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Navigating Fish Food Insecurity by Simultaneous Household and Marketed Surplus-Led Productions in Kogi State of Nigeria

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ABSTRACT

The study determined the factors influencing simultaneously household and marketed surplus-led fish production in Nigeria's Kogi State using cross-sectional data collected from 105 fish farmers. The sample size was achieved using a multi-stage sampling technique and the collected data were elicited viz. structured questionnaire complemented with interview schedule. Both descriptive and inferential statistics were used to achieve the conceptualized objectives. Empirical evidence showed that marketed surplus-led fish production was affected by less risky non-farm incomes with high-income turnover and capital paucity. However, marketable surplus-led production was enhanced by enlarged income, readily available demand that matches the supply, and entrepreneurship zeal among the youthful population in the studied area. In view of the foregoing, the research recommends the need to strengthen the value chain of fish marketing so as to contain any challenge viz. market imperfection which in the long run will jeopardize market-orientation of fish farming which is nascent among most of the farmers in the studied area. In addition, there is a need to address gender inequality in order to arrest poverty vulnerability among women folk viz. budget gender mainstreaming so as to achieve growth and development which are pre-requisite for globalization.

Keywords: Food security; Marketable surplus; Purpose; Fish farming; Kogi State; Nigeria

1. Introduction

Through the provision of nutritious diets, work opportunities and income generation, the fisheries sector has a major impact on the daily activities of most households in low to middle income countries (Belton *et al*., 2014). Approximately 540 million people, mostly from developing countries, rely either directly or indirectly on the fisheries and aquaculture sector for their livelihoods, accounting for almost 8% of the world population (Belton *et al*., 2014; Greima *et al*., 2020).

In Nigeria, the fish production sector is a major agricultural sub-sector where achieving food security has become elusive (Oluwasola and Ajayi, 2013). Agriculture contributes 24.4 percent to the Gross Domestic Product (GDP) in Nigeria, with the fishery sector contributing 0.5 percent in 2015 (FAO, 2017; Greima *et al*., 2020). Nigeria's production level from both catch and aquaculture fisheries rose from 441,377 tonnes in 2000 to 759,828 tonnes in 2014. Aquaculture had a 12-fold increase from 25,718 tonnes to 313,231 tonnes during the same period (FAO, 2017; Greima *et al*., 2020). As a result, the increase was primarily attributed to the increase in commercial fish farming in and around rural and urban cities of Nigeria and the resulting establishment of accessible fish markets for these farmers.

The intake of fish in Nigeria has risen from 7.6 kg per capita in 2000 to around 13.9 kg in 2014 (Belton and Thilsted, 2014). The rise is due to urbanization, population growth and growth in middle-income households, raising awareness of the health effects of red meat and the continued viability of Nigeria's aquaculture production systems (HLPE, 2017). Aquaculture production in sub-Saharan African countries is expected to double the annual growth rate reported in 2020 in response to increased fish demand (Greima *et al*., 2020).

Currently, Nigeria's fish production is only 0.78 million metric tons (MT), while demand is offset by imports of 750,000 MT of fish worth USD 600 billion (Greima *et al*., 2020). To sustain the annual per capita consumption level of at least 13.9 kg in Nigeria, a projected demand of at least 2.66 million MT of fish per year is needed (Belton and Thilsted, 2014). Demand far outweighs current national capacity, requiring imports of fish from all over the world (Burrows, 2018). However, due to the devaluation of the Nigerian naira, the price of imported fish has dramatically increased in recent years (Burrows, 2018). Consequently, many policy initiatives to promote local fish farming have been put in place. In order to help promote domestic production, the government is taking measures to limit fish imports, but there is still a gap in locally grown fish. To date, the results have not yielded the expected results from the monumental expenditure and policy.

This large demand gap, the supply of at least 1 million metric tons of fish, needs to be filled not by imports, but rather by increasing the market-driven value chain of aquaculture, which supplies high-quality fish and fish products for

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consumption. As its population consumes almost 2 million tons of fish per year the market potential for fish farming in Nigeria is huge (US Mission Nigeria, 2017; Burrows, 2018), and the increasing population of the country means that demand will continue to boom.

