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The locust beans value chain: profit sharing of the key actors in Oyo state, Nigeria

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Abstract: This study investigated the economic values available along the value chain of locust beans, the various activities that were performed in the links of chain and the profit sharing along the essential intra-link. The multistage sampling technique was employed. Three local Government areas (LGAs) were purposively selected, with 15 collectors from each of them, making a total of 45 respondents. In the case of the marketers of raw locust beans 102 respondents were snowballing selected from different major markets in Oyo State. The processors/marketers of processed locust beans were purposively interviewed in 5 LGAs in Oyo State, with 102 valid respondents. The study discovered profit sharing potentials along the linked activities from harvesting to consumption. The gross margin for the collector is ₦25,848.89 and contributed 33.57% to the value chain of locust beans. The gross margin for the marketers is ₦7,806.34, making the raw locust bean lucrative. Marketing contributes most to the locust beans value chain (43.02%), while the processor contributes 23.40%. The study found that there were income shares along the chain from harvest to final selling of the processed locust beans. Therefore, it is recommended that technology for different stages should be provided to create wealth and valuable source of livelihood for the people.

Keywords: Profit sharing, locust beans, depodding, depulping.

Introduction

The essence of developing commodity value chains should be to ensure the attainment of maximum quality of produce and products, a good reward for value created and added by actors, and the provision of level playing ground to all actors/players along the chain (Abubakar *et al.*, 2020). The full range of activities required producing a product or service from inception through different phases of processing, delivery of the final product to consumers and the final disposal after use is referred to as the value chain (Bwala *et al.*, 2019). Ensuring the availability of quality products in a market requires significant development of the commodity chain, which includes researching the market availability for a commodity and stimulating research and development of the commodity chain. Hence, the economic values available along the commodity chain and the placement of a distribution structure will facilitate equitable reward or profit sharing for the completed work by each actor.

The African locust bean tree is a perennial deciduous tree that has dark green and alternate bi-pinnate leaves. The tree is extremely hardy and grows well in a wide range of soils, survives fire during the dry season period and less prone to pests and diseases (Sadiku, 2010). In Nigeria, it is commonly found in the guinea savannah zones of the country and has become very important for food security. It is a species that is recognized internationally as a therapeutic food as well as a source of income for the rural populace (Kourouma *et al.*, 2011). It is an important indigenous multipurpose fruit tree and has various uses in food, medicine, livestock feeds, fibre, and fuel among others. The African locust bean tree has socioeconomic and cultural values among local people in Nigeria. It is characterized by its fruits which are

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elongated pods with seeds that are processed into a fermented product (condiment) known as 'Iru', 'Dadawa' and 'Ogiri' in the Yoruba, Hausa and Igbo Languages, respectively (Aderounmu *et al*., 2019). A mature locust bean tree can produce about one ton of harvested fruits in a season. The fruit has a brown colour when ripe and contains numerous black seeds embedded in yellowish sweet tasting pulp which can be made into colourful and refreshing drinks. So, the locust bean is nutritionally important particularly in the third world countries where the need for protein supplementation is high for both adults and infants. The harvesting technique of locust beans is universally the same that is, by the use of a hooked light pole (Aderounmu *et al*., 2019). The processing of locust bean fruits into food condiment undergoes a series of unit operations and it was observed that these unit operations are still done manually by the processors in Nigeria which has made the processing of locust bean seeds into food condiment drudgery.

The study sought to examine the profit sharing among the actors involved in Parkia biglobosa collection and the opportunity created by this enterprise. Furthermore, little or no study has been carried out identifying the players in the locust bean collection chain and the value addition component between the links. Consequently, a paucity of information exists in that regard. It is therefore necessary for the linkages within the locust beans collection chain to be examined. This empirical work shall be different from them all in that the value chain (identifying major actors in each node and how they are adequately compensated for their labour, technical expertise, skills, etc.) shall be thoroughly investigated.

Materials and methods

The study area and data collection

The study was conducted in Oyo State, in the south-western part of Nigeria. There are 33 local government areas in the state. A well-structured and pretested questionnaire was prepared to collect data in the present study in three segments for the three main key actors: the collectors, the marketers and the processor.

