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Value Chain Analysis of Palm Fruit Production and Processing in Abia State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author OJ designed the study, wrote up the abstract, cross checked the data analysis and discussion and was involved in all part of the work. Author ONC managed the literature searches, wrote up the introduction, wrote up the methodology, analyzed the data and Author IC managed the data collection and collation process. All authors read and approved the final manuscript.

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ABSTRACT

This study analyzed the value chain of palm fruit production and processing in Abia state of Nigeria. The analysis was imperative, because of the increased emphasis on value addition to improve the market value of agribusiness products. The objectives considered included the socio economic characteristics of the respondents, the cost and returns of the value addition stages in the value chain, the determinants of participation in the value chain and the effect of the value addition stages on the value chain. The tools used to achieve these objectives are descriptive statistics, gross margin analysis, probit regression analysis and polynomial regression analysis. Random samples of 40 palm fruit farmers were selected from the three agricultural zones of Abia state, to make up a sample size of 120 palm fruit Agribusiness operators. The analytical synthesis unveiled that most of the palm fruit Agribusiness operators were headed by females with highest education attainment as secondary education. A major constraint to the value chain includes credit as a limiting factor. The factors found to be significantly affecting the participation in the value chain were credit, farm size and education. The harvesting, cooking, digesting, clarification, extraction stages of value addition were found to be

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positive and significantly influencing the value chain. It is therefore recommended the education (training) and credit facilities should be made available and policies should be formulated to enhance the participation in the palm fruit value chain as it was found to be a profitable means of entrepreneurship and the proper management of the stages of value addition to enhance the palm fruit value chain.

Keywords: Value; chain; analysis; palm; fruit.

1. INTRODUCTION

The value chain is a concept from business management that was first described and popularized by Michael Porter in his 1985 best-seller, Competitive Advantage: Creating and Sustaining Superior Performance [1,2]. The study of value chains comprises of two key concepts: value and chain. The term value is synonym to "value added" in the Value Chain Analysis (VCA) as it characterizes the incremental value of a resultant product produced from processing of a product. For agricultural products, value addition can also take place through differentiation of a product based on food safety and food functionality. Price of the resultant product shows its incremental value. The term chain refers to a supply chain indicating the process and the actors involved in the life cycle (from conception to disposal) of a product [3]. [4] defines VCA as study of the "full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use". [5] in addition to the movement of a product from one stage to another and identification of the actors, firms and their services, also adds analysis of the institutional support to production at various stages to VCA [6].

Agricultural production in Nigeria is very crucial as it employs over 70 percent of the Nigerian population. This agricultural population mainly practice subsistent agriculture, as most of the foods produced are consumed by the household and any extra for sale are sold at the raw stage without any form of value addition. Value chains cut across regions. For example, the palm oil and cocoa value chains are rooted in Nigeria's Southern region where oil palms and cocoa are grown. Location specificity, however, must not extend over the entire chain. Rather the good - if not optimal - location of specific transformation and value addition processes depends on the bulkiness of the product, the availability of labour and various resources and costs of transport and distribution to the market and consumers [7].

The demand for value added agricultural products are on the increase globally, it have been observed that unprocessed and raw agricultural commodities do not attract the attention of the global market as such products are usually under priced with the exporter on losing side [8]. Countries that have engaged in the continuous improvement and modification of their agricultural products have a competitive edge in the global market as their products attract higher prices. The importance of value addition to the value of agricultural products cannot be overlooked, agricultural products has this peculiar characteristics of been perishable but with value addition processing of harvesting, processing, packaging and transportation, the shelve life of the agricultural products improves with values addition of the agricultural products. Palm fruit is a major cash crop in Nigeria, as it account for 43% of the world production in the early 1960's but now accounts for less than 7% [9]. This drop in the production of palm oil is majorly attributed to the petroleum proceeds that led to the neglect

of the agricultural sector but issues like poor value addition contributed to this drop in production with the poor infrastructural facilities like storage, preserving and processing equipments to boost value addition of the palm fruit. It is therefore imperative to analyze the value chain of palm fruit in Abia state, Nigeria. The overall objective of the study is to analyze value chain of palm fruit in Abia state.

The specific objectives include to examine the socio economic characteristics of the Agribusiness operators, analyze the farm produce value chain stages and the cost and returns, identify and prioritize constraints faced in the value chain, identify determinants of participation decision and level of participation in-farm level produce value addition and examine the effect of the value addition stages on the value chain of palm fruit.

