Economics of Smoked Farmed Catfish in Kainji Lake Basin, Nigeria

Omeje, Julius Emeka
Division of Socio-economics and Extension Services, National Institute for Freshwater Fisheries Research, P.M. B. 6006, New Bussa, Niger State, Nigeria.
Email: juliusomeje@gmail.com
Phone: +2348129218022
https://orcid.org/0000-0002-8374-8887

Achike, Anthonia Ifeyinwa
Department of Agricultural Economics, University of Nigeria Nsukka
Email: ifyachike@gmail.com
Phone: +2348034234147
https://orcid.org/0000-0003-3854-7506

Jimmy, Samuel Preye
Department of Agricultural Economics and Rural Development, Niger Delta University, Bayelsa State
Email: blazinjimmysmiles@gmail.com
Phone: +2348060916974
https://orcid.org/0000-0002-3185-2017

Manuwuike, Queen Mercy
Division of Socio-economics and Extension Services, National Institute for Freshwater Fisheries Research, P.M. B. 6006, New Bussa, Niger State, Nigeria.
Email: queenmercy123@gmail.com
Phone: +234834493087
https://orcid.org/0000-0001-6825-9092

Abstract

The study examined economics of smoke Catfish in Kainji Lake Basin, Nigeria. Random sampling technique was used to select 80 farmed-catfish processors from 20 communities. Primary data were collected through interview schedule and presented using percentages, mean, and 2-stage least square regression analysis. Results showed that the use of local oven (banda kilns) constitute the majority (at least 67%) of the method used in fish smoking. Roles such as gutting, folding, salting/brining, setting of fire and fish

monitoring were mostly performed by the women, while the men and youths supply fire woods as well as fish arrangement on racks. The average gender ratio between the men, women and youths was 0.80, indicating a near gender equality in terms of value of fixed assets, revenue, employees and wage. Profitability indicators showed that smoke fish processing is a viable business with return on investment of 11.71 % for the men, 9.99 % for the women and 8.48 % for the youths respectively. The major determinants of net-income were age, experience and initial capital investment. Hence, it is recommended that the processing industry should be strengthened through subsidy on improved smoking kilns to enable processors produce high quality processed farmed catfish.

Keywords: Economics of smoked catfish, profitability

Introduction

Gender, which refers to the societal construed roles ascribed to men and women (Kruijssena, et al. 2017), have some underlying implications in the fishery value chain development. Studies suggest that women dominate in post-harvest activities such as processing, marketing and storage while the men dominate primary production such as aquaculture (fish farming) and feed milling (Nwabeze, et al., 2017; Girei, et al., 2019). The reason is that fish farming and feed milling is capital intensive and requires much time which women don't possess due to household demands (Githukia, et al., 2020). This greatly influences women's contribution in other activities in the value chain such as fish processing and marketing which requires lesser capital outlay.

Fish processing has been an age long practice in Nigeria. The idea of fish processing in Nigeria was adopted to reduce post-harvest losses because of the perishability nature of fish which undergoes spoilage as soon as it is harvested (Amos and Ibrahim, 2017). Fish processing could be done through smoking, drying, refrigeration, frying etc; though, smoking is the principal fish processing technique in Nigeria (Alabi, et al., 2020). Fishes that are smoked have a great sensory characteristic such as good taste, flavour and texture and are highly enjoyed in diets (Puke and Galoburda, 2020). Most processors use half drum smoking systems, open fire systems and local ovens (*banda* kilns) which are generally referred to as traditional methods (Food and Agricultural Organization [FAO], 2017) while others use the improved kilns such as; National Institute for Oceanography and Marine Research (NIOMR) and National Institute for Freshwater Fisheries Research (NIFFR) smoking kilns as well as the FAO-Thiaroye fish processing technique (FFT-Thiaroye) that is been introduced in Côted'Ivoire (FAO, 2020). These smoking facilities can be used to smoke any species of fish. However, in Kainji Lake Basin Nigeria, Catfish (*Clarias* spp) is the predominantly farmed fish which are usually smoked after attaining marketable size.

