

Value-chain Analysis of Bambara Groundnut (*Vigna subterranean*) and Livelihood sustainability amongst households in derived Savanna belt of Nigeria.

Agbonlahor Mure¹, Ashaolu Olumuyiwa and Obayelu Elijah



¹ Agricultural and Development Economist. Affiliated to the Department of Agricultural Economics, Federal University of Agriculture, Abeokuta, Nigeria. Email: agbonlahormu@funaab.edu.ng

Abstract:

Bambara groundnut is cultivated by most farming households in the Southern savanna belt of Nigeria. The drought resistant crop has gained commercial and nutritional relevance in Nigeria due to the sustainable livelihood outcome it furnishes and the demand for the highly relished, ready-to-eat, steamed food (*Okpa*) produced from it. The study was carried out to analyze the structure of Bambara groundnut market and, the livelihood outcomes it furnishes households involved in the production, processing and marketing in Nigeria. A multistage sampling technique was used to select 317 farmers and 151 processors and retailers of *Okpa* from 56 communities. Production, households', community and marketing data were elicited using interview guides. Descriptive and inferential statistics were used in the analyses of data. The study finds that cultivation of the bean, processing and marketing of *Okpa* is dominated by women (86%). Most (92%) of the harvested bean are sold at the local market while 96% of *Okpa* produced are vended by women in markets and road sides in the communities. Processing was found to be the most concentrated link in the chain relative to margin realized and marketing cost. Income from sale of bean/*Okpa* represented about 9.2%, 26.1% and 39.1% of total households' income for the farmers, processors and retailers respectively. The allocation of the income shows that 44.3% and 62.7% of the income is utilized in meeting household' food needs for the retailers and processors respectively. Among the processors and retailers the income represents a major component of personal savings and investment in children education. Age, formal educational level and household size of retailers and processors as well as ownership and size of farm holdings were among the factors that significantly influence the households' dependence on income from *Okpa*. The study showed the livelihood and households' food security importance of the bean and product to the chain actors and that women constitute a significant player in the value chain. Recommendation is proffered ways to reduce associated transaction costs in processing and retailing activities.

Keywords: value chain, Bambara groundnut, household food security

Introduction

The term value-chain comprises of two key aspects- the value (utility added) and the chain (supply linkages and intermediaries). Identifying the intermediaries involved in commodity supply chain and estimating the relative value added by each player presents an optimal way of identifying supply (quantity and price) lacunas in a commodity chain. For agricultural commodities, value chain is buoyed by production, processing and marketing of the commodity and final goods. Hence the values chain analysis of agricultural commodity must explore the relative links in this tripodal stand. Kaplinsky and Morris (2001) defined values chain analysis as the study of the full range of activities which are required to bring a product 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. The broad approach to value chains analysis looks across enterprises at the range of activities implemented by various actors to bring a raw material to the final product (Coudert,1984; Hellin and Meijer, 2006; Rich et al., 2011). The broad value chain approach starts from the production system of the raw materials used to produce a product. The broad approach also comprises all backward and forward linkages, up to the level in which the raw material produced is linked to the final consumers (van den Berg et al 2009). More recently however, value chain analysis seems to be restricted to the identification of market players and their activities in the supply chains (Barrett 2008; Rich et al., 2011). Value chain analysis therefore seeks not only to identify the major players in the commodity supply chains but also attempts to identify and quantify values added by each intermediary.