To meet the country's high demand for fish, it seems to be difficult to understand the interest of fish farmers in fish farming. This has resulted in insufficient knowledge needed to predict the purpose of fish rearing in the presence of a deficit in the marketed surplus. Therefore, the need to explore aquaculture as a means of curbing this threat becomes indispensible. The interest in resolving the issue of fish farmers in relation to the purpose of fish farming must be fully understood. It is important to recognize idiosyncratic factors that stimulate interest in the purpose of fish farming, as they will promote investment decision-making and effective policy formulations that will enhance sustainable fish value chain in the study area in particular and the country in general.

With the shift of fish supply from wild catches to farming, there is little or no information on idiosyncratic factors determining the purpose of fish farming in the study area in particular and the country in general. Most of the researches shown by literature focused on fish market value chain and production. Thus, information from this research will serve as a basis for research activities and sectoral planning, identifying potential growth opportunities and addressing the challenges of development. Succinctly, the present research aimed at determining factors influencing the purpose of fish farming in Kogi State of Nigeria. The specific objectives were to describe the socio-economic profile of the respondents; determine the factors influencing household-led and marketed surplus-led fish productions; and, factors determining marketable surplus-led fish production in the study area.

2. Research Methodology

The coordinates of Kogi state are latitude 7.49’N and longitude 6.45’E and geographically situated in the middle belt of Nigeria. The creation of estuary by the two major rivers *viz*. Niger and Benue Rivers made the state to be referred as a confluence state. The state's total land area is 28,313.53 square kilometers, with a projected population of 3.3 million. The state has an average high temperature of 33.2 ° C and an average annual minimum temperature of 22.8 ° C and rainfall varies from 1016mm to 1524mm per year. The state's vegetation consists of mixed leguminous (guinea) woodland with forest savannah; in the river basin, the large expanse of Fadama; and in the western and southern belt of the state, long stretches of tropical forest. The main occupations of the inhabitants of the state are agriculture and fishing, although they are supplemented by handicrafts and *Ayurvedic* medicines.

A multi-stage sampling technique was used to draw a representative sample size of 105 homestead fish farmers from the studied area. The first stage involved convenient selection of Agricultural Zone C due to cost constraint. Subsequently, two Local Government Areas *viz.* Adavi and Lokoja were purposively chosen due to high concentration of homestead fish producers; beehive of commercial activities and readily available fish market. Thereafter, from each of the chosen LGAs, two villages were randomly selected. A sampling frame of the selected villages obtained from the Kogi State Agricultural Development Project (KSADP) was used to obtain the representative study sample size. A proportionate sampling technique was used to draw 50% of the sampling frame from each of the chosen villages. Lastly, a total of 105 randomly were drawn, thus the representative sample size for the study. The first, second and third objectives were achieved using descriptive statistics and generalized linear regression model-Bivariate probit and multinomial logit regression models. A structured questionnaire complemented with interview schedule was the instrument used to elicit data during the 2018 production cycle. The administration of the questionnaire was handled by KSADP trained enumerators.

Table 1
Sampling frame of fish farmers in the chosen LGAs.

LGA	Village	Population	Sample size
Adavi	Nagazi	22	11
	Osara	82	41
Lokoja	Ganaja	46	23
	Kankanda	60	30
Total	**4**	**210**	**105**

Source: KSADP, 2018

2.1. Model specification

2.1.1. Bivariate probit model

A bivariate probit model considering the possibility of contemporaneous correlation in the decision of household-led and marketed surplus-led fish productions (marketable surplus-led production) as food security management is given below:

$$Y_{ij} = X_{ij}\beta_j + \varepsilon_{ij} \quad (1)$$

Where $Y_{ij}\ (j = 1, \dots\dots, m)$ represent the purposes of fish farming (m=2) faced by the ith farmer (i=1, ……, n), X_{ij} is a 1* k vector of observed variables that influence the purpose of fish rearing. β_j is a k*1 vector of unknown parameters to be estimated and ε_{ij} is the stochastic term. In this specification, each Y_j is a binary variable, thus equation 1 is actually a system of m equations to be estimated:

$$Y_1^* = \alpha_1 + X\beta_1 + \varepsilon_1 \quad (2)$$

$$Y_2^* = \alpha_2 + X\beta_2 + \varepsilon_2 \quad (3)$$

Where Y_1^* and Y_2^* are two latent variables underlying each of the purpose of fish rearing such that $Y_j = 1$ if $Y_j > 0$; otherwise, 0. Y_1^* and Y_2^* are household-led production and marketed surplus-led production, respectively. The ε_{ij} of likely will experience stochastic dependence. This dependence among the elements can be considered by assuming ε_{ij} that is multivariate normally distributed (Ullah *et al*., 2016). Thus, in the bivariate probit model the stochastic term are assumed to have multivariate normal distributions with mean equal to zero.

