Original Research Article

AGRICULTURAL PRODUCTION ACTIVITIES, PROFIT EFFICIENCY NEXUS LIVELIHOOD DIVERSIFICATION AMONG PUBLIC SERVANT HOUSEHOLDS IN KWARA STATE NIGERIA

Abstract

Agricultural production activities are gradually becoming important livelihood diversification among urban and peri-urban households whose main occupation is public service. The study focuses on livelihood diversification through agricultural production activities among public servants in Kwara State, Nigeria. Both primary and secondary data (production records) were collected. Three hundred and thirty public servants comprising 150 fish farmers, 60 broiler farmers and 120 arable crop farmers were randomly selected through field survey with the aid of structured questionnaire. Data collected were analyzed using Herfindahl-Hirshman index (HHI), net margin and stochastic frontier profit function regression analysis. Fish, broiler and arable crop production were profitable with mean profit of ₦132,260 per 1000 fingerlings, ₦912 per bird and ₦89,564 per ha and mean profit efficiency of 72.6%, 74% and 68% respectively. The HHI of diversity revealed a significant level of income diversification to agricultural production activities. These contributed about 40%, 36.5% and 29% to total household income of public servants who engaged in fish farming, broiler production and arable cropping respectively. Public servant farmers should form a formidable group to enjoy economic of scale to purchase agricultural inputs and should be given adequate training through their cooperative by inviting resource personnel.

Keywords: Urban households, agricultural activities, public servants, livelihood diversification

INTRODUCTION

Agriculture is sub-divided into crop, livestock and fishery sub-sector. It is dominated in Nigeria by small scale farmers who produce about 80% of the total food requirement but offers a strong option for spurring growth, overcoming poverty, and enhancing food security [1]). However, recent studies [2, 3, 4 examining agricultural drive in Nigeria found out that the urban and peri-urban households are gradually diversifying to agricultural production activities notably homestead livestock, homegrown crop and fish farming. This connote that urban households has embrace many aspect of agriculture.

Although, Nigeria fishery production system was dominated by artisanal fishery sub-sector, it is already operating at its output frontier which culminates in fish supply-demand deficit. There is very little or no scope to increase the supply of fish especially from artisanal fishery to meet the growing demand for fish protein required for its ever increasing population. The expansion in brackish, coastal and inland water fishery, which was a major source of local fish production growth till year 2000s has reach climax and started to decline thereafter [5]. Fish farming is expanding rapidly throughout the world and has a high potential for the provision of valuable protein in less developed countries, especially Nigeria. It has been projected that aquaculture production can increase fish production by 50 million metric tons by 2050 [6].

Closely related to fish farming, poultry also serves as important source of animal protein and has certain advantages as a means of bridging the protein demand-supply gap amongst Nigerians. Apart from poultry and fish products, other sources of animal protein in Nigeria are ruminants, piggery, snails and rabbits. However, ruminants are poor candidates for rapid short-term increases in number. This is due to their low fecundity, long gestation and long generation interval [7]. It is known that piggery multiply rapidly within a relatively short-time with gestation period of 114 days. Unlike pork that has no national spread due to religious beliefs, there are virtually no taboos that hinder the consumption of both poultry meat or eggs [7] and fish products. Hence, both fish farming and poultry production has long been recognized as one of the quickest ways of rapid increase in protein supply in the short-run. Therefore, the need to meet animal protein requirements from domestic sources demands intensification of production of fishes and poultry derived from prolific animals like poultry birds and aquatic fish.

Furthermore, urban households including public servants also engage in vegetable production in form of *Vernonia amygdalina* (bitter leaf), *Talinum triangulare* (water leaf), *Spinacia*

oleracia (spinach), *Amaranthus spinosus* (green amaranth), *Citrullus lanatus* (watermelon), *Abelmoschus esculentus* (okra), *Lycopersicum esculentum* (tomatoes), *Lactuca sativa* (lettuce), *Telfairia occidentalis* (pumpkin), *Citrullus lanatus* (watermelon) and *Capsicum annum* (pepper). Though, vegetable growing are diverse, complex and management intensive, it raised the income of the farmers and reduce challenges of dry season unemployment. Along with fruits and nuts, vegetables and melons have long been recognized as vital components in the nutritional health and well-being of any nation [8]. Spurred largely by irrigation potential of the State, demand by both rural and urban households, health and diet concerns of Nigerian citizens and lack of storage facilities, increases in vegetable consumption are daily expected [3].