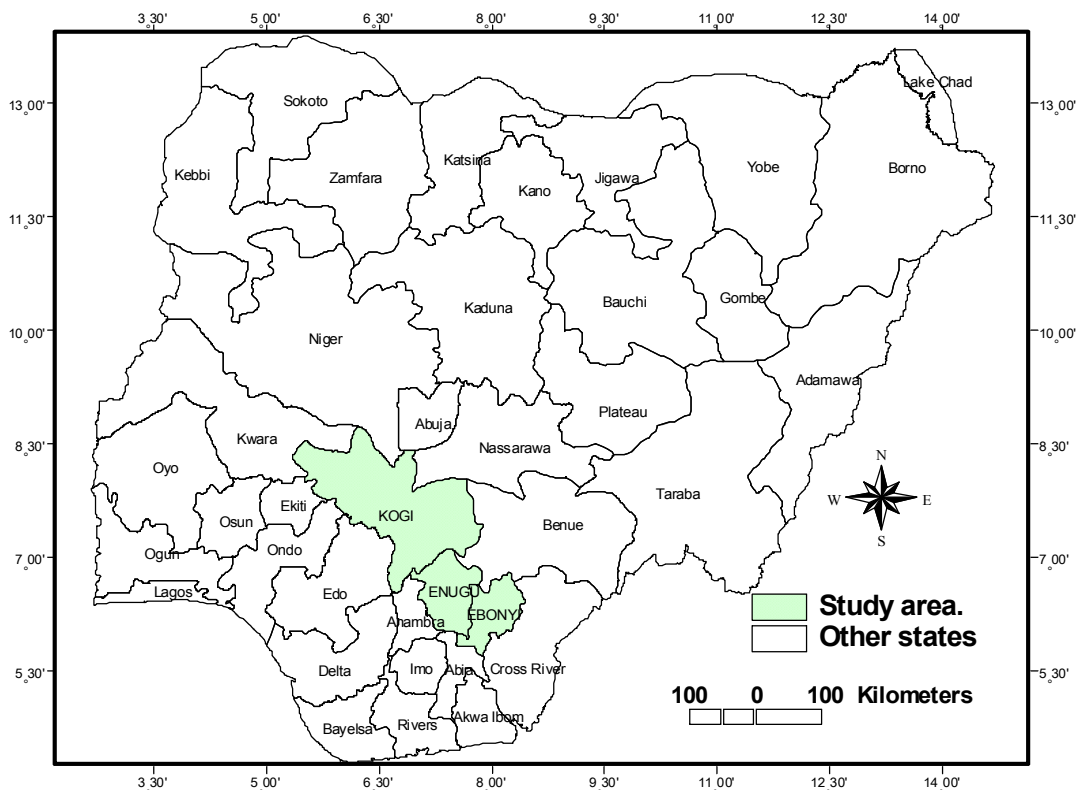
Agricultural production is the mainstay of the Nigerian economy: over 70 percent of the economically active population are engaged in agriculture and allied industries and the sector contributes about 46percent to the GDP (NBS 2012). The agricultural sector is, however,

characterized by small holders' units; average holding is 1.2ha with little or no use of purchased farm inputs and crops combination in mixed stands are most times suboptimal (<http://nigerianstat.gov.ng/sectorstat/sectors/Agriculture>). Bambara groundnut (*Vigna subterranea*) is a legume crop that is native to West Africa (Azam-Ali et al., 2001; Mkandawire and Sibuga 2002). The crop is a key feature of the cropping system of farmers in the guinea savanna and derived savanna belt. Bambara groundnut is an important crop for the small holders' (farm families, processors and marketers) livelihood as an important source of income and high protein. Also, as a nitrogen-fixing legume, the crop also contributes to the maintenance of soil fertility; considering the fact that over 60% of the cultivable land in the zone is classified as marginal (Ibana et al.,2009; Mkandawire and Sibuga2002). The crop is, also, considered to have an advantage over other food legumes (cowpea and groundnut) in its adaptation to poor soils and tolerance to drought (Azam-Ali et al., 2001; Thottappilly and Rossel, 1997). Despite these attributes, the crop has been labeled as an under-utilized crop in Nigeria due to the localization of its production and utilization, specifically, to a restricted geographical location and niche markets as well as the dearth of research activities in the crop (Hillocks et al., 2011). Also, Traditionally, Bambara groundnut and its products are often perceived as a local snack or food supplement, but not a lucrative cash crop (IPGRI 1997). As a result of this under-utilized characterization, the livelihood impact of Bambara groundnut, amongst the largely small holder' producers, processors and marketers, stands to be obscured and little policy recognition accorded Cadilhon, et al., 2006). The, seemingly, obscured livelihood benefits accruing to the value chain intermediaries, and the concomitant by-pass/neglect of the crop as a priority crop in the food and livelihood security framework, present viable research focus towards accelerating the transformation agenda of the government. Fasse et al (2009) and Barret (2008) reported that value chain analysis has become a common tool in the hands of development practitioners, who

make extensive use of the value chain concept for the design of market-driven rural development projects and pro-poor strategies. The remaining part of this paper is structured as follows: the methodology adopted in the study, the tobit model specification, the results, discussion and areas for policy recommendation.