2.1.2. Multinomial logit model

In this case, the choice set is the possible combinations of purpose of fish production for food security management and below is the specified model:

$$Y_i^* = \alpha + X\beta + \varepsilon_i \quad (4)$$

$$Y_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + X_5\beta_5 \dots . + X_n\beta_n + \varepsilon_i \quad (5)$$

Where:

Y_i^* = represents rearing purpose (1= household-led production, 2= marketed surplus-led production, 3= marketable surplus-led production). Marketable surplus-led production is a combination of household and market led-productions.

X_1 = Age (years); X_2= Gender (male =1, otherwise =0); X_3 = Marital status (married =1, otherwise = 0); X_4 = Education (years); X_5 = Household size (number); X_6 = Experience (year);

X_7 = Farm acquisition (owned =1, otherwise =0); X_8 = Farm practices (sole = 1, mixed =0); X_9 = Non-farm income (yes =1, otherwise = 0); X_{10} = Extension visit (number); X_{11} = Co-operative membership (yes = 1, otherwise = 0); X_{12} = Credit access (yes = 1, otherwise = 0); X_{13} = Fishing cycle (number); X_{14} = Income (in Naira); X_{14} = Unit price of output (in Naira); X_{16} = Fish output (kg); β_0 = Intercept; β_{1-n} = Vector of parameters to be estimated; and, ε_i = Stochastic term.

3. Result and Discussion

3.1. Socio-Economic Characteristics of the Fish Farmers in the Studied Area

Most of the farmers (47.6%) purposely reared fish to augment their income and improvise farm family with fish food. However, 32.4% and 20% of the farmers indicated that their purposes of fish cultivation are for commercial and household food consumptions, respectively. The mean and standard deviation values of 36 and ±10.09 respectively, implied that majority of the farmers to be viable and within the active- economic age. This indicates availability of viable human resource capital that can be harnessed to achieve self-sufficiency in fish supply in the studied (Table 2). The zeal of young farmers towards achieving a high standard of living due to their quest for materialistic possession will tilt them towards potential commercial fish production needed for fish food security in the studied area. The results showed evidence of gender inequality as the enterprise is laced by male farmers (62.9%) and is attributed to ease of access and control of productive resources by the men folk. Cultural and religious barriers create a gender stereotype that hinders women access and control of productive resources, thus rendering women folk susceptible to poverty shock due to widening gender inequity. Married farmers who perhaps need proceeds to augment household income and food security are the majority (70.5%) who practiced fish farming in the studied area. The results showed most of the fish farmers to be formally educated (90.4%), thus an indication of relative high tendency of ease in reception, adoption and assimilation of fish farm technologies in the studied area. As indicated by the mean and standard deviation values (6±2.7), most of the farmers were found to maintain a sustainable household size, a good omen of business sustainability as household expenditure will not constrain the going concern of the business. In addition, it revealed that the enterprise is dominated by elites who tend to have few children. However, farm labour requirements and religious factors might be responsible for the large household maintained by close to half (46.7%) of the sampled population. In the studied area, fish farming is dominated by new entrants as evidenced by the proportion of the farmers with farming experience of less or equal to 4 years (53.3%). In addition, the high standard deviation value of the mean year for experience implied that fish farming in the studied area is neither relatively new nor old. However, close to half of the sampled population (46.7%) had adequate years of experience which if properly harnessed will make them to be efficient managers in fish farm resource allocation decision. Most of the respondents are entrepreneurs as means of technical unit acquisition was purchased by most (53.3%) of the farmers. Most of the farmers practiced monoculture i.e., stocked one variety of fish (63.8%) which may be attributed to the need for specialization. However, 36.2% of the farmers stocked different varieties of species (polyculture) as a market strategy target different consumer preferences or tastes in the studied area. In addition, catfish is the most cultured fish variety (63.8%), an indication of a high consumer preference. It has a high market value of two to three times than that of tilapia in the studied area. Most of the farmers cultivated fish twice in a year (82.9%), an indication of high enterprising of fish business. There is evidence of poor income base diversification among most (64.8%) of the farmers, an indication of fish enterprise as a viable business with high market prospects, thus an overwhelming acceptability in the studied area. However, their livelihood is at stake due to non-diversification as any eventuality (risk and uncertainty) in the future will jeopardize their sustainability. Access to extension services was poor, an indication of the prevalence of use of conventional fish farming technologies among most of the farmers (86.7%) due to in accessibility of innovative fish farming technologies. There is poor utilization of their social capital among most (77.1%) of the farmers, thus implying poor access to pecuniary economies advantages which characterized co-operative membership. Collateral requirement, high cost of credit and bureaucratic bottleneck created paucity of credit services among most of the farmers (88.6%). The paucity of credit to augment fish farm capital base can dissuade producers from expansion of capital base. The results showed that 32.4% of the farmers used family labour on their farms given that it's free while 30.5% complements the family labour with hired labour. 28.6% used hired labour probably due to lack of large household or household composed of weak people and those who do not wish to compromise their children school hours with family labour requirement on their farms. The significance of all the Chi^2 for the socioeconomic profile distribution at less than 10% degree of freedom indicates that the distributional proportions for the socioeconomic characteristics are real and not by chance.