Problem Statement

Global economy recession indicates the need for urban households' especially public servants to diversify their income sources by combining primary earning and non-wage activities to sustain their livelihoods. Incomes from non-wage source are increasingly becoming a supplementary to urban households' income for public servants who reside in urban centres in many parts of Nigeria. Weekly wages and monthly income is the most essential component of public servant households' income. However, of recent this income exhibits a high irregularity and outcomes are thus uncertain, because of drastic reduction in allocation from Federal Government and global economic recession. Thus, many government establishments at the three tiers are indebted to their employees running to months. Consequently, many of these civil servants partly allocate their leisure time, off days and vacations to activities which provide a supplementary income so as to cope with adverse shocks. Livelihood diversification activities have become an important income-generating strategy for both urban and rural small farm households throughout the developing world including Nigeria. Diversification refers to the expansion of the range of activities outside their primary or main

84 occupation [9] and is seen as a dynamic adaptation process created through pressures and
85 opportunities [10]. Diversification may occur as a deliberate household strategy or as an
86 involuntary response to crisis; and can be used both as a safety net for the poor or as a means
87 of accumulation for the rich [11]. Evidence from literature [12, 13, 9] revealed that there has
88 been an increasing livelihood diversification to agriculture among urban and peri-urban
89 people including public servants. Most income diversification strategy are driven by socio-
90 economic objectives largely, nutrition improvement of rural and urban communities,
91 generation of additional family income, creation of employment and diversification of
92 income generating activities.
93 According to [10], participation in multiple activities by urban and farm (rural) families is not
94 new or only confined to the rural sectors of developing countries. Most rural and urban
95 families have truly multiple income sources which may indeed include off-farm wage work
96 in agriculture and wage from non-farm activities, rural non-farm self-employment, trading
97 and remittances from urban areas and from abroad [14]. Lately, many urban and rural
98 households including public servants play a significant role in the service sector mostly
99 casual labour in industries, craft, artisan work and, public and private institutions located near
100 their villages during the off-days, vacations, off-farm season to get work for sustaining their
101 livelihood such as cushion food shortage experienced by the households or settle domestic
102 obligation and buy back some inputs needed for farming operations [9]. It is obvious that
103 involvement of public servants in agricultural production has multiplier effects on both micro
104 and macroeconomic in Nigeria. For instance, such engagement could increase household
105 income and consumption of such produce which improves access to better nutrition, increase
106 self-sufficiency and promote overall agricultural development and productivity.
107 Considering the growing importance of the supplementary occupations among wage earners
108 in Nigeria, the study therefore, intends to estimate the profitability and determine profit

efficiency of agricultural production activities among public servant households and to what extent has this livelihood strategies improved the well-being of their households in Kwara State, Nigeria.

MATERIAL AND METHODS

The study Area and Data collection

The study was conducted in 2015 among public servants in Kwara State, Nigeria. The State is located between latitude 7^{o} 45' and 9^{o} 30' N and longitude 2^{o} 30' E and 6^{o} 25' E with a land mass covering about 32,500 square km. With an estimated population of about 2.4 million people [15], the State's population was projected in 2016 to be about 3.17 million representing 3.2% annual growth rate and an average density of ninety eight persons per sq. km. Primary data were collected from public servants (workers) through interview and structure questionnaire which was subjected to a pre-survey and secondary data through production records. Three sets of questionnaire were administered to civil servants based on the farming enterprise: Fish farming, broiler production and arable/vegetable crop farming.

Sampling Procedure, Sampling size and analytical techniques

Multi-stage sampling procedure was used to select the three categories of agricultural production activities engaged in by public servants. The lists of public servants who engage in the three farming enterprises were sought from the 16 Local Government Area (LGAs) and random sampling resulted in 180, 60 and 120 fish farmers, broiler production and vegetable farmers respectively.

Herfindal index, farm budgeting and stochastic frontier models were employed to analyze the data. The Herfindahl-Hirshman index measures the number of income sources or the level of income diversification. A value of one indicates complete dependence on a single income source while a value of 1/k represents perfectly equal earnings across income sources, where there are k different income source categories analyzed [16]. Other studies use the inverse of

the Herfindahl index [17] because it measures not only the number of income sources but also the evenness of income shares, with the parameter determining the weight of the number of sources versus evenness in the distribution of shares.