The collectors: Data were collected in two stages, the first stage involved purposive selection of three local Government areas (LGAs); these were Ogbomoso North, Iseyin and Ibarapa North LGAs. This selection was based on the fact that there was prevalence of locust bean trees in those areas. The second stage involved the snowball selection of fifteen (15) collectors from each of those areas proportionate to the sample size to make a total of forty five (45) respondents. The collection of data is not bias since the trees are scattered over the areas, no plantation of *parkia biglobosa* trees, not everyone is collecting and the questionnaire was directed to collectors alone. Locust beans is not a food with competition to consume. It is an organic condiment, using snowball sampling would not create any biasness in the sampling or analysis. The tree is one of the threaten one by charcoal producers, that is the reason it is scattered, collectors are not in a particular place.

The marketers**:** The marketers of raw locust beans in wholesale and retail measures were interviewed. About 102 respondents were snowballing sampled from different major markets in Oyo State, such as Bodija market (15), Ojo market (8), Sasa/Akinyele Market (18), Orita Merin (10) in Ibadan Odo-Oba (18), Tewure (10), Iluju in Ogbomoso town (13) and Araromi (10) in Oyo town of Oyo state, Nigeria. These markets are always crowdy with buyers and sellers. The raw locust beans sellers cannot be found in specific shelters together. The number of marketers interviewed varied because of variations in the market sizes. For instance Sasa/Akinyele Market occupies 35hactares of land which was the highest followed by Bodija with land mass of 25 hectares and other markets lower in sizes.

The processors: Processors of processed locust bean were purposively interviewed in five LGAs in Oyo state. These were Ido (22), Orire (20), Atiba (20), Ajawa (20) and Iseyin (20) LGAs who were prevalent and lived in those communities. The processing was their household livelihood and even inherited from their mostly mothers that was why the five LGAs were purposely selected

Data Analytical Tools

Descriptive Statistics in the form of frequency counts and percentages

Budgetary Analysis

i. Gross Margin Analysis

The gross margin analysis was employed to determine the costs and returns of actors along the value chain, upon which profitability and profit share were established. The gross margin is calculated as:

$$GM = TR - TC$$

Where: GM = gross margin, TR= total revenue, TC = total cost, total cost is the aggregate cost of doing business (encompasses both fixed and variable costs).

$$NFI = TR-(TFC+TVC) = TR-TC$$

Where: NFI = net farm income, TR = total revenue, TFC = total fixed cost, TVC = total variable cost, TC = total cost

Total Revenue, TR in this context were all the money coming in, in the course of selling either the raw locust

beans or the proceed beans. While **Total Cost,** TC in this context were all expenditure incurred in collection, processing and marketing which included the fixed (basket, turning stick, sack, bowls/containers and cooker/stove and variable cost also called running cost(harvest cost, depod cost, depulped, calling cost, transportation, loading, council levy, water fuel, labour,

ii. Benefit Cost Ratio (BCR):

Benefit cost ratio is another measure of profitability. It was used to evaluate and confirm the profitability of each respondent of locust bean processors and marketers. BCR= TR/TC

TR=Total Revenue

TC = Total Cost

A BCR greater than 1 indicates that the benefit outweigh the costs, and the projects ir investment is considered viable. BCR less than 1 suggests that the costs exceed the benefits and the business may not be viable.

iii. Rate of Return (ROR):

This is another measure used to determine the worthwhile of a business.

Rate of Return = TR – TC ÷ TR

Hence, the higher the rate of return, the more profitable the business is.

iv. Value addition analysis

The value addition analysis was used according to Igwenagu *et al*. (2020) to estimate the value added to the locust beans from harvesting to the raw locust beans ready for sale by various chain participants as specified below:

VA = DP – CI

where: VA = value added, DP = disposable price of output, and CI = cost of input. Thus, the value added by a chain participant / actor should further improve the quality of the product.

Results and Discussion

Socio-economic characteristics of the respondents in the study area

Table 1 presents the socio-economic characteristics of the locust beans collectors. The analysis discovered that men (55.6%) and women (44.4%) usually collected the locust beans. This was in contrary to Ijigbade *et al*. (2021) finding that females were more collectors than men The average age of the collectors was 61.4 years, which indicates that fairly old people were involved in the collection of locust beans. This is in line with Ijigbade *et al.* (2021) that collectors of locust beans were above 50 years of age About 84.4% of the collectors were married implying there would be availability of family labour which reduces costs (Abubakar *et al*., 2020), 13.3% were widows and 2.2% were single. This marital information indicated that the collection of locust beans was fully engaged by married men and women. This could be due to the fact that the business supports household livelihoods.