2. METHODOLOGY

2.1 The Study Area

The research was carried out in Abia State of Nigeria. The climate of the state is tropical and with a relative humidity all the year round. It has an annual rainfall averaging between 2000mm up to 2500 mm. Abia State is bounded by Akwa Ibom and Cross River States in East, River State in the South, Imo State in the north and Enugu and Ebonyi States in the west.

The state has mineral deposits such as petroleum, salt, limestone etc. The state shares population density with other states in the region of 173 persons per square kilometer.

The inhabitants engage in various trades and occupation, like arable and tree crop production, sheep and oil palm rearing. Other trades and occupation include food processing, namely restaurant operations, cassava and palm oil processing, bakery, fast food enterprises etc. the agricultural zones of Umuahia, Bende and Aba was chosen for the high presence of agribusiness operators in the study area.

2.2 Population of the Study

From the data received from a visit to the ministry of agriculture and cooperatives, it is estimated that Abia state have over 1000 small and medium mechanized palm agribusiness operators. These agribusiness operators are individual and cooperative agribusiness operators in form or nature.

2.3 Sampling Procedure

The sampling procedure used was a multistage random sampling method leading to the selection of 120 Agribusiness operators involved in farming and processing of palm fruit from the three agricultural zones of Abia state. Forty palm fruit Agribusiness operators from each of the three agricultural zones were selected to make the sample size of 120. The choice of the agricultural zones is because of the high presence of agricultural activities in these zones.

2.4 Data Collection Procedure

Data for the study was obtained from primary sources only. This involved administering a well-structured questionnaire to the respondents.

2.5 Methods of Data Analysis

The tools employed in analysis include, descriptive statistical tools, such as means, average, percentages, and frequency distribution tables. Other tools are Gross-margin, polynomial lag model, probit regression analysis and descriptive statistics involving tables, frequencies and percentages.

Objective (1) which is ascertaining the socio economic characteristics of the agribusiness operators was analyzed through descriptive statistical tools. Objectives (2) which are to analyze the farm produce value chain stages and the cost and return, this will be achieved using descriptive statistics and gross margin. Objective (3) which involves identifying and prioritizing constraints faced in the value chain, this will be analyzed using tables, frequencies and percentage. Objective (4) which involves the level of participation in farm level produce value addition and the determinants of participation decision which will be achieved using tables, frequencies and percentages as well as probit regression analysis and objective (5) identify determinants of value addition by the Agribusiness operators will be achieved using polynomial regression model.

2.6 Model specification

Polynomial regression model was used in the analysis of data. Obtained data were analyzed by regressing the value added on the raw palm for each stage against the value of investment in the value chain.

The model used for the analysis is written explicitly, is as stated below:
$Y_i = b_0+b_1x_i^1+b_2x_i^2+b_3x_i^3+-------+b_kxi^k+e_i$
Where,
Yi = value added on the palm
Xi = value of investment in stage (t = 1, 2…..k stage i.e investment/cost of the stages of value addition).
b_0 = Constant term
bi= Investment coefficients
e= Error term.

Generally, the objective of using a polynomial model is, to construct composite variables, which are linear combination of exogenous variables to capture the effect of each stage of the value chain on the value been added [10,6,11]. This model is regarded as a fairly sophisticated model, which has been widely used in the estimation of polynomial relationships.

In order to estimate the determinants of participation in the value chain following probit regression

The model is implicitly stated as
$Y^*i= (x_1,x_2,x_3,x_4,x_5)+ei$

$Y^*i = 1$ *if* $y^*i > 0$, 0 if $Y^*I \leq 0$
The explicit form of the model is stated as
$Y^*i = b_0+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5 + ei$

Where
Y*i = probability to participate (participating=1, non participating=0)
X_1 = level of education of the Agribusiness operators measured in years
X_2 = experience of the farmer measured in years
X_3 = farm size
X_4 = size of the farm labor force
X_5 = credit
X_6 = savings
Bi is the parameter
Ei is the error term

3. DATA PRESENTATION AND ANALYSIS

3.1 Socio Economic Characteristics of the Respondents

This section considers the socio economic characteristics if the respondents, their age of experience, level of education, income, marital status, household size etc.

3.1.1 Years of experience

The experience of the oil palm Agribusiness operators is based on the number of years the farmer has been in the business.