Table 2
Socio-economic characteristics of fish farmers in the studied area

Variables	Frequency	Percentage	Variables	Frequency	Percentage
Age			Secondary	22	21.0
20-29	36	34.3	Tertiary	61	58.1
30-39	35	33.3	Total	105	100 $[104.47^{***}]$
40-49	23	21.9	Land acquisition		
50-59	8	7.6	Inheritance	36	34.3
60	3	2.9	Community	5	4.8
Total	$105(35.86 \pm 10.1)$	100 $[73.229^{***}]$	Purchase	56	53.3
Household size			Rent	8	7.6
1-3	7	6.7	Total	105	100 $[67.229^{***}]$
4-6	49	46.7	Fish species		
7-9	26	24.7	Catfish	67	63.8
≥ 10	23	21.9	Tilapia	13	12.4
Total	$105(6 \pm 2.71)$	100 $[54.657^{***}]$	Both	25	23.8
Experience			Total	105	100 $[45.943^{***}]$
≤ 3	47	44.8	Extension contact		
4-6	33	31.4	Yes	14	13.3
7-9	11	10.5	No	91	86.7
≥ 10	14	13.3	Total	105	100 $[56.467^{***}]$
Total	105 (5.45 ± 6.45)	100 $[81.829^{***}]$	Social participation		
Gender			Yes	24	22.9
Male	66	62.9	No	81	77.1
Female	39	37.1	Total	105	100 $[30.943^{***}]$
Total	105	100 $[6.943^{***}]$	Credit access		
Marital status			Yes	12	11.4
Married	74	70.5	No	93	88.6
Single	31	29.5	Total	105	100 $[62.486^{***}]$
Total	105	100 $[131.76^{***}]$	Non-farm activity		
Education			Yes	37	35.2
Illiterate	5	4.8	No	68	64.8
Quranic	5	4.8	Total	105	100 $[9.152^{***}]$
Primary	12	11.4			
Cycle per annum	Labour used				
1	6	5.7	Family labour	34	32.4
2	87	82.9	Hired labour	30	28.6
3	12	11.4	Communal labour	9	8.6
Total	105 (2.06 ± 0.41)	100 $[116.40^{***}]$	Family & hired labour	32	30.5
	Purpose of cultivation		Total	105	100 $[15.419^{***}]$
Household consumpt.	21	20.0		Fish practice	
Income	34	32.4	Sole	67	63.8
Both	50	47.6	Mixed	38	36.2
Total	105	100 $[12.057^{***}]$	Total	105	100 $[8.010^{***}]$

*Source: Field survey, 2018 Note: *** NS; are 1% risk level and Non-significant; while values in ( ); [ ] are mean and standard error; and, Chi² respectively*

3.2. Determinants of Household-Led and Marketed Surplus-Led Fish Productions

The Wald Chi^2 test statistic being within the acceptable margin of 10% probability level implies that the bivariate model is best fit for the specified equation (Table 3). In addition, it shows that the estimated coefficients in the model are different from zero, thus reliable for future prediction with certainty, efficiency and accuracy. The significance of the LR Chi^2 test statistic at 1% probability level indicates dependency of household-led and marketed surplus-led production-dependent variables included in the model.