Several economic analyses show that smoked fish is profitable. Nwabeze, et al. (2019) reported that an estimated ₦476,931,941.67 million worth of smoked catfish were

marketed in Kainji Lake Basin in 2016; whereas, Oduwale (2019) reported that smoked fish is more profitable than frozen fish, implying that the business is profitable. Based on these economic analyses, one would suggest that irrespective of the dominance of men in other value chains, there tend to be some form of competition between the men, women and youths in smoked farmed catfish business. This is because Olufemi and Sesay (2019) reported that the fishery sector is quite attractive to men, women and youths because it presents them with employment opportunities as well as other nutritional requirements.

Although, fish smoking is predominantly done by women, Githukia, et al. (2020) reported that gender-based segregation which includes lack of access and control over assets and resources, as well as a lack of decision-making power limits full participation of women in aquaculture value chain activities. This necessitates the need to investigate further the economic contributions of men, women and youths in the value chain especially the processing segment of farmed Catfish. Most gender data on smoke-processed Catfish are aggregated which underscores the need to obtain and analyse sex-disaggregated data for effective policy which addresses the needs of men, women and youths in smoked fish processing in Kainji Lake Basin Nigeria. It is based on this background the economics of smoked Catfish in Kainji Lake Basin, Nigeria was studied. Specifically, the study:
1. examined the various methods used for fish smoking,
2. described gender roles in fish smoking,
3. estimated gender gaps in smoked fish processing,
4. computed the profitability of smoked fish processing, and
5. evaluated the socio-economic and institutional determinants of net-income of fish processors.

Methodology
The study was conducted in Kainji Lake Basin, Nigeria. The area is located between Niger and Kebbi States of Nigeria and is situated within latitudes 9^0 50' and $1^0 55'$ North and longitudes 4^0 23' and $4^0 51'$ East. The lake is the first and largest man-made lake in Nigeria that was created in 1968 as an impoundment of River Niger with a total area of 1270 km^2 (Omeje, et al., 2020).

The major occupation of the people of the area is crop farming whereas fishing, trading and other informal sector activities provides source of livelihood to others. Also, aquaculture is now a trending economic activity which provides a major source of fish to smoked-fish processors (Nwabeze,et al., 2019).

The study adopted a 2-stage sampling procedure. In the first stage, 20 communities were purposively selected based on the preponderance of processors of farmed catfish. The second stage involved the random selection of four (4) farmed Catfish processors each

from the 20 communities; making a total of 80 respondents selected from a population of 165 Catfish processors (Omeje, 2021). The sample frame was collected from registered members of fish processors association in the area. Primary data were collected through interview schedule using questionnaires. Data were disaggregated by sex and further divided into three major groups. The first and second groups comprise of the men and women above 35 years of age while the third group were the youths comprising of male/female between 18 to 35 years of age.   Data were presented using descriptive statistics such as percentages, Likert-type rating scale and analysed using gender ratio analysis and budgetary technique such as Net Income after Tax (NIAT), net profit margin and return on investment (ROI) as well as 2-stage least square regression technique.

Gender gap analysis

    i.   **Gender ratios**

$X_i = \left(\dfrac{ai}{bi}\right)$ 1

    ii.   **Relative gender gaps**

$Z_i = \left(\dfrac{ai}{bi} - 1\right) * 100$ 2

Where;

X_i=ratios for men-women, women-youths and men-youths;

Z_i=Relative gender gap;

a_i=values for men, women and youths; and

b_i=values for men, women and youths.

