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FACTOR ANALYSIS OF GENDER PARTICIPATION IN FISH PRODUCTION IN IDO LOCAL GOVERNMENT AREA OYO STATE, NIGERIA

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ABSTRACT

The study examined factors influencing gender participation in fish production in Ido local government area of Oyo State, Nigeria. Multi stage sampling technique was used to select 136 fish farmers through a well-structured questionnaire. Data was analyzed using descriptive statistics, Principal Component Analysis (PCA), three-points Likert scale and Tobit regression model. Result showed that more than 70% of the fish farmers were male literate person with an average age of 42 years. Majority of the male (80.21%) and female (77.5%) fish farmers were married while more than 60% had no access to credit facility and fishing licences. Male fish farmers always participated in the selection of fish (96.92%), pond construction (99.26%) and purchasing of inputs (98.53%) activities while the female rarely participate in all. Notwithstanding, 67.80% of the female fish farmers always participated in feed formulation activities while 97.79% of them sometimes participated in fish feeding. Factors such as making fish farming as the primary occupation, higher fish income and access to equipment were significant and positively influenced participation in fish farming production among the male fish farmers while the variable factors such as cultural beliefs and social responsibilities had negative contribution toward the participation of the female gender in fish production. Educational level (β= 0.020, $p<0.05$), access to credit (β= 3.874, $p<0.01$) and fishing licences (β= 0.270, $p<0.05$) positively influenced both fish farmer's gender participation in fish production. It is necessary for policy makers to establish a local fish forum or group so as to offer educational training regarding those cultural norms that prevent women's full participation in fish production. Encouraging and supporting income diversification among fish farmers could strengthen fish farmers to reinvest secondary income into fish production.

Keywords: Factor analysis, Gender participation, Fish farming, Participation level, Male fish farmers.

1. INTRODUCTION

Aquaculture, the essential component of agriculture, involves the cultivation of aquatic plants and animals such as catfish, tilapia, ornamental fish and plant for food and other uses (Carl *et al.*, 2024; Nwabeze, 2010; Njoku, 2000)[7,18,17]. It involves the rearing of fish for the purpose of consumption (food security) or for sale (profit) and economic growth (Chin *et al.*, 2019; Umunna *et al.*, 2020)[8,29]. It contributes between 0.5% and 1% to Nigeria's domestic fish production

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(Awoyemi and Ajiboye, 2011)[6]. Fish is a vital source of good quality protein needed in human diets. It has the highest level of easily metabolisable protein, fats, vitamin, calcium, iron and essential amino acids when compared to other sources of animal protein such as poultry and beef (Ayoola, 2010)[5]. Fish farming provides important services including supporting nutritional wellbeing, providing feed stocks for the industrial sector, increasing export opportunities, making contributions to rural development among others (Oke *et al.,* 2021; Dagtekin *et al.,* 2007)[20,9].

Gender concerns in the fishery sector involve the roles and responsibilities assigned to both the male and the female fish farmers as well as their level of participation in fish production activities (Akinpelu *et al.,* 2013)[4]. These roles include the selection and supplying of fingerlings, pond construction, liming, processing and marketing (Agbontale *et al.,* 2020)[2]. Friday *et al.,* (2022)[12] revealed that men participated mostly in activities such as selection and supplying of - fingerlings, pond construction and liming etc. Women participate mostly in fish feeding, processors, and marketing activities. Friday *et al.,* (2022)[12] and Sunderarajan (2001)[24] reported that women were found to be actively involved in fish farming and they have significantly contributed to the growth of the fisheries sector. Fish production may serve as a reliable source of income diversification, reducing reliance on crop farming. Increased income from fish farming can enhance the financial independence of the households, improve household welfare, and contribute to poverty alleviation in rural communities (Oke *et al.,* 2021)[20]. However, Subasinghe *et a*l., (2021)[23] claim that most women farmers produce on a small-scale.