Methodology

The study was conducted in the southern guinea savanna belt of Nigeria. The guinea savanna belt is part of the grain corridor in Nigeria. It is characterized by intensive agricultural production of arable food crops such as maize, sorghum, soybean and yam. The zone covers a land area of approximately 24% of the total land area of Nigeria.



A multistage sampling approach was used in the selection of 56 communities from three states (Enugu, Ebonyi and Kogi) in the zone. A total of 317 farmers, 29 processors and 122 retailers of Bambara groundnut and products were interviewed for the study. Field survey using questionnaire and focus group discussion sessions (FGD) were used to elicit data from the respondents. Data collected were analyzed using descriptive statistics and multiple linear regression analysis.

The Regression model

Ordinary Least Squares (OLS) regression was used to analyze the correlates of that influence chain actors' dependence on income from Bamabara groundnut/okpa. The choice of OLS regression was informed by the satisfaction of the assumed econometric criteria and properties of the variables. The regression model was fitted to understand the important factors that influence the, largely, small holder' intermediaries dependence on income from bamabara groundnut. The model is also, expected to identify policy relevant variables expected to influence the vulnerability level of the households' to changes in the income from Bambara groundnut.

The dependent variable, *depprop*, is the proportion of the household income from bambara groundnut activity. The dependent variable is thus a non-zero, continuous variable that shows the index (upper value of 1) of the household dependent on income from bambara groundnut. The independent variables specified in the model are variables that are hypothesized to influence household dependence on specific income source. The independent variables therefore, include personal, households', activity as well as community related characteristics. The Knowledge of the factors is expected to inform the formulation of pro-poor policy strategy to ensure livelihood sustainability of the small holders that dominants the Bambara groundnut value chain.

Depprop = f (age, agesg, hhsiz, sex, educ, marit, invol, comyrs, exp, native, farmown, school, market, proc, retail, μ) -----Equation1.

Where,

Depprop= index of household's dependence on income from bambara groundnut, calculated as product of income from bambara groundnut activities divided by total household's income.

Age =age of the respondent (years)

Agesq= the squared age of the respondent

Hhsize= total household size of respondents (number of people present in the household)

Sex= sex of respondent (dummy; female=1, otherwise=0)

Educ= highest educational level attained (years in school)

Marit= marital status (dummy; married=1, otherwise=0)

Invol= number of household members involved in bambara activity

Comyrs= number of years in community

Exp= years of experience in bambara groundnut activity

Native= native status (dummy; native of community=1, otherwise=0)

Farmown= ownership of cultivated farm land (dummy, owns a farm=1, otherwise=0)

School= presence of school in community (dummy; presence=1, otherwise=0)

Market= presence of market in community (dummy; presence=1, otherwise=0)

Proc= processor status (dummy; if a processor=1, otherwise=0)

Retail= retailer status (dummy; if a retailer= 1, otherwise=0)

μ = error term

Operationalization of variables

Age (in years) of the farmer, processor or retailer is expected to influence the households' dependence on income from activity in Bambara groundnut. The apriori expectation is that the older the value chain operator the more the dependence on income from Bambara groundnut/Okpa. This is because age restrict the capacity of the operator to take advantage of economy of scope, in terms of the capacity to diversify their income sources. The age squared is fitted in the model to identify the non-linear relationship between earned income and age. Bambara groundnut production, processing and retailer is most times taken as a family business. Our apriori expectation is that increase in the household size will increase the number of labours available to produce, process and market Bambara groundnut/Okpa which concomitantly increases the income from the activity and the dependence on the household on the income.