Net income after tax (NIAT)
NIAT= *Revenue-Total expenses*   3
Net profit margin

Net Profit Margin=$\dfrac{Profit\ after\ tax}{Revenue} * 100$ 4
Where: Revenue=Unit Price* Quantity supplied
Cost of Goods sold=Cost of processing fish in a month
Return on investment (ROI)

Return on Investment =$\dfrac{Net\ income\ after\ tax}{Total\ assets} * 100$

       5
2-stage ordinary least square
The structural equation is specified as thus;
The structural equation is specified as thus;

$$Y = \beta_0 + \beta_1 X_1 + b_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$
$$6$$

Where; Y=net-income (₦), X_1=Years in school (years), X_2= Experience (years), X_3=age (years),
X_4= initial capital (₦), X_5=household size (number), X_6=Commodity price (₦), X_7=Levy (₦) and ε=error term

Reduced form of the equation
$$X_1 = \pi_0 + \pi_1 Z_i + \pi_2 X2 + \pi_3 X_3 + \pi_4 X_4 + \pi_5 X_5 + \pi_6 X_6 + \pi_7 X_7$$
$$7$$

Where; Z_i =parents' income and $\pi_1 \neq 0$

Results and Discussion

Methods used in fish processing
Presented in Table 1 are the different methods used in smoking farmed catfish in Kainji Lake area. From the figures, the use of local ovens (*Banda*) was the most prevalent method used in fish smoking by the men, women and youths. This traditional method is similar to the Chorkor oven widely used in other African countries for smoking fish (FAO, 2017). This method is dominantly used because the *banda* smoking ovens are cost effective or cheap to construct and can smoke large volumes of fish. The improved Kilns (NIFFR Kilns) on the other hand, are expensive to procure but have the capacity of producing high quality smoked fish that are acceptable in the international market. The fishes that are smoked using this technique have little deposits of hydrocarbon on the flesh with minimal risks to human health compared to that of the *banda* smoking kilns. The drum smoking methods, although still practiced in some areas, is gradually fading away with the emergence of the *banda* methods. These methods used for fish smoking are not new to literature as confirmed by Alabi, et al. (2020) that traditional methods such as mud, box and drum ovens are the dominant fish smoking methods in Nigeria. Although, Alabi et al. (2020) reported low adoption of improved technologies of fish smoking in Lagos, Nigeria; however, with the growing aquaculture activities in Kainji Lake Basin, there seems to be a gradual adoption of a better, safer fish smoking method.

Smoked catfish can be a good export commodity for foreign exchange earnings; however, it is losing its ground in Nigeria because of some sets of food safety y and agricultural health standards. The quality of smoke processed fish is usually assessed based on some criteria such as: the degree of drying, hydrocarbon deposits, appearance, damages and insect infestation. Hence, with time, the use of improved kilns (NIFFR kiln) which was designed to meet these standards stands a chance to become a major smoke-fish processing method in the area.

Table 1: Methods used in smoking farmed catfish

Methods	Men	Women	Youths
Local Ovens (*banda* kilns)	71 %	73%	67%
Drum smoking	11%	10%	14%
Improved Kilns (NIFFR or NIOMR)	18%	17%	19%
Total	**100**	**100**	**100**

Source: Field survey data, 2020

Gender roles in fish processing activity

The result of the analysis on gender roles in fish processing activity is presented in Table 2. The result shows that 62.64%, 61.54%, 61.54% and 50.55% of the women perform the task of fish salting/brining, folding, washing and gutting respectively. About 50.55% of the youths and 49.45 % of women were involved in arranging the fish on racks in the smoking kiln. The setting of fire and monitoring of fish during smoking was mostly done by the women. However, the finding does confirm that the youths perform such tasks too of setting of fire (38.46%) and monitoring of fish during the smoking process (36.26 %). However, the activities of men in the fish processing chain were quite low. The active involvement of men (62.44%) in the processing chain was observed in the splitting and selling of fuel wood used for fish smoking. These findings corroborate the report of Girei, et al. (2019) that fish processing is a prominent activity of women in fisheries value chain in Nigeria. Also, it affirms the role of women in postharvest activities of fisheries value chain as reported by Nagoli and Chiwona-Karltun (2017) that women in Malawi, dominate the fish processing and marketing nodes. Although, the situation may seem unchanged, it is necessary to uphold the emergence of youths in the business. This is because the involvement of youths in fish processing activities is gaining prominence as they are virtually involved in all the processing activities in the value chain.