The study found that the educational level or standard of education was very low in the study area, with the majority having no formal education 35.6% and just 33.3% having primary education. The low level of literacy among the actors could affect, to a large extent, the efficiency of discharging value chain activities and also innovations are likely not to be accepted. This is because the ability to read and write gives individuals the ability to discern immediately the implications of their actions in business; it also enables them to discharge their duties without employing a translator. This corroborates the findings of Kadigi (2013) that education is important to manage the business as well as in decision making. But Ijibade *et al*. (2021), found in Akoko that majority of collectors had higher level of education and will be ready to accept new innovations on the business when introduced to them.

The household size of 46.7% of the collectors was between 1and 5 in number, while the remaining 53.3% was 6 and above. This implies that the respondents in the study area had relatively large household sizes. The major occupation of the respondent was farming 77.8%, followed by 22.2 % for civil service and trading, while the major source of income was locust bean collection and other crop farming (68.9%) followed by locust bean collection only (20%). The majority of the bean collectors (71.1%) had a monthly income between ₦10,000 and ₦50,000, 17.8% had between ₦51,000 and ₦100,000 and 11.1% had above this range amount income.

Plantation of locust bean *(Parkia biglobosa)* was very common, as 100% of the collectors inherited the trees from their parents. The majority of them (51.1%) harvested a maximum of 25kg of locust bean pods in a year (Table 2). The collectors mostly sold as wholesalers to the marketers (64.4%) and about 24.4% of middlemen who assembled the locust beans and took to the main market. This is in line with Sudirman *et al*.. (2020) who found that most farmers (51.66%) sold as wholesalers to the marketers.

Value addition analysis

The table 4 below shows the average value paid on different activities supporting the collectors. The value added by a chain participant/actor should further improve the quality of the product and hence attract higher price from the market. Since there is no

Table 1: Socio-economic characteristics of the collectors presented in percentage

Variables	Frequency	Percentage	Variable	Frequency	Percentage
Sex			**Education level**		
Male	25	55.6	Primary	15	33,3
Female	20	44.4	Secondary	8	17.8
Total	45	100.0	Tertiary	6	13.3
			No formal education	16	35.6
			Total	45	100
Age			**Household size**		
40-49	4	8.9	1-5	46.7	46.7
50-59	11	24.4	6-10	53.3	53.3
>60	30	66.7	Total	100.0	100.0
Total	45	100			
Marital Status			**Major occupation**		
Single	1	2.2	Farming	35	77.8
Married	38	84.4	Civil Service	5	11.1
Widow	6	13.3	Trading	5	11.1
Total	45	100.0	Total	45	100.0
Source of income			**Monthly income**		
Parkia production	9	20.0	10000 - 50000	32	71.1
Parkia & Other crops	31	68.9	51,000- 100,000	8	17.8
Trading	1	2.2	101,000-150000	5	11.1
Others	4	8.9	Total	45	100.0
Total	45	100.0			

Source; Field data, 2021

T**able 2.** Technical information about the locust bean collectors.

Variable	Frequency	Percentage	Variable	Frequency	Percentage
Farm Acquisition			**Quantity Harvested**		
Inherited	45	100	1-25Kg	23	51.1
Planted	0	0	26 -50Kg	14	31.1
Total	45	100	51 -100Kg	5	11.1
			>101Kg	3	6.7
			Total	45	100.0
Number Harvest per year			**Sell To**		
			Processor	5	11.1
Once	45	100	Marketers	29	64.4
Twice	0	0	Middlemen	11	24.4
More times	0	0	Total	45	100.0
Total	45	100			
Measure Selling					
Kilogram	8	17.8			
Bag	20	44.4			
Others	17	37.8			
Total	45	100.0			

Source; Field data, 2021

Table 4: Profitability of Locust beans Collection

Cost and Returns	N	Mean ₦
Harvest cost	45	2,577.78
De-pod cost	45	1,955.56
De-pulped cost	45	2,164.44
Sun-drying Cost	45	320.00
Total Variable Cost (TVC)	45	7,017.78
Total Revenue (TR)	45	32,866.67
Gross Margin (GM)	45	25,848.89
Benefit Cost ratio (BCR)	45	4.66
Rate of Return (ROR)	45	3.68

Source; Field data, 2021

disposable income in this case. The cost of labour for each activity is the value added. The average cost of harvesting per tree was ₦2,577.78, the average cost of depodding was ₦1955.56, depulping was ₦2164.44, while sun drying and other costs were about ₦320 only.