The stochastic frontier profit function was defined as:

$$\pi_i = f(X_i; \delta) + \varepsilon_i \quad (1)$$

Where π normalized profit of the ith farms is, X_i is a vector of inputs used by farm i, and ε_i is a "composed'' error term. The error term ε_i is equal to $v_i - u_i$. The term v_i is a two-sided $(-\infty < v_i < \infty)$ normally distributed random error $(v \sim N[0, \sigma_v^2])$ that represents the stochastic effects outside the farmers' control. The term u_i is a one-sided $(u_i \geq 0)$ efficiency component that represents the technical inefficiency of farm. The distribution of the term u_i can be half-normal, exponential, or gamma and half-normal distribution $(u \sim N[0, \sigma_u^2])$ is used in this study. The two components $v_i \, and \, u_i$ are also assumed to be independent of each other according to [18].

Empirical model specification for the determinants of profit efficiency was as follows;

$$\ln\pi_{i=} \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + V_i - U_i \quad (2)$$

Where: π_i = Profit of the ith farmers (₦); $X_1 – X_{11}$ were defined in the results, and subscript i refer to the observation of ith farmers; ln = Logarithm to base e. The inefficiency effects, V_i is a random error term assumed to be independently and identically distributed as N $(0, \sigma_V^2)$. U_i represents profit inefficiency and is identically and distributed as a truncated normal with truncations at zero of the normal distribution [19]. The U_i is defined as:

$$u_i = \omega_0 + \omega_1 Z_1 + \omega_2 Z_2 + \omega_3 Z_3 + \omega_4 Z_4 + \omega_5 Z_5 \quad (3)$$

Where: U_i= technical inefficiency of the ith farmers; $Z_1 - Z_5$ were defined in the results

A Foster-Greer-Thorbecke (FGT) index was used to determine the influence of income with or without agricultural earning on welfare of public servants given as:

$$p_{ai} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{a} \quad (4)$$

Where: P_{ai} is the threshold index for the i[th] sub-groups, n is the total number of households, Y_i is the per adult equivalent income of i-th households, z is the poverty line, q is the number of the sampled household population below the poverty line and α is the aversion to poverty it ranges from 0 to 2 [20].

RESULTS AND DISCUSSION

Returns in fish farming of public servants

The results of net margin and profitability analysis are presented in Table 1. The study confirmed that public servants engaging in agricultural production activities were not only satisfying the household's food need or subsistence, but also interested in selling their outputs to raise income. Thus, the farmers like any other entrepreneur had a profit motive. Therefore, efforts were made to determine the costs associated with farm enterprises and also revenue that accrues to their efforts. Both the variable and fixed costs of production were considered, because the bulk of farmers acquired homestead building, pond, pumping machine and a few of them dug boreholes.

The result revealed the average net returns of ₦132,260 per 1000 fingerlings invested with profit margin of about 26.5%. This implies fish that farming venture among public servants in Kwara State is profitable. The level of profit could be bridged up and perhaps, doubled (₦260,520) if the production season is repeated twice in a year as study found out that most of the fish reach table size or are sold in about 6 months of production. It suffices to note that variable cost (97%) carried the larger portion of total cost; cost of feed accounted for 71.7% and 70% of total variable cost and total cost respectively.

Table 1: Costs and return estimate of homestead fish farming of public servants

Variables	Input-output items	Value (₦)	% of TVC	% of TC
A. Variable costs (VC)	1,000 Fingerlings/juvenile	30,000.3	8.39	8.15
	Feeds	256,320.9	71.73	69.66
	Chemicals: lime & fertilizers	5,650.5	1.58	1.54
	Drugs and anti-stress	4,570.0	1.28	1.25
	Cost of water pump (L)	27,640.4	7.73	7.51
	Hired labour	18,000.0	5.04	4.89
	Family labour	12,000.0	3.36	3.26
	Transportation cost	3,170.0	0.89	0.86
Total VC		**357,352.1**	**100.0**	**97.11**
B. Fixed costs (depreciated)	Pond	1,250.0	11.76	0.34
	Homestead building	1,758.0	16.54	0.48
	Pumping machine	3,509.7	33.03	0.95
	Pond excavation	2,250.0	21.17	0.61
	Miscellaneous expenses	1,860.0	17.50	0.50
TFC		**10.627.7**	**100.0**	**2.89**
C. Total TC		**367,979.8**		**100.0**
D. Revenue				
Unit price	1kg	520.0		
Average loss	Cannibalism & diseases: 38	19,760.0		
Average gain	Mostly Clarias: 962	500,240.0		
Total revenue		**500,240.2**		
Net margin		132,260.2		
Profit margin		26.44%		
Production period	6 months			