Table 1. Distribution of the respondents based on the years of experience

Age range (years)	Frequency	Percentage (%)
0-5	45	37.50
6-15	33	27.50
11-15	29	24.17
16-20	13	10.83
Total	**120**	**100**

Source: field survey, 2013

The result from data computation as presented in Table 1, indicate that agribusiness operators which has their years of experience ranging from 0-5 years are 45 in number representing 37.50 % of the agribusiness operators studied. The result also show that agribusiness operators that have been in the business within 6-15 years have the frequency of 33 and a percentage of 24.15, while 13 agribusiness operators representing 10.80 % were established for over 16 year ago. This Study reveals that the palm oil value addition business does not require much experience since most of the agribusiness operators have experience ranging within 0-5 years.

3.1.2 Labor size of the Agribusiness operators

The agribusiness operators in the study area are noted to engage the services of less than two workers. This is presented in Table 2, 85 percent of the respondents had a labor size of

1-2 workers that assist that owner of the business in the preparation of the palm fruit at each stage of the value chain. 13.33 percent of the respondents had a labour size of 3-4 workers.

Table 2. Distribution according to number of workers

No of employee	Frequency	Percentage (%)
1-2	102	85.00
3-4	16	13.33
5 and above	2	1.67
Total	**120**	**100**

Source: field survey, 2013

3.1.3 Level of education of the respondents in the study area

Table 3 presents the distribution of the agribusiness operators according to their level of education.

Table 3. Level of education

Level of education	Frequency	Percentage
Non formal	69	57.50
Primary	41	34.17
Secondary	10	8.33
Tertiary	0	0
Post graduate	0	0
Total	**120**	**100**

Source: field survey, 2013

Table 3 above illustrates the distribution of the respondents according to the level of education of the respondents. Most of the agribusiness operators had no formal education representing 57.00 percent of the responses, 34.17 percent of the responses had primary education and 8.33 percent of the agribusiness operators had junior secondary education. This indicates that farming business is a business that does not much skill and training and is a viable business to be embarked upon either on part time or full time as education is no barrier to the business.

3.1.4 Source of capital for the value chain business

Table 4 gives a breakdown of how the agribusiness operators raise capital to fund their business.

Table 4. Distribution according to the sources of capital

Source of capital	Frequency	Percentage (%)
Equity/owners capital	200	48.154093
Thrift/cooperative society	100	16.051364
Loan: Bank	189	30.337079
Other informal sources	34	5.4574639

Source: field survey, 2013
**multiple response*

The composition of the source of the agribusiness operators capital comprise of equity, grants and loans. All the agribusiness operators had part of their capital composed of equity, 189 Agribusiness operators obtained their loans from bank, while 34 used other sources such as grants from relatives. 100 agribusiness operators are funded with money from thrift and cooperative societies. This indicates that to start the oil palm business capital can be raised from both informal and formal source, since the capital requirement is not huge.

3.1.5 Distribution of the Agribusiness operators According to Income Generation per month

The Table 5 presents the distribution of the respondents according to the amount of money generated per month.

Table 5. Distribution of Agribusiness operators According to Income Generation per month

Income range (N) 000	Frequency	Percentage (%)
Less than 50,000	78	65.00
51,000-100,000	32	26.67
101,000 and above	10	8.33
Total	**120**	**100**

Source: field survey, 2013

The Table above shows the distribution of the respondents according to the amount of income generated by the Agribusiness operators per month. 65.00 percent of the agribusiness operators earn less than 50,000 per month, 26.67 percent of the respondents earn an income that falls within the range of 51,000 -100,000 per month and 8.33 percent of the agribusiness operators earn an income more than 101,000 naira per month this result indicates that oil palm processing and retail business is a viable income generating venture capable of alleviating poverty and empowering especially the women.

3.1.6 Distribution of the Agribusiness operators' according to gender

Table 6 illustrates the distribution of the respondents according to the sex of the Agribusiness operators in the selected study areas.

Table 6. Distribution of the respondents according to gender

	Location					
	Rural		Suburb		Total	
	Frequency	Percentage	frequency	percentage	frequency	Percentage
Male	8	6.67	18	15.00	26	21.67
Female	52	43.33	42	35.00	94	78.33
Total	60	50.00	60	50.00	120	100

Source: survey data, 2013

Table 6 presents the distribution of the respondents according to the gender of the Agribusiness operators sampled in the study area. Majority of the respondents are female representing 78.33 percent of the entire sample size. 21. 67 percent of the sample size was males. The oil palm processing business as indicated in the table is mainly dominated by the

females. This may be as a result of the fact that the oil palm business is mainly embarked upon by the women.