Most studies conducted on gender participation in fish farming in Oyo state and Nigeria usually focus on analysis of gender roles and the gender participation level without considering the factors responsible or influencing their participation**.** However, there seems to be dearth of research in relation to factors influencing their participation. Despite the fact that both the male and the female fish farmers do participate actively in fish farming activities, the former are always do better recognized, while the later are not (Umunna *et al.*,2020)[29]. Also, Adeoye *et al.,* (2020)[1] and Ajala *et al.,* (2017)[3]reported that male fish farmer participated more than their female counterparts in fish farming system. However, factors responsible or influencing this are yet to be examined. Analyzing factors influencing gender participation helps to identify factors militating against equal participation in fish farming between the male and the female fish farmers in Oyo state and Nigeria (Kachina and Hiam, 2025)[13]. Gender analysis influences knowledge, perceptions and needs of farmers as well as their access to agricultural technologies. This study bridged this gap and added to the existing literature by identifying factors influencing gender participation in fish farming in the study area.

Thus, this study analyzed the factors influencing gender participation in fish farming by identifying the different roles assumed by the male and the female fish farmers; and to examine the various factors influencing their participation in fish farming in Ido local government area of Oyo state, Nigeria. The findings of this study will aid Policy makers and the Non-Governmental Organizations (NGOs) in effective formulation of gender participation strategies that will focus on the provision of incentives to increase women participation in ways that will translate to improvement on their standard of living and productivity.

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2. METHODOLOGY

Study area

The study was carried out in Ido local government area, Oyo state. Located in the tropics, it has a land area of 986 km² lying between longitude 3°47′34.99″E and latitude 7°30′44.49″N with an estimated population of 103,261 in 2006 (National Population Commission, 2006). It shares boundaries with Akinyele local government in the east, Ibarapa east local government in the west, Ibadan south-west in the north and Egbeda local government in the south. Its annual rainfall is 1,800 mm with a peak from April to June and the second peak from August to October. There is also high humidity and average daily temperature between 25°C and 35°C throughout the year. Large areas of grasslands abound which support livestock production as well as many rivers and water bodies to practice fish production.

Sampling technique and data collection

Multi-stage sampling technique was employed to select catfish farmers in the study area. Stage one involved a purposive selection of seven (7) wards known for mostly engaging in fish production while stage two involved the random selection of two (2) communities from each ward which gives the total sum of fourteen (14) communities. The third stage involved a simple random selection of ten (10) fish farmers from each community to give a total of 140 catfish farmers. The fourth (final) stage involves stratification of the fish farmers into male and female. The selection of female fish farmers was proportionate to their number in each community. This implies that the population of female fish farmers varies from one community to the other and their selection was based on their population. Finally, primary data through the administration of a structured questionnaire vis-à-vis interview guide was employed to elicit information from the fish farmer. Therefore, a total number of 136 copies of duly completed questionnaire were collected of which 96 were males and 40 were females.

Analytical techniques

The data collected were analyzed using descriptive and inferential statistics. Principal Component Analysis (PCA) model was used to construct participation index. The study used the three-points Likert scale to capture the fish farmers participation level, such as: Always participated, sometimes participated, and rarely participated in fish farming activities.

Construction of the participation index

The participation index was constructed using Principal Component Analysis (PCA) model. Principal Component Analysis (PCA) is therefore a multivariate statistical technique that was used to reduce the number of variables in the data set into a smaller number of ‘dimensions’ without losing too much information in the process. PCA technique achieves this by creating a fewer number of variables which explain most of the variations in the original variables (Filmer and Pritchett, 2001). PCA can determine the weight as a factor score for each fishing participating activity. It seeks a linear combination of variables such that the maximum variance is extracted from the variables. It then removes this variance and seeks a second linear combination which explains the maximum proportion of the remaining variance. The first principal component is the linear index of variables with the largest amount of information common to all of the variables. The participation index derived from PCA for the fish farmers can be written as follows:

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$Aj = \sum_{i=1}^{n} f_i(aji - ai)/Si$ ....(ii)

Where:

A_j is a participation index for the fish farmer (j =1,…….,n)

f_i is the scoring factor for the fish farmer (i =1,……,n)

a_{ji} is the i th participating activity of j th the fish farmer (i ,j =1,……,n)

a_i is the mean of i th the fish farmer (i =1,……,n)

s_i is the standard deviation of i th the fish farmer (i =1,……,n)

Derived from PCA, are scoring factors of the first principal component (the efficient component). This was used for constructing the participation index of fish farmer.

Tobit regression model

The Tobit model is a statistical model proposed by James Tobin in 1958, used in order to explain the relationship between a non-negative dependent variable and an independent one assuming that there is a latent variable which linearly depends on the independent one through a parameter (beta) that determines the relationship between the independent and latent variables. According to Verbeek (2004), Tobit regression is usually the best model when the dependent variable is continuous and has a constrained rage, representing a positive variable. The Tobit model is a censored regression model where observations of the dependent variable (Y*) at, or below zero are censored. Therefore, Tobit model was used to examine the factors influencing the gender participation in fish production. This model was employed because; it has an advantage over other models (such as linear probability models, logit, and probit) in that, it is useable when the dependent variable is continuous, not binary and positive. It also reveals the probability of the extent of gender participation on the variables included. This statistical model has previously been used in studies such as Odah *et al* (2017)[19], Muhammad and Abdul Karim (2021)[16] etc.

Tobit model can be written as:

$$y_i^* = \beta^t x_i + e_i \qquad i = 1,2,\dots,n$$

$$y_i = y_i^* = \begin{cases} y_i = y_i^* \; if \; y_i^* > 0 \\ y_i = 0 \; if \; y_i^* \leq 0 \end{cases}$$

$y_i* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon$

Yi * = the latent variable which is not observable.

Where;

Yi = Participation index, ßo = constant, β_1 - β_{16} = Coefficient to be estimated and Ɛ = error term

X_1- X_{16} = Vector of independent variables

X_1 = Age of the fish farmer, X_2 = Household size, X_3 = Level of education, X_4 = Fishing Experience, X_5 = Access to credit (1=Yes 0= No), X_6 = Access to fishing licenses (1= Yes, 0= No), X_7 = Marital status (1= Married, 0= not married), X_8 = Primary Occupation, X_9 = Income, X_{10} = Pond size, X_{11} = Secondary occupation, X_{12} = Social responsibilities, X_{13} =Access to market fish supply, X_{14} = Access to equipment, X_{15} = Cultural beliefs, X_{16} = Cooperative association.

3. RESULTS AND DISCUSSION

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The results in Table 1 revealed that majority (70.59%) of the fish farmers were males. The result is similar to the findings of Adeoye *et al.*, (2020)[1] that fish farming production were dominated by the male gender. Majority of the fish farmers were young, energetic and in their productive ages with the average age of 42 years across the data. This was similar to the findings of Siyanbola *et al.*, (2020)[26]. Their study revealed that fish farmers were still young, agile and could easily adapt to new techniques that could enhance their productivity. Result in Table 1 also revealed that 80.21% and 77.5% of the male and female fish farmers respectively were married while more than 60% of the fish farmers had no access to credit facilities and fish licences. The average fish farming years of fishing experience was 13 years which implies that majority of the fish farmers have been in fisheries operations for a long time. Friday *et al.*, (2022)[12] reported that the higher the years of fishing experience, the higher the level of productivity and efficiency.