Source: field survey, 2014/2015

Profitability Analysis of broiler production of public servants

The results of net farm income and profitability analysis of broiler are presented in Table 2. Majority of the respondents (95%) were interested in selling their outputs to raise additional income. The result revealed that the gross margin and net farm income per bird was ₦886 and ₦750 as well as profit margin and return on investment (ROI) of 45% and 1.8 respectively. The net margin analysis has shown that poultry production among public servants is profitable. However, it is pertinent to show that both price of chick stock and cost of feed account for about 70% and 60% of total variable cost and total cost respectively. Furthermore, the variable costs gulped about 85% of total cost of broiler production. The results are comparable to studies by [21, 22] that reported that broiler production are profitable in Pakistan and Ondo State respectively.

Table 2: Average Cost and Returns of broiler production of 100 broilers

Variables	Values (₦)	% TVC or FC	% TC
A. Variable costs			
Price of chicks stock	21,000.0	27.6	23.4
Cost of feed	31,820.0	41.9	35.5
Cost of labour	11,000.0	14.5	12.3
Cost of vaccination	7,074.9	9.3	7.9
Cost of electricity	1,500.0	2.0	1.7
Other costs	3550.8	4.7	4.0
Total Variable Cost	**75,945.7**	**100.0**	**84.8**
A. Fixed costs			
Depreciation cost of poultry shed	7,250.5	53.3	8.1
Depreciation cost of other equipment	6,350.8	46.7	7.1
Total Fixed Cost	**13,601.3**	**100.0**	**15.2**
B. Total Cost (A + B)	89,547.0		100.0
Net Returns			
Quantity sold (broilers)	94		
Average loss	6		
Unit price	1750.5		
C. Total Revenue	**164547.0**		
Gross Margin	88601.3		
D. Net Farm Income (C-B)	75,000.4		
Profit margin (D/C*100)	45.6		

Source: Field Survey, 2014; production and financial records

Profitability Analysis of vegetable production of public servants

The results of gross and net margin analysis are presented in Table 3. The arable crop farmers are primarily interested in selling their outputs to raise income and probably satisfied the household's food need or subsistence. Thus, the farmers like any other entrepreneur may have a profit motive. The result revealed the average net returns of integrated crop farming was ₦75,000 per ha with profit margin of about 46%. This also implies that crop farming venture among public servants in Kwara State is profitable. The level of profit could be bridged up and perhaps, more than doubled if farmers combine rainfed and dry season irrigation. It suffices to note that variable cost carried the larger portion of total cost (86%); labour accounted for about 44% and 37% of total variable cost and total cost respectively.

Table 3: Average costs and revenue per hectare of integrated arable crop production

Variables	Values (₦)	% TR	% TVC or FC	% TC
Revenue from(₦):			-	
leafy vegetables	89,750.09	48.2	-	-
Fruity vegetables	64,650.9	34.7	-	-
Other crops	31,800.0	17.1	-	-
A. Total revenue	**186,200.99**	**100.0**	**-**	
Variable cost (₦)				
Seedling materials	4,520.8	-	6.4	5.5
Fertilizer	13,704.3	-	19.3	16.5
Organic manure	10,834.7	-	15.2	13.1
Chemicals	3,762.8	-	5.3	4.5
Labour	31, 000.7	-	43.6	37.3
energy	7,256.1	-	10.2	8.7
B. Total variable cost	**71,079.4**	**-**	**100.0**	**85.6**
C. Gross margin(A-B)	**115,121.6**	**-**	**-**	
Fixed cost items				
Land charges	5,000.0	-	41.7	6.0
Depreciation	6,984.5	-	58.3	8.4
D. Total Fixed Cost	**11,984.5**	**-**	**100.0**	**14.4**
E. Total costs (B+D)	**83,063.9**	**-**	**-**	
F.Net margin/ha (A-E)	**103,137.1**	**-**	**-**	
Profit margin (F/A)	**0.55**	**-**	**-**	