Profitability of locust beans collection

The results shows that the collectors incurred an average total cost of ₦7,017.78, which involves harvest cost (₦2,577.78) de-pod cost (₦1,955.56) and the de-pulped cost (₦2,164.44) while sun drying and transportation cost was (₦320) for about average of 33 kilogrammes harvested by the collectors. The Total revenue generated was ₦32,866.66. Furthermore

Gross margin realized was ₦25,848.88; this indicates that there is an addition of value by gathering the beans pulp for average of 33 kilogrammes depoded, depulped and sundried. The benefit cost ratio is an indication that the collection is worthwhile and the rate of return analysis is great one, the higher it is the more profitable the business.

Marketing of raw locust bean

Marketing is concerned with all stages of operations that aid the movement of commodities from the farm to consumers, and these include assemblage of goods storage, transportation, processing grading, and financing of all these activities. Agricultural marketing also involves the supply of raw materials to processing industries and the marketing of processed products including an assessment of demand as well as policies related to agricultural marketing. Most agricultural products are seasonal, whereas demand is stable throughout the year. There must be ways to handle or control products, even out the seasonal variations. Efficient marketing ensures that supplies of seasonal goods become available throughout the year with a few variations in prices that can be attributed to the cost of storage (Adegeye and Dittoh, 1982).

Socio-economic Characteristics of the Marketers

These marketers buy from various parts of the country such as Niger, Kwara and Oyo states. The age range of the majority (86.2%) of the marketers was 41 years and above (Table 5.), implying that they were in their economic active age (Abubarkar *et al.,* 2020). About 5.9% of the marketers of raw locust beans were single, 87.3% were married implying that there would be availability of family labour which reduces production costs (Abubarkar *et al.,* 2020) and that the business supported household livelihoods, while 6.9% were widows (Table 5). Most of the marketers (39.2%) did not have formal education, 10.8% had primary education, 36.3% had secondary education, and 13.7% attained tertiary education. These spread in education levels helped in the journey of sourcing information as to where to get their products. This is because the ability to read and write gives an individual the ability to discern immediately the implications of his actions in his business (Kadigi, 2013). The empirical research found that the marketers' major occupation (98.0%) is just trading, the average monthly income was between ₦10,000 and ₦100,000 for 85.3% of the marketers, and all the marketers (100%) buy at the local or village markets.

Profitability of marketing

The estimated gross margin analysis for locust beans traders is presented in Table 6. The total average variable cost was summed as ₦83,132.24 with mean calling cost (₦495.10), loading (₦995.54), offloading cost (₦449.51), Government levy (₦118.73), transportation cost (₦2002.94), cost of purchase (₦78,588.24) and middlemen charge (₦482.18). The total income realized was ₦90,950.98, therefore the gross margin was ₦7,806.3366, which makes the trading in locust beans very lucrative.

The Processor

Socio-economic characteristics of the processor

About 64.7% of locust beans processors were married, this is substantiated by Kolapo *et al.*. (2020) who found that most of the processors (87.3%) were married, about 14.7% were widowed and 19.6% were separated. Most of the locust beans processors (83.4%) had no formal education and 12.8% had primary education, while just 3.8% had tertiary and secondary education. The low level of literacy among the actors could affect, to a large extent, the efficiency of discharging value chain activities and also innovations are likely not to be accepted. This is because the ability to read and write gives an individual the ability to discern immediately the implications of his actions in his business. It also enables him to discharge his duties without employing a translator. This corroborates the findings of Kadigi (2013) who reported that education is important to manage the business as well as in decision making. Also, it shows that a low level of education is responsible for some of challenges that innovation and other technology ought to put in place, which results in a low level of their productivity (Farayola *et al.,* 2012).

It was discover from the study that processing and marketing locust beans was their major occupation (80.4%). About 85.3% of processing locust beans had generates monthly income of between ₦10,000 and ₦50,000 while just 14.7% of them had generates monthly income between ₦51,000 and ₦100,000.