Table 1: Distribution of the socio-economic characteristics of the respondents

	Male (96)		Female (40)		Pooled data (136)	
Variables	**Frequency**	**Percentages**	**Frequency**	**Percentages**	**Frequency**	**Percentages**
Age						
≤30	22	22.92	11	27.50	33	24.26
31-50	48	50.00	22	55.00	70	51.47
51-70	23	23.96	6	15.00	29	21.32
71 and above	3	3.13	1	2.50	4	2.94
Mean	43(±14)		41(±13.6)		42 (±13.8)	
Educational level						
No formal	10	10.42	9	22.50	15	11.03
Primary	20	20.83	4	10.00	20	14.71
Secondary	52	54.16	19	47.50	85	62.50
Adult	8	8.33	2	5.00	10	7.35
Tertiary	5	5.21	6	15.00	6	4.41
Marital status						
Single	17	17.71	7	17.50	24	17.65
Married	77	80.21	31	77.50	108	79.41
Widowed	2	2.08	2	5.00	4	2.95
Access to fish licenses						
Yes	32	33.33	16	40.00	48	35.29
No	64	66.66	24	60. 00	88	64.70
Access to credit						

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Yes	27	28.18	13	32.50	40	29.41
No	69	71.82	27	67.50	96	70.59
Fishing Experience						
<15	69	71.88	27	67.50	96	70.59
16-30	23	23.96	11	27.50	34	25.00
31 and above	4	4.17	2	5.00	6	4.41
Mean	13(±11.33)		11(±9.87)		13(±11.65)	

Source: Field survey, 2024

Level of gender participation in fish farming production

Result in Table 2 showed the four fish farming production activities groups. These include pre-production, production, processing and marketing fishing activities. Male fish farmers always participated in the selection of fish (96.92%), pond construction (99.26%) and purchasing of inputs (98.53%) activities while the female rarely participate in all. Notwithstanding, 67.80% of the female fish farmers always participated in feed formulation activities while 97.79% of them sometimes participated in fish feeding. In the same vein, more than 90% of the female fish farmers always participated in the marketing activities in which male fish farmers rarely participated. In summary, the finding revealed that male fish farmers had highest participation level in most of the activities under both pre-production and production fishing activities than the female. However, female fish farmers had the highest participation level in processing and marketing activities except in the weighing of fish in which the females rarely participated. The result is similar to the studies of Omitoyin *et al.*, (2021)[22] and Agbontale *et al.*, (2020)[2] that the males fish farmers mostly get involved in the technical aspects of post-harvest practices while the females are mostly involved in frying, smoking, and marketing of fish.

Table 2: Level of gender participation in different activities of fish farming production

Activities	**Gender Participation level**					
	Male (%)			**Female (%)**		
	Always	**Sometimes**	**Rarely**	**Always**	**Sometimes**	**Rarely**
Pre-production activities						
Selection of fish	96.32	3.68	-	1.47	1.47	97.06
Pond Construction	99.26	0.74	-	1.47	1.47	97.06
Purchasing inputs	98.53	1.47	-	2.21	0.74	97.06
Capital sourcing	100	-	-	1.47	1.47	97.06
Feed Formulation	2.21	74.0	23.79	67.80	1.47	30.73
Production activities						
Feeding of fish	97.79	1.47	0.74	2.21	97.79	-
Stocking of fish	98.53	1.47	-	0.74	13.97	85.29
Treating of fish	97.79	1.47	0.74	1.47	10.29	88.24
weeding of pond	98.53	1.47	-	1.47	0.74	97.79

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Harvesting of fish	98.53	1.47	-	1.47	0.74	97.79
Processing of fish						
Weighing of fish	97.79	2.21	-	1.48	12.59	85.93
Smoking of fish	30.53	21.47	48.00	71.48	0.74	27.78
Salting of fish	44.85	25.15	30.00	91.48	0.74	7.78
Drying of fish	26.67	3.85	69.48	97.48	0.74	1.78
Storage of fish	68.53	1.47	30.00	81.48	9.74	8.78
Marketing of fish						
Wholesaling	20.47	10.58	68.95	95.59	4.41	-
Retailing	2.21	5.15	92.65	95.59	4.41	-
Exporting	26.67	3.85	69.48	95.59	4.41	-