The summary statistics for the variables used in the model are shown in Table 1. Among other things, the Table shows the dependent variable, depprop, which accounts for the relative dependence of the different value chain actors on income from Bambara groundnut and product sales. It is evident that okpa retailing households are more dependent on Bambara groundnut income (39%) compared to the processors (21%) and the farmers (9%). The proc and retail variables were included in the model as dummies. The aim was to capture how processing and retailing activities, as major occupation, influence households' dependence on the income form

Bambara groundnut and Okpa. The farmown variable was to capture the effect of ownership of own farm on chain actors dependent on income from Bambara groundnut activity.

Table1. Summary statistics of variables in model

<i>Variable</i>	Mean		
	<i>farmers</i>	<i>Processor</i>	<i>retailer</i>
<i>Depprop</i>	0.09(0.21)	0.26(0.26)	0.39(0.23)
<i>Age</i>	54.2(12.6)	45.2(15.24)	34.9(11.41)
<i>Agesq</i>	241.2(119)	187.9(106.22)	146(141.24)
<i>Hhsize</i>	9(3.1)	8(3.9)	6(6.2)
<i>Sex</i>	0.11(0.31)	0.18(0.25)	0.07(0.31)
<i>Educ</i>	2.78(2.99)	9.64(7.78)	14.98(9.278)
<i>Marit</i>	0.92(0.32)	0.86(0.44)	0.71(0.51)
<i>Invol</i>	3(2.71)	5(2.09)	3(2.01)
<i>Comyrs</i>	43.8(5.03)	31.9(9.71)	33.2(5.24)
<i>Exp</i>	40.23(9.20)	21.8(20.21)	7.72(7.01)
<i>Native</i>	0.81(0.271)	0.42(0.41)	0.44(0.19)
<i>Farmown</i>	1(0.61)	0.55(0.69)	0.41(0.26)
<i>School</i>	0.19(0.13)	0.25(0.75)	0.19(0.11)
<i>Market</i>	0.26(0.17)	0.41(0.51)	0.63(0.11)
<i>Proc</i>	0	0.04(0.65)	0
<i>Retail</i>	0	0	0.26(0.70)

Source: Authors calculation from field data (2014)

Values in parenthesis are standard deviation

Results and Discussions

The distribution of the respondents' socio-demographic characteristics is presented in Table 2. Based on sex distribution, majority of the Bambara value chain actors are female –farmers (92%); processors (63%) and retailers (98%). The high women involvement in the produce is not unrelated to the status of the crop, among farmers, as a low commercial value bean and, considering the fact that over 60% of the crop is sold as processed (women dominated activity) local snacks. The educational qualification of the actors shows that majority of the farmers have little or no exposure to formal education; primary education is the highest educational attainment by a majority of the actors. Based on years of experience in Bambara groundnut activity, farmers and processors have more years of experience compared to the retailers. This has implication for

experience requirement necessary to perform the activities at each level of the chain. The retailers are also younger and better educated than the other actors.

The income realized from the Bambara groundnut activity shows that majority of the actors received less than twenty thousand naira (twenty thousand naira) from the value activity. Sales at the farm gate and local market level are the most important means of produce disposal amongst farmers and processor, while roadsides and market vending are common among retailers. Table 3 shows the allocation of income realized from Bambara groundnut activity by the chain actors. Household's food purchase and children education expenses represent the most common use of the income among all the actors. Also, among the retailers, savings represent a significant investment avenue for income from okpa hawking.

The efficiency of the value adding activities performed by each chain actor is presented in Table 4. The activity value efficiency of the processor (2.52) was found to be higher compared to that of retailers (2.23) and farmers (1.84). The implication of this is that per kilogram of Bambara groundnut handled, the processors received a return of about two and a half (2.52) times of naira invested in processing.