A cursory review of the results showed that household-led and marketed surplus-led fish productions were influenced by unit price of fish output and total fish output; and, age, gender, marital status, non-farm income, co-operative membership, access to credit, fishing cycle per annum, annual income and total fish output, respectively, as indicated by their respective estimated coefficients that were within the acceptable margin of 10% significance level.

The positive sign and significance of the age coefficient revealed market-orientation among the middle-aged fish farmers, thus opted for marketed surplus-led fish production. In addition, the quest for materialism and the need to achieve a descent means of better livelihood gingered the middle-aged farmers to cultivate fish for the purpose of income generation. This finding is reaffirmed by the positive non-significant of the age coefficient with respect to household-led fish production which implied poor involvement of youthful farmers in the choice of household-led production purpose. Thus, the odd ratio in favor of marketed surplus-led fish production for a unit increase in age will be 6.85%.

The positive and significance of the gender coefficient implied that access and control to productive resources encouraged male fish farmers to opt for marketed surplus-led production against their female counterpart. The possible explanation is that gender inequality and stereotypes due to cultural and religious barriers hinders women from access and control to productive resources which are precursor to the establishment of market-oriented fish enterprise which is capital intensive, thus affected women active involvement in marketed surplus-led fish production. However, in the case of household-led fish production, though non-significant, the negative sign associated with the gender coefficient showed that women actively engaged in household-led fish production in order to improvise their household with food and nutritional security. This did not come as a surprise as women are likely to spend their earn cash, even if relatively less, on family food in order to keep the body and soul together as compared to the male farmers whose incomes does not improve the quality of food accessible to their families as they either re-invest their earn cash on business capital expansion or capital consumption items. Therefore, the probability of men farmers engaging in marketed surplus-led fish production will be 76.25% more than that of the female farmers.

The negative significance of the marital status coefficient showed that unmarried fish farmers are less involved in marketed surplus-led fish production because of capital constrain and little or no family responsibility to carter for. The high involvement of married farmers in marketed surplus-led fish production may be attributed to twin capital benefits *viz.* social and economic capitals which characterized marriage in the studied area and the need to have a sustainable income stream for family up-keeping. Thus, the likelihood of unmarried farmers withdrawing from marketed surplus-led fish production will be more than 200% as compared to the married farmers whose likelihood of opting for marketed surplus-led production will be more than 200%. Besides, the positive and non-significant of the marital status coefficient in respect of household-led fish production implied low involvement of married farmers in household-led fish production. The possible explanation for poor involvement may be due to the need to have a sustainable business that will fend for their household needs.

The negative significant of non-farm income implied that access to multiple income streams from non-farm activities discouraged marketed surplus-led fish production. Market-oriented fish farming is capital intensive and highly risky, thus an investment in fish enterprise for the purpose of income generation alongside other viable less risky-high income turnover non-farm business may not be worthwhile as the fish business posed as a risk to the invested capital of the non-farm income activities. A drain on non-farm investments due to capital shift to marketed surplus-led fish business has attendant consequence on income diversification, thus dissuade farmers with non-farm income to opt for marketed surplus-led fish production. Farmers with non-farm income, though few, preferred household-led fish production as evidenced by the positive non-significant of the non-farm income coefficient in respect of household-led fish production. Thus, the probability of a farmer with access to non-farm income withdrawing from marketed surplus-led production will be 58.32%.

Pecuniary advantages associated with co-operative membership *viz.* marketing bargaining power, bulk discount for input purchase, technical assistance and credit provisions in kind or cash encouraged marketed surplus-led fish production among farmers that participate in social organization as indicated by the positive significant of the co-operative membership estimated coefficient. The associated pecuniary advantages provide members with capital wherewithal to engage in market-oriented fish cultivation which is capital intensive and require high technical know-how. Thus, the likelihood of cultivating fish for the sole purpose of income generation among farmers who belong to social organization will be more than 200%.

The negative significant of access to credit coefficient revealed that farmers with no access to credit are less likely to opt for marketed surplus-led fish production due to its intensive capital requirement. A fish business required high capital commitment and credit been a catalyst makes it a pre-requisite for the establishment of a fish enterprise given that most of the fish farmers in the study area lack economic capital for the establishment of self-equity fish enterprise. Therefore, the probability of fish farmers with no access to credit withdrawing from marketed surplus-led fish production will be more than 250%.