***Source*:** field survey, 2024 always participated, sometimes participated and rarely participated

Factors influencing gender participation in fish production

Factor analysis of gender participation in fish farming was examined, as presented in Table 3 using a tobit regression model analysis. With a LR chi^2(11) value of 57.07 and R-squared of 0.4891 that indicates that the overall equation is statistically significant at 1 percent ($p<0.000$). Factor analysis of the gender participation in fish production showed that primary occupation ($\beta= 0.549$, $p<0.05$) positively influenced participation of male fish farmers in fish production. This implies that engaging in fish production as the primary occupation increases the level of participation of the male fish farmers by 5.49%. Having fish farming as the primary livelihood likely increases the time, labour, and resources dedicated to production, leading to higher participation levels, higher profitability, gaining expertise and an expansion on the activities. Level of income ($\beta= 0.591$, $p<0.10$) for male and ($\beta= 1.261$, $p<0.000$) female gender also positively increased the gender participation in fish farming production. Increased income provides the financial capacity to purchase quality inputs, adopts improved technologies, hires more labour, undergoes training and expands production. The result suggested that an increase in income in fish farming production guarantee sustainability which is one of the major components of business enterprises. The result is similar to the study of Onyeneke *et al.,* (2020)[21] that fish farming significantly contributes to income of the both men and women in the South-East zone of Nigeria

The results in Table 3 still revealed that having access to fishing licences **(**$\beta=0.270$; $P=0.000$) influences positively the gender participation level in fish farming in the study area. The result implies that possession of fishing linceces increases male and female participation in fish farming. The result concurs with the position of some scholars including Frangoudes and Gerard (2019)[11] who argued that access to licenses has positive significant contribution towards women inclusion. Access to market fish supply was also a significant factor influencing the farmer's participation in fish production **(**$\beta=0.184$; $P=0.000$). The result implies that many women participated in fish production because of the easy access to market. This finding also concurred with the study of Lynch *et al*. (2016)[15] which established that women played a significant role in fisheries value additions with the advantage of market facilities.

However, result in Table 3 revealed that there was a negative relationship between cultural beliefs (customs and norms) **(**$\beta= -0.386$; $P=0.000$), social responsibilities **(**$\beta= -1.741$; $P=0.05$). and women participation in fish farming. The result implies that customs and norms discriminate against the female engaging in fishing activities. The result suggested that the female gender that

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is fully participated in community social functions, participates less in fish farming. The result is similar to the study of Kleiber *et al.* (2017)[14] who found the norms and customs of a society, as having negative contributions towards women inclusion in fish value chain. It also similar to the report of Siwila (2024) who recognized social, cultural, economic and political factors as determinants of female's active participation in a business opportunity.

Furthermore, the result in Table 3 also indicated that access to credit **(**β= 3.874; P=0.000) was significant and positively influenced both the male and the female fish farmers participating in fish farming. Access to credit enables farmer to procure essential inputs such as quality fingerlings, feed, and equipment, as well as to adopt improved production technologies and practices. The result suggested that financial capital is a critical determinant of women's involvement in fish farming production. This finding aligns with the study of Solomon (2023)[27] which emphasizes that financial inclusion enhances female's capacity to participate meaningfully in fish value chains. Shelly and Costa (2001)[25] also argued that access to credit has positive significant contributions towards women inclusion. Access to credit is an incentive factor that influences / motivates individual farmers to the fish farming. However, the coefficient of female fish farmer's access to credit (β=5.542) was higher than that of the male (β=0.414) indicating that female fish farmers require more access and opportunities to credit facilities as incentive to participate in fish farming enterprise than men. Several studies reported that women have limited access to credit facilities due to their lack of collateral (UNDP, 1996) insufficient access to land and low productivity (Adeoye *et al.*, 2020)[1].

