ANALYSIS OF YAM (*DIOSCOREA ROTUNDATA)* COMMERCIALISATION AMONG SMALLHOLDER FARMERS IN IMO STATE, NIGERIA

Onyenobi, V.O., Okoye, B.C., Ewuziem, J.E., Mazza, Mary-Ann, Ogbonna, M.C. and Mbuba, R.N. Oti

National Root Crops Research Institute, Umudike, P.M.B. 7006, Umuahia, Abia State, Nigeria.
*Corresponding author: onyenobivincent@yahoo.co.uk

ABSTRACT
The study was conducted in Imo State in the southeastern agricultural zone of Nigeria to determine the socio-economic characteristics of the smallholder farmers, the extent of yam commercialization, and the determinants of yam commercialization by smallholder farmers in the study area. Multistage random sampling technique used in the study. Random field data from respondents using well structured questionnaire and oral interview were analyzed using descriptive statistics and OLS multiple regression model. The results of the study indicated that most of the farmers had a mean farm size of 0.71ha, and land holding by households was the major factor that determined the household income earning, while farm size, fertilizer input, access to extension service, access to credit and road conditions to the nearest market significantly influenced yam commercialization by smallholder farmers in the study area. These results called for government policy to motivate the smallholder farmers to become market oriented in yam production through the provision of good roads and adequate off-farm employment, as well as promotion of economies of scale in yam production through efficient use of land resources, fertilizer input, access to extension service and access to credit in the study area.

Keywords: Yam commercialization, market orientation and economic growth

INTRODUCTION
Yam commercialization by smallholder farmers is a market orientation of subsistence yam production for sustainable household food security, employment and income generation especially in areas characterized by high urbanization and withdrawal of labour from the agricultural sector. Smallholder yam commercialization entails a shift from subsistence yam production to increased production and consumption of yam based on market signals. Annual production of yam in Nigeria is estimated at 38 million metric tonnes (FAO, 2013). Production of yam in Nigeria is usually carried out by smallholder farmers. The crop contributes significantly to national economy and rural income by providing employment to many rural dwellers (Asumugha *et al.,2010*) and cheap carbohydrate staple for over 80 percent of the populace (Nwachukwu, 2008), and reduces poverty level (Emokaro and Law-Ogbomo, 2008). In Imo State yam commercialization by smallholder farmers has great potential for increase in economic growth.

Commercial transformation of subsistence agriculture is an indispensible pathway to economic growth and development for many agricultural dependent developing countries (von Braun, 1994; Pingali and Rosegrant, 1995; Timmer, 1997; World Bank, 2008). Jelata (2009) argues that commercialization benefits the poor by increasing agricultural labour productivity which in turn generates employment in low-capital smallholder agricultural production. Both the households that are commercializing their production and hired labourers receive direct income benefits (Von Braun, 1994). Agricultural commercialization leads to greater market orientation of farm production and a gradual decline of integrated farming systems and their replacement by specialized enterprises for crops, livestock, poultry and aquaculture products (Olawandi and Mathenge (2010). Commercialization by itself rarely

has adverse consequences on household welfare, while commercialization combined with failure of institution, policies or market can be damaging (von Braun, 1994) and adversely affects certain household members such as women and children when allocation of income is not done properly (Olawandi and Mathenge (2010).

Commercialization enhances the links between the input and output sides of agricultural markets (Gebremedhin and Jaleta, 2010). A major question in the literature of agricultural growth and development in sub-Saharan Africa is how to encourage peasants primarily engaged in subsistence farming to become market oriented (Hinderink and Sterkenberg, 1987; Inmink and Alarcon, 1993; Kennedy, 1994; von Braun, 1995). Studies (Mellor, 1976; Johnston *et al*., 1975) clearly contrasted the experiences of smallholder-led "inclusive agricultural development" in green revolution Asia which was crucial to structural transformation and poverty reduction, with the estate-led Latin America which also achieved agricultural growth, but not in an inclusive way. For instance, Latifundio estates in Latin America expanded production impressively in many cases while millions of small peasant farms remained mired in poverty (Mellor, 1976). For market oriented smallholder-led yam production to result in agricultural growth and reduce poverty, it must be inclusive. This means there is no real alternative to a smallholder-led agricultural development strategy (Jayne *et al*., 2011). Therefore, the overall objective of the study was to determine the effect of market transformation of subsistence yam production on economic development of Imo State, while the specific objectives of the study were to determine the socio-economic characteristics of the smallholder farmers, the extent of yam commercialization, and the determinants of yam commercialization by smallholder farmers in the study area.