3.2 Analysis of the Cost and Return of the Stages of Palm Value Chain

The Table 7 presents the cost and return analysis of the value chain considering the different stages of value addition in the palm fruit. The total revenue stood at N25909800, 000 and considering the expenditure in the harvesting stage threshing stage, cooling stage, digestion stage, and oil extraction stage, drying stage, storage/packing stage, kernel and kernel oil processing stage. The analysis considered the cost items in each of the value chain stage.

Table 7. Analysis of the cost and return of the stages of the value chain

Item		amount(N)000	cost as a ratio of total cost
Total revenue		25909800	
Expenditure			
Harvesting stage			
Labour		400000	3.176
loading cost		100000	0.794
offloading cost		60000	0.476
fuel		100000	0.794
Transportation		589000	4.676
other input costs		300000	2.381
Total revenue	1543000		
Threshing stage			
Labour		40000	0.317
threshing equipments		1200000	9.528
fuel/fuel wood		45000	0.318
other input costs		234000	1.823
Total	1519000		
Cooking/sterilization stage			
Labour		45000	3.572
Water		23000	1.826
fuel/fuel wood		345000	2.739
other input costs		130000	1.03
Total	750000		
Digestion stage			
Labour		300000	2.381
fuel/fuel wood		123000	0.9766
Total		463000	
Pressing/extaction oil stage		450000	3.572
Labour		300000	2.381
extraction equipments		3400000	2.69
fuel/fuel wood		250000	1.984
other input costs	1340000		
Total			
Clarification and drying stage			
Labour		450000	37.29
Water		200000	1.59
fuel/fuel wood		450000	35.73
Total	3887000		

Table 7 Continued……..

Storage/packaging			
labour equipment		320000	2.54
Containers		50000	0.396
fuel/fuel wood		30000	0.24
other input costs		245000	1.95
Total	663500		
Kernal recovery stage			
Labour		40000	0.32
Water		200000	1.59
other input costs		180000	1.43
Total			
Kernal oil processing stage			
labour		120000	0.95
Fuel wood		140000	1.11
other input costs		130000	1.03
Total	390000		
Total variable cost		8194500	65.064
Fixed			
Rent		1000000	7.93
Levies		100000	0.79
delivery van		2800000	22.23
Equipment		500000	3.69
total fixed cost		4400000	34.93
total cost of production		12594500	
profitability indictors			
profit		13315300	
gross margin		17715300	
net earning		13315300	
gross return/naira invested		1.40659	

Source: survey data, 2013.

In the harvesting stage of the value chain analysis, labour accounted for 3.2 percent of the total cost, loading cost accounted for 0.794 percent of the total cost of the value chain, offloading costing was 0.476 percent to the total cost of value addition. Transportation accounted for 4.677 percent of the total cost of value at this stage of value addition while another inputs accounted for 2.382 percent of value chain analysis cost In the threshing stage of the value chain, the cost items are considered as a percentage of total cost of value chain. Labour and fuel wood contributed 0.318 percent, threshing equipment contributed to 9.528 percent of the total cost of the value chain while other inputs cost contributed to 1.823 percent. In the cooking/sterilization stage, labor contributed to 3.573 percent to total cost of the value chain, water contributed 1.826 percent, and fuel wood contributed 2.739 percent and other inputs cost contributed to 1.032 percent of the total cost of the value chain.

In the digestion stage labour contributed to 2.382 percent of the total cost of the palm fruit value chain analysis while fuel wood contributed to 0.997 percent of the total cost of the value chain. In the oil extraction value addition stage labour accounted for 5.5724 percent of the total cost of the value chain, extraction equipments contributed 2.382 percent, fuel wood contributed 2.699 and other inputs contributed 1.99 percent of the total value chain. The drying stage, labour contributed to 3.729, water contributed to 1.58 percent while fuel wood contributed 3.572 percent to the total cost of value addition in the palm fruit value chain. In

the storage and packing value addition stage, labour contributes to 2.541 percent; containers contributed 0.397 percent, fuel wood/fuel contributed to 0.238 percent, while other inputs contributed to 1.945 percent to the total cost of the value chain.

The total variable cost in the palm fruit value chain accounted for 65.1 percent of the total cost of the value chain, and fixed cost contributed to 34936 percent to the total cost of value addition in the value chain the total cost of value addition stood at N12594500,0000. The gross per naira invested stood at N1.4 indicating that each naira invested, N1.4 is been recouped with a profit of N13315200.000.

3.3 The Constraints facing the palm fruit value chain.

Table 8 represents the response of the agribusiness operators to the constraints identified by the agribusiness operators in the palm fruit value chain the study area.