Table 3: Factors influencing gender participation in fish production

Variables	Male fish farmers			Female fish farmers			Pooled data		
	Coefficient	**Stand. Error**	**P>|t|**	**Coefficient**	**Stand. Error**	**P>|t|**	**Coefficient**	**Stand. Error**	**P>|t|**
Age	0.004	0.017	0.795	-0.009	-0.015	0.528	-0.013	0.014	0.345
Marital status	-0.024	0.405	0.953	-0.426	0.305	0.178	-0.348	0.308	0.262
Educational level	0.199	0.413	0.270	0.314	0.416	0.460	0.020**	0.419	0.047
Household size	0.028	0.064	0.683	0.659	0.058	0.954	0.059	0.053	0.270
Primary Occupation	0.549**	0.237	0.024	-0.224	0.277	0.429	0.370*	0.210	0.082
Fishing Experience	0.002	0.018	0.932	2.603***	1.296	0.001	0.005	0.015	0.720
Access to fish licenses	0.205 ***	0.012	0.000	0.479**	0.337	0.024	0.270***	0.423	0.005
Income	0.591*	0.292	0.064	1.261***	0.231	0.000	-0.015	0.188	0.935
Pond size	0.000	0.000	0.912	-0.001	0.003	0.546	6.92e-06	0.000	0.955
Access to market fish supply	0.012	0.038	0.932	1.184***	0.017	0.000	0.362*	0.218	0.093
Access to	0.414*	0.994	0.079	5.542*	2.048	0.053	3.874***	0.585	0.000

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credit									
Social responsibilities	-0.163	0.636	0.799	-1.741**	0..627	0.011	-3.950***	0. 551	0.000
Cooperative Association	0.356	0.976	0.716	2.461**	1.219	0.041	0.0945	0.100	0.945
Cultural beliefs	0.011	0.013	0.420	-0.386***	0.857	0.000	0.021	0.043	0.510
Secondary occupation	0.022	0.395	0.955	1.064***	0.249	0.000	0.477*	0.201	0.019
Access to equipment	0.362***	0.281	0.003	0.028	0.018	1.615	0.569***	0.186	0.003
Constant	-1.23	1.76	0.489	5.023***	1.453	0.002	6.595***	1.390	0.000
Number of obs	96			40			136		
LR chi2(11)	8.66			46.18			57.07		
Prob > chi^2	0.0028			0.0000			0.0000		
Pseudo R^2	0.4532			0.5877			0.4891		
Log likelihood	-149.0763			-36.470381			-206.68553		

Source: field survey, 2024

4. CONCLUSION

The study area was dominated by male fish farmers who participated mostly in fish pre-production and production activities, while the female fish farmers dominated in marketing and processing activities. Educational level, access to credit facilities and possession of fishing licences positively influenced both gender participation in fish farming. However, factors such as cultural beliefs (norms and customs) and having social responsibilities have negative influences towards the participation of female gender in fish farming production.

5. RECOMMENDATIONS

The study revealed that educational level, access to credit facilities and possession of fishing licences were significant and positively influenced gender participation in fish production. It is therefore, necessary for government and other stake holders in fish farming production to provide policy measures such as providing targeted support, access to credit facilities and other input resources, technical training and mentorship opportunities, value addition and market linkages for both the new entrants and full-time fish farmers. It is also necessary for policy makers to establish a local fish forum so as to offer education regarding those cultural norms that prevent the female gender full participation in fish farming. Encouraging and supporting income diversification (through savings groups, business development training among others) among fish farmers could strengthen their ability to sustain and expand fish farming activities. This approach could lead to higher participation rates, increased productivity, and improved economic resilience of the fish farmers.

Authors contributions

Dr. Adeoye, A

Conceptualization, Data curation, Formal analysis, Writing – original draft

Dr. Adekola, A.O

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Investigation, Methodology, Project administration

Bakare, O.S

Resources, Software, Writing – review & editing

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