METHODOLOGY

Study Area

The study was conducted in Imo State, which is located in the southeastern agricultural zone of Nigeria. Imo State is one of the 36 states in Nigeria. The state has a land area of 5,530km^2, and a population of about 3.939 million. The state has 27 local government areas each of which has several communities and villages. It has 3 agricultural zones, Orlu, Okigwe and Owerri. (NPC, 2006). The area lies between latitudes 5.2^{o}N and 6.08^{o}N and longitudes 6.6^{o}E and 7.5^{o}E. The area has tropical climate marked by high rainfall of between 15000mm-20000mm and temperature range of 34^{o}C-37^{o}C. Agriculture is the major occupation of people of the state. Major root and tuber crops cultivated in the state include cassava, yam, sweet potato and cocoyam. Imo State is chosen for the study, because among the farmers in the state yam has high- income elasticity of demand by consumers when compared to other root and tuber crops cultivated in the state.

Data Collection Method

Multistage random sampling technique was used in the study. This involved a random selection of 2 Agricultural Zones from the 3 Agricultural Zones in Imo State, and a random selection of 4 Local Government Areas (LGAs) known for yam production which comprised 2 LGAs from each Agricultural Zone randomly selected for the study. A total of 120 farmers used for the study comprised 30 farmers randomly selected from each LGA selected for the study. Random field data for the study were collected from respondents using well structured questionnaire and oral interview.

Data Analysis

Data were analyzed using descriptive statistics and Ordinary Least Squares (OLS) multiple regression model. The socio-economic characteristics of the smallholder farmers were described using the respondents' sex, age educational level, marital status, household size, farm size, farming experience and marketing experience.

The extent of yam commercialization by smallholder farmers represents the degree of market integration of the farmers in the economy. This is the interrelationship between the quartile grouping of farmers according to mean farm size (ha) and mean income of farmer, and can be determined using either the consumption concept or the income concept of the smallholder farmer subsistence orientation or ratio following Okezie *et al.* (2012). The consumption concept of the smallholder farmer subsistence orientation or ratio is measured by the relationship between the mean value of non-marketed farm produce and the mean value farm production (₦), as follows:

$CA = AS/AP$ … (1)
where
CA = smallholder farmer subsistence ratio; AS = mean value of non-marketed farm produce (₦); AP = Mean value of farm production (₦).
In this study, the income concept of the smallholder farmer subsistence orientation or ratio is functionally represented as follows:

$CY = AS/\bar{Y}$ …… (2)
$\bar{Y} = (AP + AC + Y_O + Y_W + Y_Z + Y_L)/N$…… (3)
where:
CY = smallholder yam subsistence ratio; AS = mean value of non-traded yam produce; $\bar{Y}$ = mean income of the smallholder farmer ₦ha^{-1}; AP = mean value of yam produce ₦ha^{-1}; AC = mean cost of yam produce ₦ha^{-1}; Y_O = mean transfer income (rent) ₦ha^{-1} from fixed asset (land); Y_W = mean transfer income (wage) ₦ha^{-1} from labour in non-yam production sectors; Y_L = mean income ₦ ha^{-1} equivalent to leisure; N = no of observations

The determinants of yam commercialization by smallholder in the study area are implicitly represented using the OLS multiple regression model as follows:
$Y_i = f(X_1, X_2, \ldots, X_{18}, e_i)$ ……. (4)
where:
Y_i = degree of smallholder yam commercialization defined as the percentage value of household yam sales over the value of household yam production; X_1 = sex of farmer (dummy: 1 = male; 0 = female); X_2 = age of farmer (years); X_3 = educational level of farmer (years); X_4 = marital status (dummy: 1 = married; 0 = unmarried); X_5 = household size of farmer; X_6 = farm size of farmer (ha); X_7 = farming experience of farmer (years); X_8 = marketing experience of farmer (years); X_9 = fertilizer input (₦ha^{-1}); X_{10} = transfer income (wage) (₦ha^{-1}); X_{11} = transfer income (rent) (₦ha^{-1}); X_{12} = distance from household to the nearest market (km); X_{13} = Road conditions to the nearest market; X_{14} = access to extension service; X_{15} = access to credit; e_i = error term.