Table 8 presents the responses of the agribusiness operators to the constraints experience by them. Access to capital was highly rated by 58% of the respondents. Marital obligations was highly rated by 66.67% of the respondents, lack of adequate labour was lowly rated by 66.67% of the respondents while high cost of inputs was highly rated by 46.67% of the respondents.

Table 8. The constraints faced by the respondents

Constraints	Rating					
	High		Average		Low	
	frequency	Percentage	Frequency	Percentage	Frequency	Percentage
access to capital	35	58.33	16	26.67	14	23.33
marital obligation	40	66.67	8	13.33	12	20
lack of adequate labor	8	13.33	12	20	40	66.67
high cost of input	28	46.67	12	20	20	33.33
lack of experience	34	56.67	16	26.67	10	16.67
taxes and levies	25	41.67	15	25	20	33.33

Source: survey data, 2013

3.4 Analysis of the Factor Inflecting the Participation in the Palm Fruit Value Chain

From Table 9 which present the regression result of the factors influencing the probability to participate in the value chain of palm fruit.

The probit regression model was found to be statistically significant at 1 percent based on the wald value which was 44.638. Education was found to be statistically significant at 10 percent and positively related to the probability to participate in the palm fruit vale chain. This indicates that as the agribusiness operators acquire more education in the firm of training and skill acquisition, he intends to participate in the value chain.

Credit was statistically significant at 10 percent and positively affecting the probability of participating in the palm fruit value chain. This indicates that as the farmer accesses more credit he will participate in the palm fruit value chain as these will increase his income. Farm size was significant at 10 percent and positively related to the probability to participate in the value chain this indicates that as the farmer's farm sizes increases, the probability to participate in the palm fruit value chain

Table 9. Factors affecting the participation in the value chain

	B	S.E.	Wald	Sig.
Education	-0.594	0.317	3.512	*
Experience	-0.096	0.147	0.428	
Credit	0.002	0.001	3.597	*
Savings	0.980	1.208	0.811	
Farm size	2.746	1.469	3.497	*
Constant	2.475	1.018	5.912	*
Wald	44.636*			

Source: survey data, 2013.

3.5 Analysis of the Effect of the Value Addition Stages on the Value Chain of the Palm Fruit

From Table 10 which presents the result of the polynomial regression analysis considering the effect of the value of addition states of the palm fruit value chain on the value of the product.

The model was found to be statically significant at 1 percent based on the value of the f-statistics which was 80.617. The value of the R^2 was 0.732 indicating that 73.7 percent of the total variation in the dependent variable was accounted for by the independent variable including in model.

Table 10. Analysis of the effect of the value addition states on the value chain of the palm fruit

	B	STD.ERROR	T	Sig.
(Constant)	-66864	45530.87	-1.46854101	
Harvesting	5.482	1.137	4.821459982	***
Threshing	-1.78E-05	9.01E-06	-1.97558269	*
Cooking	2.03E-11	0.056	3.625E-10	
Digestion	23.433	11.504	2.036943672	*
Extraction	14.54	7.4297	1.957010377	*
Clarification	18.23	9.8011	1.859995307	*
Packaging	-9.75E-39	0.912	-1.0691E-38	
R	R Square	Adjusted R Square	F	
.859[a]	0.737	0.728	80.617	

Source: survey data, 2013.

The harvesting stage was found to be significant at 1 percent and positively affecting the value chain. This implies that as more resource are been channeled in the harvesting of the more palm fruits the more value is added to the value chain this impels that there should be

more investment in t he harvesting of the palm fruits. The excess harvested palm fruit can be stored temporarily to keep the value chain going.

The threshing stage was found to be significant at 10 percent and negatively influencing the value chain. This implies that as more is even invested in the threshing stage, the value chain is being affected negatively. The implication f this is that the threshing stage is delicate and if not properly handled and managed any excessive threshold palm fruit will spoil there by having a negative effect on the value of chain of the products. Less should be invested in the threshing stage as it determines other stages in the chain to avoid spoilage and loss in the palm fruit value chain.

The digestion stage was significant at 10 percent and positively influencing the value chain. This implies that as more money is invested in the digestion stage the more value is being added to the value chain.

The investment in the extracting stage was statistically significant at 10 percent and positively relate to value addition in the value chain. This implies that as more oil is being extracted the more the value in the value chain increases.

Clarification/drying stage, this investment at this stage was found to be significant at 10 percent and positively related to the value addition in the value chain. This therefore implies that as more investment is been made at his stage the more good palm oil is been made and ore value added to the value chain.