Table 2: Socio-demographic characteristics of values chain actors

	<i>farmers</i>		<i>processors</i>		<i>retailer(Okpa)</i>	
	<i>Frequency</i>	<i>Percent</i>	<i>Frequency</i>	<i>Percent</i>	<i>Frequency</i>	<i>Percent</i>
Sex						
Male	26	8.20	14	36.84	2	1.77
Female	291	91.80	24	63.16	111	98.23
Highest education						
No formal education	69	21.77	9	23.68	29	25.66
Primary education	141	44.48	22	57.89	63	55.75
Secondary	86	27.13	4	10.53	15	13.27
Post secondary	21	6.62	3	7.89	6	5.31
Experience in bambara activity						
< 5yrs	32	10.09	2	5.26	39	34.51
5-10yrs	102	32.18	14	36.84	51	45.13
11-20yrs	97	30.60	17	44.74	15	13.27
>20yrs	86	27.13	5	13.16	8	7.08
Income from activity/month						
< N10,000	154	48.58	21	55.26	47	41.59
N10,000-N20000	107	33.75	13	34.21	39	34.51
N20,001-N30,000	42	13.25	2	5.26	19	16.81
> N30,000	14	4.42	2	5.26	8	7.08
Place of produce sales						
Farm gate	102	32.18	29	76.32		0.00
Local market	184	58.04	6	15.79	12	10.62
Major market	31	9.78	3	7.89	36	31.86
Road side/hawking					65	57.52

Source: Authors calculation from field data (2014)

Table 3: Allocation of Income from Bambara groundnut and okpa sales activity

	Farmers		Processors		retailer(Okpa)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<i>Allocation of Income</i>						
<i>Food purchase</i>	312	98.42	37	97.37	112	99.12
<i>children education</i>	308	97.16	22	57.89	97	85.84
<i>Health care</i>	98	30.91	16	42.11	66	58.41
<i>Savings</i>	102	32.18	17	44.74	102	90.27
<i>Non-food</i>						
<i>household's item purchase</i>	96	30.28	8	21.05	88	77.88

Source: Authors calculation from field data (2014)

Table 4: Efficiency of Value-chain Actors

	Farmers	processors	retailer(Okpa)
value chain efficiency			
Margin (naira/kg)	385.11	390.33	459.92
Marketing cost (naira/kg)	209.22	154.9	206.52
Marketing efficiency	1.84	2.52	2.23

Source: Authors calculation from field data (2014)

The multiple regression analysis was used to explain the factors that influence chain actors' households' dependence on income from Bambara groundnut activity. The regression coefficients show the rate of change in the conditional mean of the dependent variable, dependence on Bambara groundnut income, due to a unit increase in a factor as other factors are held constant (Cook and Weisberg 1999). Table 5 shows the regression coefficients and the test of variable significance (t-value). The factors that have positive significant influence on farmers' dependence on income from Bambara activities are the age of the farmer, the household size and the years of experience in Bambara cultivation. The sex of the farmer however had a negative significant influence on farmer's dependence income from on Bambara groundnut production.

The implication of this, among other things, is that for Bambara groundnut farmers, a unit increase in the age of farmer, as other factors are held constant, will increase the dependence (proportion of the total household' income sourced from Bambara production) of the household on income from Bambara production by 9.43.

Among the processors, the significant factors that influenced household' dependence on income from Bambara activities were the squared age and their processing experience. Other factors include presence of market in the community and if processing activity is the major occupation of the processor. It is noteworthy to report that all the significant variable shad positive effect on the conditional mean of the dependent variable with the exception of the age of the processor. The regression analysis of the factors that influence retailers' dependence on income from Bambara groundnut/okpa retailing activities are shown in Table 5. As evident, the significant factors are age, sex, marital status and retailing experience of the retailer. Other factors are presence of school and market in the community as well as if retailing is the major occupation of the retailer.

Conclusion and Recommendation

The study finds that Bambara groundnut and product provides a sustainable means of livelihood for value chain actors in Nigeria. Women were found to be the key player in the production, processing and retailing of the bean and product. The study also, finds that the value chain of the bean is fragmented and that the chain actors have not been able to take advantage of the diversification opportunities inherent in the chain to increase income; this is evident by the low value adding efficiency among the chain actors. Lack of capital and liquidity, trust and formal contracts and high transaction cost were identified as problems that limits the efficiency of

Bambara groundnut value chain in Nigeria. The study recommends the need to build the capacity of chain actors in input sourcing and management, market targeting as well as in finance access