Table 2: Participants roles in fish processing activity

	Participants (%)		
Activity	Men	Women	Youths
Gutting	12.1	**50.6**	37.4
Folding	12.1	**61.5**	26.4
Washing	0.0	**61.5**	38.5
Salting/Brining	0.0	**62.6**	37.4
Arrangement in Racks	0.0	49.5	**50.6**
Supply of fuel wood	**62.6**	0.0	37.4
Setting of fire	12.1	**49.5**	38.5
Monitoring	0.0	**63.7**	36.3

Source: Field survey, 2020

Value of Fixed Assets, Revenue and Gender-Based Employment in Fish Processing

The result of the analysis on the value of fixed assets, revenue and gender-based employment in fish processing is presented in Table 3. The result shows that the value of fixed assets for the men, women and youth were ₦ 812735.30, ₦ 816501.30 and ₦ 636030.40 respectively. This implies that the men and women have approximately equal value of fixed assets compared to that of the youths. It also shows the huge investment in fish processing by the women over a long period of time which marginally exceeded the value of that of the men. This is because, fish processing has been an age-long practice of the women in the fisheries value chain (Kruijssena, et al., 2017). The men, on the other hand, having been involved in order nodes of the fish value chain, have accumulated capital for investment in fish processing, thus, diversifying their means of generating income. This was affirmed by Chiwaula, et al. (2018) that male fish processors have a higher levels of willingness to pay to upgrade than female fish processors. Their argument was based on the capital strength of men compared to the women. This justifies the willingness to commit financially to economic diversification by men. The youths, however, have contributed immensely as labour which resulted into skill acquisition in the processing activities along the chain; hence, prompting their investment in the aquaculture fish processing chain as entrepreneurs.

Also, the result shows that the men realize about ₦ 4872443.93 revenue per month, the women realize about ₦ 4861657.54 revenue per month and the youths realize about ₦ 4086989.72 revenue per month from fish processing in the area. This implies that revenue realized by the youths is less than the revenue realized by the men and women; probably because the youths have a lower investment outlay as well as limited processing and marketing strategies in running the business compared to the men and women.

Finally, the result on gender-based employment (employees) in the processing chain shows that an average number of 1 man, 2 women and 2 youths were employed by the men, women and youths respectively in the processing chain. This implies that fewer numbers of labour are required to successfully operate a fish processing business in the area when compared to other segment of the value chain such as fish farming. However, it is important to note that the labour requirement is dependent on the investment capacity of a fish processor to process large volume of harvested/available fish.

Table 3: Information on value of fixed assets, revenue and employment in fish processing chain

Items	Men MN	Men MUP (₦)	Men TP (₦)	Women MN	Women MUP (₦)	Women TP (₦)	Youths MN	Youths MUP (₦)	Youths TP (₦)
Fixed Assets									
Land	1.00	698823.53	698823.53	1.00	718000.00	718000.00	1.00	548000.00	548000.00
Smoking Kilns	6.88	13823.53	95105.89	5.85	13575.00	79413.75	5.44	12360.00	67238.40
Bowls	7.41	1845.68	13676.47	8.00	1657.81	13262.50	6.82	2187.68	14920.00
Knife	8.23	623.26	5129.41	8.75	665.71	5825.00	7.73	759.64	5872.00
Total		**715116.00**	**812735.30**		**733898.52**	**816501.30**		**563307.32**	**636030.40**
Revenue									
a) Working days/M	7.28			8.86			8.92		
b) Kg/Kiln	128.2			127.4			112.6		
c)Qty/M (Kg)	6421.08			6603.27			5463.89		
d) Price/Kg		758.82			736.25			748.00	
TR/M=d*c			**4872443.93**			**4861657.54**			**4086989.72**
Employment		**Wage/M**	**TW/M**		**Wage/M**	**TW/M**		**Wage/M**	**TW/M**
Men	1.20	16866.67	20240.00	1.11	17172.40	18889.64	1.13	14388.88	18705.54
Women	2.33	13866.66	32309.31	2.22	12862.07	28533.79	2.12	14722.22	31211.11
Youths	2.58	11750.00	30315.00	2.17	11647.05	25274.09	2.15	13076.92	28115.37