The effect of these stages of value addition of the value added in the palm fruit value chain is further buttressed by the scatter plot of Fig. 1. This shows that at this initial stage of the value chain which is the harvesting stage the value added is minimal at 0.00 – 200000, but as the stages of the value chain progressed the value add increases to its peak. The scatter plot assumes a curve at the point fall around a curve indicating that there are fluctuations in the effect of the value chain stages on the value added.

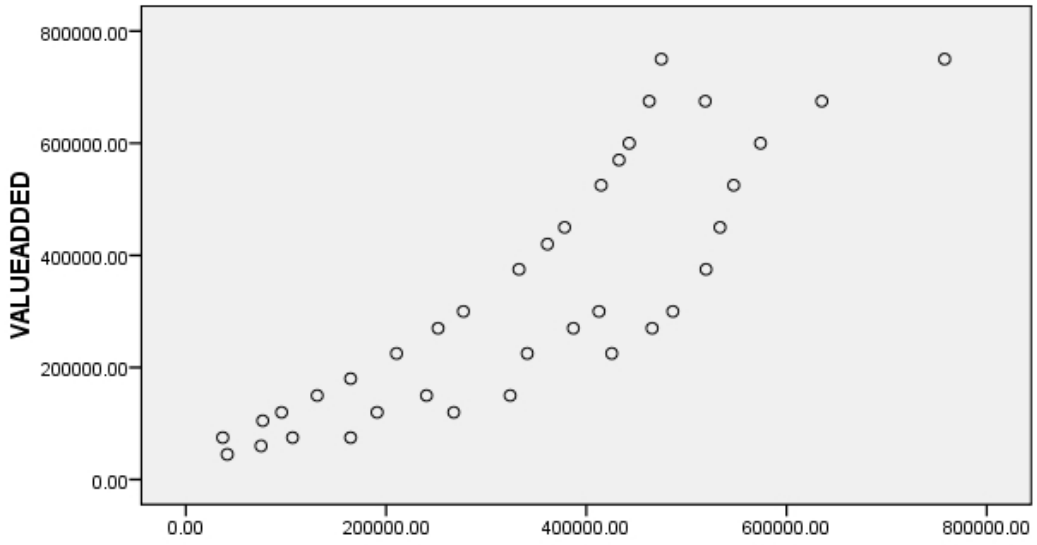

Fig. 1. Scatter plots of the effect of the stages of value addition

4. CONCLUSION

This study analyzed the value of palm fruit in Abia state. The value chain analysis is very crucial issue facing the agribusiness sector of the Nigerian economy, as the Nigeria agribusiness is been noted for the sale of raw agricultural products palm fruit is one of the major cash crops in Nigeria. And have been noted to be under performing due to the challenges of value addition, it became imperative to analyze the value chain of palm fruit in Abia state. The specific objectives of the study include determining the socio economic characteristics of the famers analyze the cost and returns of the value chain, analyze the constraints facing the value chain, and analyze the factors influencing the participation in the value chain and an analysis of the factors influencing the value addition stages on the value chain. The tool employed in the study includes descriptive statistics, probit regression analysis and polynomial regression analysis. The study found that most of the respondents have been in the palm fruit value chain for a time period of above 6 years, none of the respondents had education above the secondary level as most of the respondent got their credit for the value chain business through equity source as most of the participants in the value chain are females. The palm fruit value chain was found to be profit able with N1.4 return per naira invested. The harvesting stage, cooking stage, digestion stage, drying stages, and packing stage was found to be positively affecting the value chain while an increase in the investment in the threshing stage negatively affects the value chain. The polynomial regression was used considered that the investment in each stage of the value chain was continuous and assumes a curve fit. The factor found to be significantly affecting the Agribusiness operators participate in the value chain include education, credit and farm size was the factors influencing participation in the value chain. Access to credit facilities was one of the major constraints facing value chain. Based on the finding of this study the following recommendations are proffered:

1. Proper education of the Agribusiness operators as education through training is significant factors influencing participation in the value chain.
2. Adopting and formulating a good land tenure policy that enhances the availability of farm land for farming since it is a factor influencing the participation in the palm fruit value chain.
3. Policies should be formulated to enhance the palm fruit value chain, since it is found to be profitable.
4. Proper management of the stages in the palm fruit value chain should be encouraged as these valued stages have effect on the value chain.

COMPETING INTERESTS

The authors do hereby declare that there are no competing interests.

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