20.

Fitzpatrick J (2019) Competitiveness of the African cashew sector. Gates Open Res 3.

Florian L (2014) Measuring competition in banking: A critical review of methods." CERDI Working Papers.

Gilleo J, Jassey K, Yeager Sallah J (2011) Cashew Business Basics. The Gambia river basin Cashew Value Chain Enhancement Project. International Relief and Development.

Goujon P, Lefebvre A, Leturcq P, Marcellesi A, Praloran J (1973) Etudes sur l'Anacardier. Bois & Forets des Tropiques. 151, 27-53.

Heinrich M, (2012) Case study of the African cashew initiative–focus: Ghana. Donor Committee for Enterprise Development, Lessons from working with new and multiple partners–emerging results. Accra, Ghana.

ISSER (2008) The State of the Ghanaian Economy, Institute of Statistical, Social, and Economic Research Report, University of Ghana.

Jaffee S (1994) Private Sector Response to Market Liberalization: The Experience of Tanzania's Cashew Nut Industry, World Bank Publications.

Jekayinfa S, Bamgboye A (2006) Estimating energy requirement in cashew (*Anacardium occidentale* L.) nut processing operations." Energy. 31(8-9), 1305-1320.

Kielland A, Tovo MC (2006) Children at work: Child labor practices in Africa, Lynne Rienner Publishers Boulder, CO.

MoFA (2008) Agriculture in Ghana. Facts and Figures. Statistics, Research and Information Directorate (SRID). Accra.

Oro K, Pritchard B, (2011) The evolution of global value chains: displacement of captive upstream investment in the Australia–Japan beef trade. Journal of Economic Geography. 11(4), 709-729.

Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A (2009) Agroforestree Database: a tree reference and selection guide. Version 4. Agroforestree Database: a tree reference and selection guide. Version 4.

Osei A, Pandey P, Spiro D, Nielson J, Shrestha R,Talukder Z, Quinn V, Haselow N (2010)

Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. Food and Nutrition Bulletin. 31(4), 483-494.

Porter ME, Kramer MR (1985) Advantage. Creating and Sustaining Superior Performance, Simons.

Sarpong PK (2011) An assessment of the contribution of cashew production to local economic development: a case study of the Brong Ahafo Region.

Srivastava SK (2007) Green supply ‐ chain management: a state ‐ of ‐ the ‐ art literature review." International Journal of Management Reviews. 9(1), 53-80.

Tamarack LM (2004) Prevalence and Attitudes Towards Illegal Piracy of Entertainment Media, University of South Carolina.

Telascrêa M, Leão AL, Ferreira MZ, Pupo HFdF, Cherian BM, Narine S (2014) Use of a cashew nut shell liquid resin as a potential replacement for phenolic resins in the preparation of panels–a review. Molecular Crystals and Liquid Crystals. 604(1), 222-232.