Four functional forms of the OLS multiple regression model (linear, exponential, semi log and double log) were flitted to the data. The double log functional form was chosen as the best-fit or lead regression form for the model based on the coefficient of multiple determination R^2, level of significance of the overall equation (F-statistic), number of regression coefficients that were significant, level of significance of each regression coefficient (t-statistic), and conformity of sign of each coefficient relative to a prior expectations of the OLS multiple regression model.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Smallholder Farmers

Table 1 shows the socio-economic characteristics of smallholder farmers in the study area. It indicates that among smallholder farmers 73.33 percent were males because the males had more right to land as

productive resource than the females. Most of the farmers were aged 42.62 years, married (80%), had large household size (6.82) and farm size (0.71 ha). These indicate that the farmers had great potentials for increased market orientation of yam production for sustainable household food security, employment and income generation in the study area.

Table 1: Socio-economic Characteristics of Smallholder Farmers in Imo State, Nigeria

Variables	No. of observations	Mean	Minimum	Maximum	Percentage
Sex:					
Male	88				73.33
Female	32				26.67
Total	120				100
Age (Years)	120	42.62 (4.00)	32	54	
Educational level (Years)	120	8.80 (4.73)	0	18	
Marital status:					
Married	96				80
Unmarried	24				20
Total	120				100
Household size	I20	6.82 (2.50)	2	12	
Farm size (Ha)	120	0.71 (0.67)	0.25	3.50	
Farming experience(Years)	120	10.92 (5.45)	3	18	
Marketing experience (Years)	120	8.08 (2.57)	2	13	

Source: Field Survey Data
Figures in parenthesis are standard deviations

Extent of Smallholder Yam Commercialization

Yam market integration by smallholder farmers in the study area (Table 2) which shows the extent of yam commercialization by smallholder farmers based on the income concept of the smallholder subsistence orientation or ratio ($CY = AS/\bar{Y}$) indicated that land holding by households was the major factor that determined the household income earning (Okezie *et al*., 2012) in the study area.

The most subsistence oriented farmers (the top 25 percent) represented by 6 farmers (5 percent) had mean farm size of 1.70 ha. Farmers in this group owned 44.15 percent of the farm land available for yam production in the study area. Farmers in this group also made the highest contribution in terms of mean values for income (₦73316.66), yam produce (₦ 92400), non-traded yam produce (₦71196), transfer income from rent (₦29333.33) and wage (₦15850), and their smallholder subsistence ratio was 0.91. Households with large landholding also depended on land rent and labour wages in order to increase their income.

Comparatively, the least subsistence oriented farmers (the lowest 25 percent) represented by 69 farmers (57.5 percent) had mean farm size of 0.25 ha. Farmers in this group owned 6.49 percent of the farmland available for yam production in the study area. Farmers in this group also made relatively low contribution in terms of mean values for income (₦33909.10), yam produce (₦15750), non-traded yam (₦12134.66), transfer income from rent (₦7500), wage (₦10806.82) and leisure (₦10806.22), and their smallholder subsistence ratio was 0.36. Households with small landholding spent more time off-farm in order to increase their income, in agreement with Okezie *et al* (2012). In aggregate terms, the least subsistence farmers in the first quartile grouping can be said to be more significant given that they constituted 57.6 percent of the farmers in the study area.