The positive significance of fishing cycle and fish output coefficients showed that fish farmers with high productivity that yield more than a harvest per annum opted for marketed surplus-led fish production. The viability of marketed surplus-led fish enterprise incentivized the farmers towards market dimension in the production of fish. Thus, an increase in the fishing cycle and output will increase the chances of marketed surplus-led fish production among the farmers by 103 and 64.28% respectively.

High income earning affected marketed surplus-led fish production, as fish farmers with enlarged income divested towards higher remunerative market-led business as indicated by the negative significance of the income estimated coefficient. Due to the high risk associated with fish business, fish entrepreneurs divested their investments towards less risky market-led businesses with high income turnover so as to sustain the going concern of their limited capital. Therefore, the probability of fish farmers shifting from marketed surplus-led fish production to other businesses with higher income turnover in case of a unit increase in annual income will be 25.63%.

Table 3
Bivariate probit model for household and marketed surplus-led productions

Variable	Household-led production		Marketed surplus-led production	
	Coefficient	t-stat	Coefficient	t-stat
Intercept	19.943(5.2551)	3.795***	−1.6481(5.1771)	0.318^{NS}
Age	0.0115(0.0152)	0.759^{NS}	0.0684(0.0188)	3.626***
Gender	−0.3167(0.4251)	0.745^{NS}	0.7624(0.3987)	1.912*
Marital status	0.0413(0.3654)	0.113^{NS}	−2.0024(0.5595)	3.579***
Education	−0.0212(0.0411)	0.516^{NS}	0.0651(0.0482)	1.350^{NS}
Household size	0.0174(0.0657)	0.265^{NS}	−0.0780(0.0865)	0.900^{NS}
Experience	0.0298(0.0238)	1.251^{NS}	0.0608(0.0605)	1.006^{NS}
Farm acquisition	0.2266(0.3186)	0.711^{NS}	−0.0144(0.3994)	0.036^{NS}
Farm practice	−0.3854(0.3240)	1.189^{NS}	0.3132(0.4078)	0.768^{NS}
Non-farm income	0.5409(0.3741)	1.446^{NS}	−0.5832(0.3198)	1.824*
Extension visit	0.2698(0.4953)	0.544^{NS}	0.1694(0.4318)	0.392^{NS}
Co-op. membership	−0.2739(0.4875)	0.562^{NS}	2.1814(0.6978)	3.126***
Credit access	−0.8103(0.7162)	1.131^{NS}	−2.5514(0.8769)	2.909***
Fishing cycle	−0.5048(0.4785)	1.055^{NS}	1.0323(0.4928)	2.094**
Annual income	−0.2357(0.1465)	1.608^{NS}	−0.5103(0.2156)	2.366**
Unit price of output	−1.8582(0.5501)	3.378***	−0.2562(0.4911)	0.521^{NS}
Fish output	−0.6022(0.1528)	3.940***	0.6427(0.2016)	3.187***
Wald Chi^2	69.05[0.0002]***			
LR Chi^2	26.20[0.000]***			

Source: Field survey, 2018
*Note: *** ** * & ^{NS} imply significant at 1%, 5%, 10% & non-significant, respectively.*
Figures in ( ) and [ ] are standard error and probability level, respectively

3.3. *Determinants of Marketable Surplus-Led Production*

Given the dependency of the household and marketed surplus-led productions as evidenced by the significance of the test of independence Chi^2 statistics at 1% probability level, thus the effect of idiosyncratic variables on marketable surplus-led production was determined using multinomial logit regression model. The significance of the LR Chi^2 test statistic at 1% probability level showed that the chosen model is best fit for the specified equation (Table 4). In addition, the explanatory variables included in the model are different from zero at 10% degree of freedom, thus reliable for future prediction. The case of collinear relationship between the predictor variables was not observed as indicated by the predictor variables variance inflation factors which were within the plausible margin of 10.0.

The empirical evidence showed that marketable surplus-led production among the fish farmers was determined by age, annual income, output unit price and fish output as evident by the significance of their respective estimated coefficients which were different from zero at 10% degree of freedom.