Source: Computation from field survey, 2020

Note: MN=Mean Number, MUP=Mean Unit Price, TP=Total Price, TR/M=Total Revenue/Month, TW/M=Total Wage/Month

Where: TP=MUP*MN

TW/M=Wage/M*MN

Qty/M=b*NM of Smoking kilns*a

Gap Ratios in Fish Processing

The gender gap ratios in fish processing are presented in Table 4. The ratios in terms of value of fixed assets between the men and women were 0.99, the ratio between the men and youths was 0.78 and the ratio between the women and youths was 0.78. This means that there was some level of gender equality in terms of value of fixed assets invested by the men, women and youths. Also, the ratio in terms of revenue between the men and women was 0.99, the ratio between the men and youths was 0.84 and the ratio between the women and youths was 0.84; indicating that there is near equality in the revenue realized by the men, women and youths in the fish processing chain in Kainji Lake Basin, Nigeria. However, in terms of paid labour, there seems to be inequality between the ratio of men and women (0.52), men and youths (0.50) whereas there is slight equality in the ratio of women and youths (0.97) employed as paid labour in the processing chain. The result indicates close competition among men, women and youths in fish processing; thus, posing a threat to the dominance of women in fish processing as reported in previous studies (Nagoli and Chiwona-Karltun, 2017; Girei, Kigbu and Boyi, 2019). Although the women still dominate in terms of number or representation, the men and youths who are high risk takers than women (Castillo and Freer, 2018), in addition to their economic diversification drive will most likely displace the dominance of women in fish processing in the near future.

The ratio in terms of wage paid between the men and women was 0.86, the ratio between men and youths was 0.75 and the ratio between women and youths was 0.88; which implies that there is no significant gender bias in terms of the wage paid to labour employed in the fish processing chain.

Table 4: Gap ratios in fish processing

Indicators	Absolute Gender Gap	Relative Gender Gap (%)	Gender Gap Ratio
Value of Fixed Assets			
Men & Women	3,766	0.46	0.99
Men & Youths	176,705	27.78	0.78
Women & Youths	180,471	28.37	0.78
Revenue			
Men & Women	10,786	0.22	0.99
Men & Youths	785,454	19.21	0.84
Women & Youths	774,668	18.95	0.84
Employees			
Men & Women	1.1	93.04	0.52
Men & Youths	1.2	100.00	0.5
Women & Youths	0.1	3.60	0.97
Wage			
Men & Women	2325.67	16.83197	0.86
Men & Youths	3984.68	32.77422	0.75
Women & Youths	1659.01	13.64545	0.88

Source: computation from field survey, 2020

Cost and Returns in Fish Processing

The cost and returns analysis for the men, women and youths is presented in Table 5. The result of the analysis shows that the men incurred a Total Expenses of ₦4361544.46 per month, while the women and youths incurred ₦4420006.56 per month and ₦3767595.05 per month respectively as Total Expenses. The Net-Income on the other hand, was ₦510899.47 per month for the men, ₦441650.98 per month for the women and ₦319394.67 per month for the youth. This indicates that the fish processing business generates enough revenue in excess of operating costs used in the business. This result agrees with Oduwale (2019) that smoked fish business is a profitable economic activity which generates a higher return than frozen fish business.

Furthermore, the men had 10.49% net profit margin and 11.71% Return on Investment (ROI) while the women had 9.08 % net profit margin and 9.99 % Return on Investment. The youths, on the other hand, had 7.81% net profit margin and 8.48 % Return on Investment. The results indicate that to every ₦ 1 invested in fish smoking business, 11 kobo, 9 kobo and 8 kobo were received as profit by the men, women and youths respectively. The finding is in consonance with Onogwu, et al. (2019) that smoked-fish processors realize a net return of 3.06 times per ₦ 1.00 invested in fish smoking. However, the men and women had a higher return on investment than the youths.