Profitability of the locust bean processing

Budgeting Analysis

The estimated gross margin analysis for processed locust beans was ₦17860.42, as presented in table 8, and the average profit obtained was ₦11,690.81 making processing and marketing of locust beans very lucrative. This is corroborated by Farayola *et al.*. (2012) who suggested that processing and marketing of locust beans was profitable.

The Benefit Cost Ratio (BRC), is another measure of profitability. It was used to evaluate and confirm the profitability of each respondent of locust bean processors and marketers. The BCR was found to be greater than one (BCR > 2.57) implying that business can be termed profitable (Adegeye and Dittoh, 1982).

Table 5. Socio-economic characteristics of the locust beans marketers

Variables	Frequency	Percentage	Variables	Frequency	Percentage
Age			**Education**		
>29	4	3.9	Primary	11	10.8
30-40	10	9.8	Secondary	37	36.3
41-50	19	18.6	Tertiary	14	13.7
51 and above	69	67.6	No formal	40	39.2
Total	102	100.0	Total	102	100.0
Sex			**Occupation**		
Male	55	53.9	Farming	1	1.0
Female	47	46.1	Civil Service	1	1.0
Total	102	100.0	Trading	100	98.0
			Total	102	100.0
Marital Status			**Households Size**		
Single	6	5.9	1-5	19	18.6
Married	89	87.3	6-10	39	38.2
Widow	7	6.9	11-15	18	17.6
Total	102	100.0	16 and Above	26	25.5
			Total	102	100.0
Monthly Income			**Source of Raw Beans**		
10,000-50,000	44	43.1			
51,000-100,000	43	42.2	Farm Gate	0	0
101,000-150,000	15	14.7	Local Market	102	100
151,000-200,000	102	100.0	Urban Market	0	0
			Total	102	100

Table 6. Locust Beans Marketing Profitability

Items	Freq.	Average Cost
Calling cost	102	495.10
Loading cost	101	995.54
Off-loading cost	102	449.51
Council levy	102	118.73
Middlemen cost	101	482.18
Transport	102	2,002.94
Purchase cost	102	78588.24
Total Variable Cost, TVC	101	83,132.24
Total Revenue, TR	102	90,950.98
Gross Margin, GM	101	7,818.74
Valid N	100	

Source; Field data, 2021

Table 7: Socio-economic characteristics of the processors

Factors	Frequency	Percentage	Factors	Frequency	Percentage
Sex			**Education**		
Male	36	35.3	Primary	13	12.8
Female	66	64.7	Secondary	2	1.9
Total	102	100.0	Tertiary	2	1.9
			No Formal	85	83.4
			Total	102	100.0
Age			**Occupation**		
>29	5	4.9	**P**rocessing	82	80.4
30 -40	13	12.7	Farming	7	6.9
41-50	31	30.4	Trading	13	12.7
51 and above	53	52.0	Total	102	100.0
Total	102	100.0			
Marital			**Monthly income**		
Single	1	1.0	10000 - 50000		
Married	66	64.7	51000- 00000	87	85.3
Widow	15	14.7	Total	15	14.7
Separated	20	19.6		102	100.0
Total	102	100.0			

Source; Field data, 2021

The Rate of Return (ROR) which another measure used to determine the worth-whileness of a business was 4.48% on investment. The higher the ROR the more worthy to invest in the business (Adegeye and Dittoh, 1982). This result is corroborated by Olapade-Ogunwale *et al.*, 2011, that the ROR was 3.3%. This is in contrary to Farayola *et al.*, 2012, whose rate of return was 0.5% which is very less than one and indicated that locust beans processing and marketing was not profitable and not sustainable.

Profit sharing analysis along locust beans value chain

The profit sharing (Table 9) among the key actors: the collector (₦25,848.89), the marketers (₦7818.7435) and the processors/sellers (₦18,020.6186), show that the marketing of raw locust beans is more profitable and had highest profit sharing. The research also shows that marketing added highest value, 43.02% along the chain while collectors added 33.57% and processor added just 23.40%.

Constraints Facing Locust Bean Actors in the Study Areas.