The positive significant of the annual income coefficient implied that fish farmers with enlarged income engaged in marketable surplus-led fish production. The possible reason is to improvised their household with nutritional quality by retain a reasonable proportion while the remaining is disposed-off or marketed to the urban population. Therefore, the probability of marketable surplus-led fish production among fish farmers with high annual income will be 91.73% if there is a unit increase in their annual income. The negative significant of age coefficient implied that declined labour productivity and little or no entrepreneurship focus affected marketable surplus-led fish production among the aged farmers in the studied area. Thus, a unit increase in aged farmers' age will lead to a decrease in their chances to take-up marketable surplus-led fish production by 6.1% in the studied area. The positive significant of the unit price of fish output revealed that remunerative prices and the need to have access to balance nutrition in order not to make fish food beyond the reach of the farm family due to attendant skyrocketed market prices of fish encouraged marketable surplus-led fish production in the studied area. Thus, a unit increase in the unit price of fish output will increase the probability of marketable surplus-led production by 367.3%. High output which owed to high productivity and efficient management of risks encouraged marketable surplus-led fish production in the studied area as evidenced by the positive significant of the output estimated coefficient. The possible explanation is that there is a readily demand which contained glut given that the supply carter for both farm and non-farm families consumptions, thus encouraged marketable surplus-led fish production. Therefore, a unit increase in the output of fish will increase the probability of marketable surplus-led fish production by 108.4% in the studied area.

Table 4
Multinomial regression for marketed surplus and marketable surplus-led productions

Variable	M		M*		VIF
	Coefficient	t-stat	Coefficient	t-stat	
Intercept	−27.211(13.833)	1.967**	−44.274(9.8630)	4.489***	
Age	0.0775(0.0374)	2.071**	−0.0606(0.0361)	1.678*	1.704
Gender	1.2441(1.1753)	1.059^{NS}	0.0622(1.0229)	0.060^{NS}	1.531
Marital status	−2.6084(0.9021)	2.892***	1.4042(0.8686)	1.617^{NS}	1.339
Education	0.1371(0.1193)	1.149^{NS}	0.0593(0.0988)	0.600^{NS}	1.357
Household size	−0.2110(0.2020)	1.045^{NS}	−0.0910(0.1367)	0.665^{NS}	1.453
Experience	0.0102(0.0679)	0.149^{NS}	−0.0992(0.0793)	1.251^{NS}	1.318
Farm acquisition	0.2872(0.7919)	0.362^{NS}	0.0061(0.8009)	0.007^{NS}	1.209
Farm practice	0.3490(0.8301)	0.420^{NS}	−0.1334(0.6755)	0.197^{NS}	1.192
Non-farm income	−1.4496(0.8987)	1.613^{NS}	−0.9667(0.7038)	1.374^{NS}	1.368
Extension visit	−0.2559(0.9100)	0.281^{NS}	−0.5194(1.1717)	0.443^{NS}	1.331
Co-op. membership	3.2124(1.4507)	2.214**	−0.4554(1.4193)	0.320^{NS}	1.673
Credit access	−1.9860(1.7844)	1.113^{NS}	2.2490(1.4364)	1.566^{NS}	1.731
Fishing cycle	1.9696(1.5391)	1.280^{NS}	1.1944(1.2804)	0.932^{NS}	1.165
Annual income	−0.2101(0.3544)	0.592^{NS}	0.9173(0.3201)	2.866***	1.402
Unit price of output	2.1166(1.0586)	1.999**	3.6729(0.8957)	4.100***	1.262
Fish output	1.3173(0.5817)	2.264**	1.0836(0.3620)	2.993***	1.317
LR Chi^2	79.23 [0.000]***				

Source: Field survey, 2018

Note: *** ** * $^{NS,\ M\ \&\ M*}$ imply significant at 1%, 5%, 10%, non-significant, marketed surplus-led production and marketable surplus-led production, respectively.

Figures in ( ) and [ ] are standard error and probability level, respectively. Household-led production is the base outcome

4. Conclusion and Recommendations

Based on the findings, it can be inferred that marketed surplus-led fish production was affected by higher turnover non-farm incomes and capital paucity *viz*. poor access to credit. However, it was observed that marketable surplus-led fish production was enhanced by enlarged income, readily available demand that matches the supply and entrepreneurship zeal among the youthful population in the studied area. Therefore, the study recommends the need to strengthen the value chain of fish marketing so as to contain any challenge *viz.* market imperfection which in the long-run will jeopardize market-orientation of fish farming which is nascent among most of the farmers in the studied area. In addition, there is need to address gender inequality *viz*. budget gender mainstreaming so as to achieve development as gender stereotype due to culture and religion has made women folk a willing tool in the hand of poverty.

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