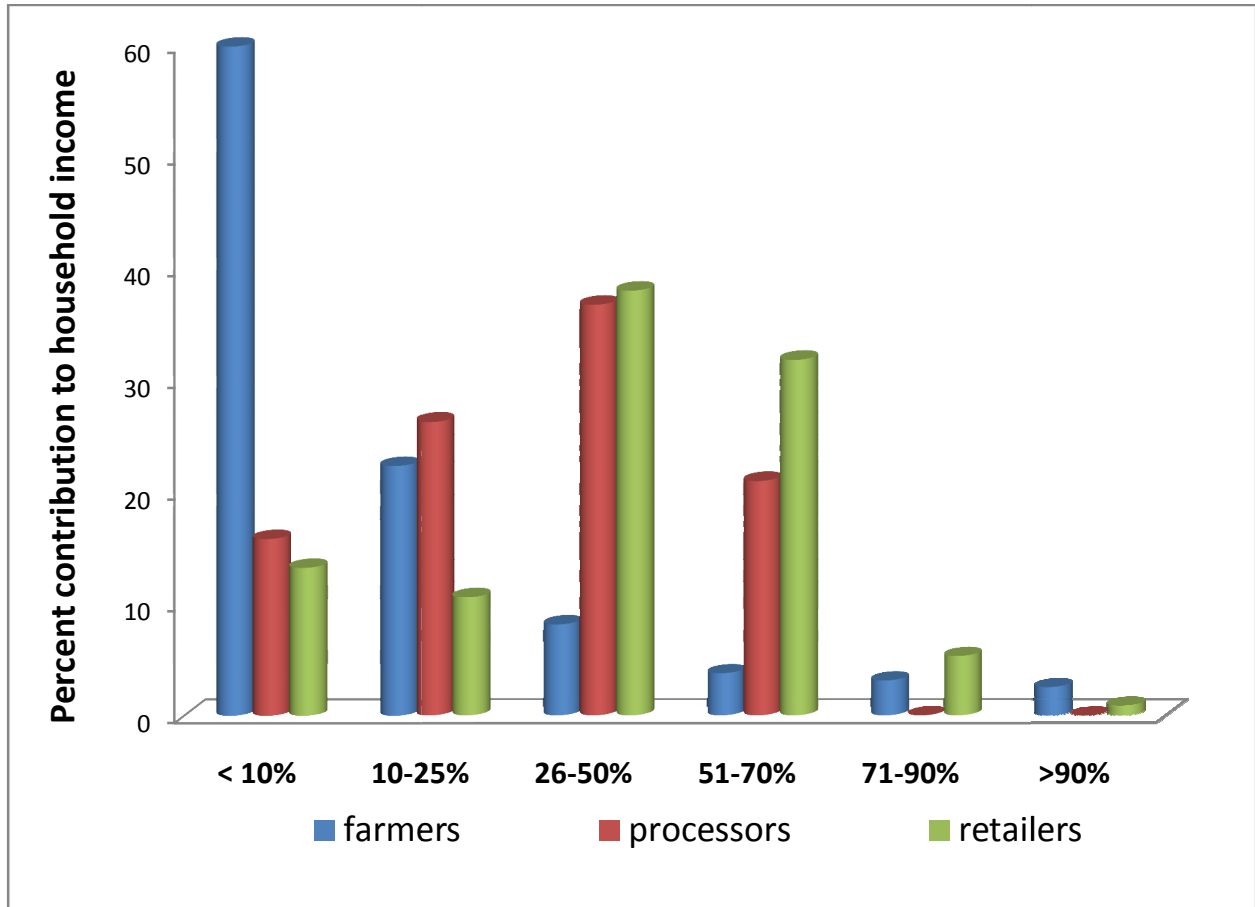


Table 4: Linear regression coefficients to explain factors that influence values chain actors' dependence on income from Bambara groundnut