Table 10 depicts the distribution of locust bean actors by major constraints in the various study areas. Results found that lack of modern technology which was the first and most severe problem of the collectors for the harvesting method, depodding and depulping were been done manually which constituted a great constraints (97.7%).

Table 8. Profitability of Processed Locust Beans

COST	Minimum cost ₦	Maximum cost ₦	Average cost ₦	Std. Deviation
Water	0.00	2000.00	1050.98	701.871
Fuel	0.00	6000.00	1238.24	1293.705
Labour	200.00	2000.00	747.42	578.088
TVC	700.00	6000.00	3036.64	1358.62398
Pot	0.00	5000.00	1668.63	1493.019
Basket	300.00	25000.00	3006.86	5604.052
Bowl	0.00	1000.00	471.57	306.813
Stove	0.00	1800.00	571.57	541.245
Sack	0.00	400.00	248.04	113.216
Turning stick	0.00	500.00	202.94	147.22239
Total Fixed Cost	1100.00	29100.00	6,169.61	5879.41179
Total Cost	3000.00	25600.00	9,206.25	4104.61562
Total Revenue	2800.00	80000.00	20,897.06	15229.118
Gross Margin	-1500.00	79300.00	17,860.42	15532.96185
Profit	-14800.00	66000.00	11,690.81	15857.32673
Rate of Return			1.27	
Benefit cost ratio			2.27	

Source; Field data, 2021.

Table 9: Profit Share Analysis along Locust beans Value Chain

Actors	Total Variable cost, TVC, (₦)	Total Revenue, TR, (₦)	Gross margin, GM, (₦)	Percentage Contribution
Collectors	7,017.7778	32,866.667	25,848.89	33.57188
Marketers	83,132.24	90,950.98	7,818.74	43.023392
Processor	3,036.64	20,897.06	17,860.40	23.404724
Value chain				100.00

Source; Field data, 2021.

Table 10: Constraints Facing Locust Bean Actors in the Study Areas.

Constraints	**Collectors (n=45)**	**Marketers(n=102)**	**Processors (n=102)**
Modern Technology	97.7% (44)	---	98% (100)
Capital	88.9% (40)	98% (100)	88.2% (90)
Transportation	93.3% (42)	100% (102)	90.1% (92)
Storage Facility	84.4 (38)	98 (100)	34.3% (35)

Source: Field Data, 2021.

Then transportation from the farm to the processing unit was another challenge (93.3%), mostly carried the harvest on their heads for as many times as they were done, about 88.9% had capital issues and 84.4% attested to poor storage facility.

The marketers of raw locust beans had majorly faced with cost of transportation challenge (98%) due to cost of fuel problem in Nigeria and bad road of the rural areas. About 98% complained of poor storage facility and capital constraint (100%) to purchase in large quantity.

The study revealed that modern technology was the greatest problem faced by the processors, about 98% of them still processed manually in the study areas. Cost of transportation to the markets and consumer was another constraint (90.1%) which adds to the cost of production, about 88.2% complained of limitation in capital to embark on large scale production while storage was not seen as a problem (34.3%) to many of the processors because they could store well in their local way.

Conclusion and Recommendation

The study has shown the economic values available along the value chain of locust beans, the various activities that were performed in a links in the chain and the profit sharing along the essential intra-link. The study discovered that the three main actors in the value chain added values and shared income. The gross margin for the collector is ₦25,848.89 and

contributed 33.57% to the value chain of locust beans. The gross margin for the marketers is ₦7,806.3366 and the marketing efficiency is 11. 33% making the raw locust bean to be lucrative. The marketing contributes most to locust bean value chain, 43.02%.

Some profit sharing potentials which are source of livelihoods to some actors within the locust beans collections such as harvesting, depodding, depulping, sundrying and transportation costs were also discovered. The average profit of ₦11,690.81 making processing and marketing of locust beans very lucrative, The Benefit Cost Ratio (BRC), is another measure of profitability, was found to be greater than one (BCR > 2, 27) implying that business can be termed profitable The Rate of Return (ROR) which another measure used to determine the worth of a business was 1.27 on investment. The processor contributed 23. 40% to locust bean value chain.

It is therefore recommended that technology for different stages of collection be provided for different activities along the chain, such as harvesting, depodding, depulping and sun drying in order to make the processes faster and easier since they could be a source of livelihood and wealth creation for so many people, even the unemployed.

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