Table 2: Yam Market Integration by Smallholder Farmers in Imo State, Nigeria

Quartile grouping of farmers	Mean No. of farmers	Mean farm size (Ha)	Mean income of farmers $\bar{Y}$	Mean value of yam produce AP	Mean value of non-traded yam produce AS	Mean cost of yam produce AC	Mean Transfer Income			**AS/$\bar{Y}$**
							Rent Y_R	Wage Y_W	Leisure Y_L	
1st quartile (least Subsistence oriented)	69 (57.5)	0.25 (6.49)	33909.10 (2025)	15750 (10.44)	12134.66 (10.44)	10954.54 (10.44)	1500 (3.07)	15306.82 (19.73)	12306.82 (60.83)	0.36
2nd quartile (less Subsistence oriented)	30 (25)	0.70 (18.18)	37308.33 (22.28)	23100 (15.31)	17797.50 (15.31)	16066.67 (15.31)	5500 (11.27)	15850 (30.78)	7925 (39.17)	0.48
3rd quartile (more subsistence oriented)	15 (12.5)	1.20 (31.67)	22910.38 (13.68)	19613.21 (13.00)	15111.08 (90.90)	13641.51 (13.00)	12452.83 (25.52)	4485.85 (8.71)	_	0.66
4th quartile (most subsistence oriented)	6 (5)	1.70 (44.16)	73316.66 (43.78)	92400 (61.25)	71190 (61.25)	64266.67 (61.25)	29333.33 (60.13)	15850 (30.78)	_	0.91

Source: Field survey Date; 201

Figures in parenthesis are percentages

Determinants of Yam Commercialization by Smallholder Farmers

Table 3 shows the estimated OLS regression results of the determinants of yam commercialization among smallholder farmers in the study area. The linear functional form was chosen as lead equation for the study. The coefficient of multiple determination for the lead equation R^2 = 0.5897 was significant at 5.0 percent probability level, indicating that 58.97 percent of the variations in yam commercialization by smallholder farmer were significantly explained by the variables investigated in the study area.

Table 3: Regression Estimates of Determinants of Yam Commercialization among Smallholder Farmers in Imo State, Nigeria

Variable	+Linear	Double log	Semi log	Exponential
Intercept	2.23e+08	52.082	2.46e+07	-335.515
	(-1.40)	(1.47)	(1.06)	(1.37)
Sex of farmer X_1	2153.942	-4.78e-03	62.239	0.005
	(40.1)	(-0.02)	(0.00)	(0.21)
Age of farmer X_2	1763.067	0.174	1.19e+05	0.003
	(1.05)	(1.31)	(1.37)	(1.01)
Educational level X_3	1813.386	0.013	1.05e+04	0.002
	(1.28)	(0.41)	(0.50)	(1.12)
Marital status X_4	-23363	-0.031	-23029	-0.032
	(-1.49)	(-1.06)	(-1.19)	(-1.32)
Household size X_5	-3717.102	-0.037	-25527	-0.005
	(-1.45)	(-1.12)	(-1.19)	(-1.41)
Farm size X_6	-27034	-0.051	-33171	-0.042
	(-2.70)**	(-2.33)**	(-2.33)**	(-2.76)**
Farming experience X_7	-1278.280	-0.019	-13732	-0.002
	(-1.14)	(-1.04)	(-1.16)	(-1.05)
Marketing experience X_8	1702.539	0.027	16898	0.003
	(0.65)	(0.88)	(0.84)	(0.67)
Fertilizer input X_9	-15.663	-0.130	-77225	-2.42e-05
	(-2.80)***	(-0.59)	(-0.54)	(-2.82)**
Transfer income (rent) X_{10}	-33.871	-3.379	-2.10e+06	-5.72e-05
	(-1.03)	(-1.05)	(-1.00)	(-1.14)
Transfer income (wage) X_{11}	-182.351	-0.189	-124159	-2.95e-04
	(-0.70)	(-0.51)	(-0.52)	(-0.74)
Road conditions to the nearest market	12808	0.003	14925	0.018
X_{12}	(1.83)*	(0.15)	(1.45)	(1.67)*
	-2861.265	-0.049	1215.463	-0.004
distance from household to farm	(-0.21)	(-1.86)*	(0.08)	(-0.18)
nearest market X_{13}	-33761	-0.085	-31784	-0.051
	(2.46)**	(-2.68)**	(-1.85)*	(-2.43) **
Access to extension service X_{I4}	-39758	0.021	-54234	-0.062
	(-2.32)**	(1.31)	(-2.63)**	(-2.37)**
Access to credit X_{15}				
R^2	0.5897	0.2744	0.2832	0.4841
Adjusted R^2	0.4631	0.1449	0.1552	0.4565
F-Ratio	2.29**	2.12*	2.21*	2.23**

Source: Field survey data, 2013. ***, **, * = significant at 1%, 5% and 10% respectively.
+ = lead equation. Figures in parenthesis are t-ratios.