Source: Field survey, 2014/2015; ***ROI indicate Return on Investment***

Profit efficiency and its determinants among public servant farmers

Table 4 showed the frequency distribution of the profit frontier model of agricultural production activities in Kwara State. The result of the profit frontier of fish farming revealed that the estimated coefficient of the parameters of cost of feed (P<0.01) and cost of fingerlings (P<0.05) were positive while cost of family labour (P<0.01) was negative. This showed that a unit increase in prices of the positive coefficient inputs will lead to increase in the net margin of fish production and vice versa. The mean profit efficiency shows that farmers are able to obtain about 0.79 of potential output from a given one unit mix of production inputs. Therefore the fish farmers can expand their output further by a relatively high margin of 0.21 by adopting more superior and improve techniques and technology by the best practised farmer to attain the profit efficiency of one. Similarly, cost of hired labour (P<0.05), cost of feed (P<0.01) and marginally, cost of vaccine and drug (P<0.1) were

significant inputs in broiler production. However, cost of family labour (P<0.05), cost of organic manure (P<0.01) and to a lesser degree, cost of chemical fertilizer (P<0.1) were found to be significant variables in profit efficiency of arable farmers.

Table 4: MLE Results of Frontier Profit Function of agricultural production activities

Variables	β	**Fish farmer**	**Broiler farmer**	**Crop farmer**
Cost Function		Coefficient (t-v)	Coefficient (t-v)	Coefficient (t-v)
Constant	β_0	0.321 (2.2**)	0.099 (2.0**)	0.607 (1.79*)
Cost of hired labour (X_1)	β_1	0.005 (1.2)	0.341 (2.2**)	0.219 (1.1)
Cost of family labour (X_2)	β_2	-0.542 (2.7***)	-0.007 (1.1)	0.693(2.0**)
Cost of feed (X_3)	β_3	0.861 (9.4***)	0.457(4.1***)	-
Depr. of capital items (X_4)	β_4	0.145 (0.88)	-0.002(0.68)	-0.329(0.59)
Cost of vac. And drugs (X_5)	β_5	-0.109 (0.78)	0.298(1.95*)	-
Cost of fingerlings[1] or day old chicks[2] or seed[3] (X_6)	β_6	0.519[1] (2.18**)	0.399[2] (2.90***)	0.027[3](0.32)
Cost of pesticide (X_7)	β_7	-	-	0.523(1.0)
Cost of chem. fertilizer (X_8)	β_8	-	-	0.276(1.74*)
Cost of organic Manure (X_9)	β_9	-	-	0.187(2.98***)
Cost of investment (X_{10})	B_{10}	0.427 (1.87*)	0.065(1.3)	0.004(0.43)
Inefficiency variable				
Constant	Z_0	0.410 (2.1**)	0.099 (1.50)	0.003 (2.9***)
Age	Z_1	0.04 (1.1)	0.061 (0.79)	0.205 (1.3)
Adjusted household size	Z_2	0.312 (1.04)	-0.402 (1.98*)	-0.005 (0.63)
Farming experience	Z_3	0.528 (1.0)	-0.207 (1.29)	0.284 (0.87)
Social organization	Z_4	-0.651(2.79***)	0.309 (0.73)	-0.056 (1.86*)
Credit	Z_5	-0.501(1.3)	-0.822 (4.9***)	-0.452 (2.0**)
Education	Z_6	-0.282 (4.7***)	-0.562 (2.8***)	-0.723 (8.1***)
Diagnostic Statistic				
Sigma-square (σ^2)		0.008 (1.90*)	0.206 (1.85*)	0.427 (3.9***)
Gamma (**γ**)		0.421 (2.4***)	0.311 (3.9***)	0.241 (6.0***)
Log likelihood function *L/f*		56.5	49.5	53.6
LR test		-142.7	132.9	93.0
Mean efficiency		78.5	73.0	64.9
No of observation		150	60	120

*Asterisk indicate significance ***1%,**5%, *10%*

The inefficiency sources also in Table 4 showed cooperative membership and level of education were the significant factors affecting fish production, credit and education play a crucial role in both broiler and arable crop production thus, as these variables increase, the profit inefficiency of the farmer decreases. The distribution of profit efficiency estimates from the stochastic frontier model in Table 5 shows that both fish and broiler farmers' efficiency were concentrated in the range of 0.41-0.80 totaling 77.4% and 68% respectively.

However, arable crop efficiency of public servant farmers tilted averagely towards range of 0.41-0.60.