Variable	<i>OLS regression coefficient</i>		
	farmers	Processor	retailer
constant	10.32	9.44	14.9
Age	9.43**(2.93)	23.82(1.04)	-11.91(3.07)
Agesq	12.9(1.22)	-9.92*(2.24)	-14.98**(2.874)
Hhsize	7.92*(2.44)	5.05(0.80)	11.93(1.01)
Sex	-21.11*(2.03)	5.92(2.21)	-14.92**(3.53)
Educ	-5.19(1.03)	-5.07(0.89)	-11.13(1.22)
Marit	1.88(0.14)	3.04(0.92)	14.61*(2.22)
Invol	1.02(2.90)	3.92(0.47)	2.62(1.61)
Comyrs	7.92(0.58)	6.9*(2.30)	2.9(0.64)
Exp	9.82**(2.66)	11.92**(3.45)	16.72*(2.01)
Native	1.9(1.04)	2.01(1.08)	-6.9(0.47)
Farmown	2.89(1.19)	-1.98(1.43)	-1.99(1.09)
School	2.9(1.33)	5.66(0.81)	4.17**(3.04)
Market	4.41(1.07)	3.82**(2.28)	19.01**(2.84)
Proc	-6.01(0.02)	2**(3.11)	1.11(1.07)
Retail	-2.98(0.49)	7.22(0.07)	3.09**(4.22)
F-stat	2.90	3.02	2.76
Adj. R ²	0.53	0.72	0.81

Source: Data Analysis (2014)

Values in parenthesis are t-values

** Coefficient significant at 5% probability level,

*Coefficient significant at 10% probability level

References

- Azam-Ali, S. N., Sesay, A., Karikari, S. K., Massawe, F. J., Aguilar-Manjarrez, J., Brennan, M. and Hampson, K. J. (2001) "Assessing the potential of an underutilized crop – a case study using Bambara groundnut". *Experimental Agriculture* 37: 433–472.
- Barrett C. (2008) "Smallholder market participation: concepts and evidence from eastern and southern Africa". *Food Policy* Vol. 33, pp. 299-317
- Cadilhon, J. P. Moustier, N. Poole, P. Tam and A. Fearne. (2006). "Traditional vs. modern food systems? Insights from vegetable supply chains to Ho Chi Minh City (Vietnam)". *Development Policy Review*, 24 (1): 31-49.
- Cook, R.D and S. Weisberg (1999), "Applied Regression Including Computing and Graphics". Wiley, Section 10.8 (pp. 250 - 255).

- Coudert, M. J. (1984). "Market openings in West Africa for cowpea and Bambara groundnuts." *International Trade Forum* 20: 14-19.
- Ferris S, Mundy P and Best R. (2009) "Getting to market; from agriculture to agroenterprise". Baltimore: Catholic Relief Services (CRS).
<http://www.crsprogramquality.org/storage/pubs/ageny/getting-to-market.pdf>.
- Hellin J and Meijer M. (2006) "Guidelines for value chain analysis". Rome: Food and Agriculture Organization (FAO). ftp://ftp.fao.org/es/esa/lisfame/guidel_valueChain.pdf
- Ibana, S., Odoemena, B., Akintola, J.O., Ihedioha, D., Paul, O. (2009) "Constraints to the delivery of clean seed yams in the lowland sub-humid tropics of Nigeria: The supply chain Approach". *African Journal of Agricultural Research*, 4 (4), pp. 321-329
- IPGRI. (1997) "Bambara Groundnut" In. Proceedings of the Workshop on Conservation and Improvement of Bambara Groundnut (*Vigna subterranea* (L.) Verdc.), 14–16 November 1995, Harare, Zimbabwe, ed. by Heller J, Begemann F and Mushonga J, Institute of Plant Genetics and Crop Plant Research, Gatersleben, Department of Research & Specialist Services, Harare and International Plant Genetic Resources Institute, Rome, Italy, 162 pp
- Mkandawire, F. I., & Sibuga, K. P. (2002). "Yield response of bambara groundnut to plant population and seedbed type". *Africa Crop Science Journal*, 10(1), 39-49.
- Rich KM, Ross RB, Baker AD, Negassa A. (2011) "Quantifying value chain analysis in the context of livestock systems in developing countries". *Food Policy* 36: 214-222.