The coefficients of farm size (X_6), fertilizer input (X_9), access to extension service (X_{I4}) and access to credit (X_{15}) significantly negatively related to yam commercialization by smallholder farmers in the study area. These indicate that the farmers significantly experienced diseconomies of scale in production and hence low income from farming, as a result of inefficient use of land resources, fertilizer input, extension service and credit available for agricultural transformation in the study area. These diseconomies of scale in production and low income from farming were implicated for dependence by farmer's off-farm in order to increase their income and food security in the study area. The coefficient of road conditions to the nearest market (X_{13}) significantly positively related to yam commercialization by smallholder farmers in the study area. This indicates that provision of good roads significantly lead to easy movement of outputs and inputs needed for agricultural transformation in the study area.

CONCLUSION

The factors that significantly influenced yam commercialization by smallholder farmers in the study area include farm size, fertilizer input, access to extension service, access to credit and road conditions to the nearest market. The results of the study call for government policy to motivate the smallholder farmers to become market oriented in order to increase the effect of agricultural commercialization on economic growth of Imo State. The government should provide good roads and adequate off-farm employment to motivate the least subsistence farmers with small land holding to migrate to non-farm employments in order to increase their income and food security in the study area. The government should also promote economies of scale in yam production through efficient use of land resources, fertilizer input, access to extension service and access to credit in the study area. Government policy on the provision of good roads and promotion of economies of scale in yam production will motivate the most subsistence oriented farmers with large land holding to become market oriented in the production of yam in order to increase their income and food security, as well as provide employment for the least subsistence oriented farmers with small land holding who would otherwise migrate to less competitive non-farm employments in order to increase their income and food security in the study area.

REFERENCES

Gebremedhin, B. and Jaleta, M. (2010).Commercialization of Smallholders: Is Market Participation Enough? *Contributed Paper presented at the Joint 3rd African Association of AgriculturalEconomists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010.*

Jalet, M., Gebremedhin, B. and Hoekstra, D. (2009). Smallholder Commercialization: Process, Determinants and Impact. *Discussion Paper No. 18. Improve Productivity and Market Success (IPMS) of Ethiopian Farmers Projects, ILKRI, Nairobi, Kenya,* 55 pages.

Jayne, T.S., Haggblade, S., Minot, N. and Rashid, S. (2011). Agricultural Commercialization, Rural Transformation and Poverty Reduction: What have We Learned about How to Achieve This? *Synthesis report prepared for the African Agricultural Markets Programme Policy Symposium, Alliance for Commodity Trade in Eastern and Southern Africa* April 20-22, 2011, Kigali, Rwanda.

Johnston, B. F. and P. Kilby. 1975. *Agriculture and Structural Transformation: Economic Strategies in Late Developing Countries*. New York: Oxford University Press.

Mellor, J. (1976). *The New Economics of Growth*. Ithaca, NY, Cornell University Press.

National Population Commission (N.P.C) (2006), Abuja, Nigeria.

Okezie, C.A., Sulaiman, J. and Nwosu, A.C., (2012). Farm Level Determinants of Agricultural Commercialization. *International Journal of Agriculture and Forestry,* 2012, 2 920: 1-5.

Olwande, J. and Mathenge, M., (2010). *Market Participation and Poor Rural Household in Kenya.* Tegemeo. Institute of Agricultural Policy and Development, Egerton University.

Pingali, L.P., and Rosegrant, M.W., (1995). Agricultural commercialization and Diversity: Process and Policies. *Food Policy,* 20 (3): 171 – 185.

Timmer, C.P. (1997). Farmers and Markets: the Political Economy of New Paradigms. American Journal of Agricultural Economies, 79 (2): 621-627.

Von Braun, J., (1994). *Introduction*. In: von Braun, J., And E. Kennedy (Eds). Agricultural Commercialization, Economic Development and Nutrition. John Hopkins University Press Baltimore, MD. Pp.3-8.

World Bank, (2008). World Development Report 2008: Agriculture for Development. Washington D.C.