Table 5: Distribution of profit efficiency estimates from the stochastic frontier model

Class	Fish farmer		Broiler farmer		Arable crop farmer	
	F	%	F	%	F	%
0.01-0.20	3	2.0	4	6.6	22	18.3
0.21-0.40	12	8.0	7	11.7	15	12.5
0.41-0.60	64	42.7	16	26.7	61	50.8
0.61-0.80	52	34.7	25	41.7	17	14.2
0.81-1.00	19	12.6	8	13.3	5	4.2
Total	150	100.0	60	100.0	120	100.0

Note:

Measuring livelihood diversification with and without agricultural income

The Herfindahl-Hirshman index (HHI) of diversity revealed a significant level of income diversification to agricultural production activities. These contributed about 40%, 36.5% and 29% to total household income of public servants who engaged in fish farming, broiler production and arable cropping respectively. Figure 1 presents the Cumulative Distribution Function (CDF) for households with and without access to agricultural income activities at different levels. The CDF of public servants households without access to agricultural income stochastically dominated the CDF of households with access to additional income. This shows that households with no access to farm income would have more poverty incidence, depth and severity than households with access to additional income over the range of the poverty line. The second order stochastic dominance also holds true.

Implications of the Livelihood Diversification Strategy

The result implies that agricultural production activities were profitable among public servants in Kwara State attesting to the fact that Nigeria has a huge agricultural endowment of human, materials and natural resources. Despite this, the nation faces a lot of challenges including that of attaining food security and self-sufficiency in virtually all food commodities which they have production comparative advantages. Engaging in agricultural production by urban and peri-urban households enables households to have diversified incomes, enhance

their food security, increase agricultural production and most importantly reduce shocks of unpaid salary and arrears. Thus, it is very important for adequate institutional framework to be put in place by all the three tiers of governments to encourage homestead agricultural production activities among public servants and urban households in general since such engagement could increase household income, consumption of such produce would improves access to better nutrition, increase self-sufficiency, create employment and promote overall agricultural development and productivity.

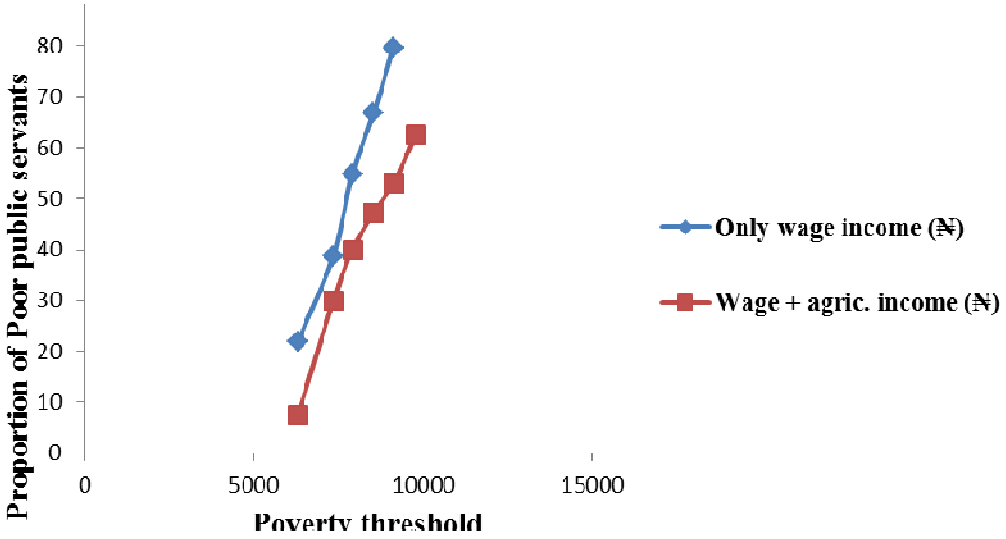

Fig. 1: Dominance analysis by level of Income Earned by Household Heads

CONCLUSION AND RECOMMENDATIONS

It could be concluded that proceeds from both farming units {net margins (profit)} has proved to be a strong relief in term of finance, employment and such household may likely not experience cycle of seasonal food shortage, experienced by majority of households in Nigeria, and, likely to overcome caloric and nutrition insufficiencies, and earned more and stable income to fulfill their domestic obligations. Urban farming households should form a formidable social organization to benefit from economy of bulk purchase of fish input supply, fish farm advisory services, increased access to micro-credit, and access to modern fish pond techniques. Production of quality and affordable inputs such as fish and poultry feeds, feed

pellets locally could spurs more people to invest in aquaculture and broiler production and reduce cost of production since most farmers depend on imported quality feeds which are expensive and not affordable. Finally, in view of the fact that urban households are now diversifying to agriculture suggests also that any agricultural policy or project aimed at improving the livelihood strategies and standard of living of the urban households should promote these agricultural activities in urban centres.

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