Table 5: Cost and returns in fish processing per month

Item	Men (₦)	Women (₦)	Youths (₦)
Revenue from Sales	**4872443.93**	**4861657.54**	**4086989.72**
Expenses			
Cost of fresh fish	4176784.12	4250590.93	3594966.43
Fuelwood	25647.06	21050.00	21760.00
Salt	2933.33	2685.71	3190.48
Water	1082.35	1052.50	1040.00
Salary/wages	82864.31	72697.52	78032.02
Labour (cutting, folding, cleaning)	33900.00	35782.50	34080.00
Transport	25505.88	24680.00	24448.00
Depreciation	11027.40	9337.39	8146.13
Others (Match stick, folding sticks etc)	1800.00	2130.00	1932.00
Total	**4361544.46**	**4420006.56**	**3767595.05**
Net income=Revenue-Expenses	**510899.47**	**441650.98**	**319394.67**
Net Profit Margin=NI/revenue*100	10.49%	9.08%	7.81%
Return on Investment (ROI)	11.71%	9.99%	8.48 %
Benefit Cost Ratio (BCR)	1.11	1.10	1.08

Source: Computation from field survey, 2020

Socio-economic and Institutional Determinants of Net-Income
The socio-economic and institutional determinant of net-income of smoked-fish processors is presented in Table 6. From the result of the 2-stage least square, the

years of experience, age and initial capital investment were the significant determinants of net-income of fish processors.

The years of experience had a positive sign and is statistically significant (p<0.1) on net-income. This implies that as the years of experience in fish processing increases, the net-income of fish processors increases as well. The years of experience is positively related to economic efficiency. This is because a longer year of experience is an indication of mastery of cost-minimization or profit maximization strategies employed by the fish processors in order to receive a higher market share of their final produce. This justifies Onyekuru, et al., (2019) that longer year of experience is a necessity for higher level of productivity with resultant increase in profits.

The age of fish processors had a positive sign and is statistically significant (p<0.05) on net-income. This implies that an increase in age of fish processors will result to an increase in net-income. According to Omeje, et al., (2021), age is an indication of maturity for well-informed management decision making as well as day-to-day management of the business. The level of profit realized by a business is significantly affected by the age of the manager. Hence, fish processors make higher levels of profits with an increase in age.

The initial capital investment had a positive sign and is statistically significant (p<0.05) on net-income of fish processors. This implies that the amount received as net-income increases with an increase in capital investment. This result is plausible because Singh and Bagga (2019) posited that the capital structure of a firm has a significant and positive impact on the level of profit realized; hence, a higher investment in assets will result to higher output with a resultant increase in net-income.

Other variables such as: years in school, household size, commodity price and levy were statistically insignificant (p<0.05) on net-income while the R-squared was 0.7038 which implies that about 70 % variation of the dependent variable (net-income) is being accounted for by the explanatory variables fitted in the model.

Table 6: Socio-economic and Institutional determinants of net-income

	OLS estimates		2sls estimates	
Variable	Coefficients	t	Coefficients	T
Years in School	0.85	1.94	0.011	0.64
Experience	0.017	2.27	0.566	1.89*
Age	0.744	2.83	0.047	2.13**
Initial Capital	0.118	3.10	0.519	2.36**
Household size	0.040	0.52	0.776	0.62
Commodity Price	0.804	0.58	0.633	0.45
Community Levy	-0.016	-0.27	-0.015	-0.26
Constant	14.32	1.68	13.19	1.52
R-squared	0.7391		0.7038	
Prob>F	0.000		0.000	

Source: Computation from field survey, 2020   ***significant at 0.05, **significant at 0.1**

Conclusion and Recommendation

Fish smoking is a profitable business with a positive return on investment among the various participants. Also, there is a close competition among men, women and youths in smoke Catfish business even though the women dominate and perform majority of the tasks involved in fish processing. The men and women were found to earn a higher net-income than the youths. Based on the findings of the study, it is recommended that the processing industry in the area should be strengthened through subsidy on cost of improved smoking kilns such as the NIFFR and NIOMR Kilns to enable processors produce high quality smoke-processed farmed Catfish. This can be done through collaboration with the government, financial institutions and NGOs in the procurement and subsidization of the prices of these smoking kilns.

Conflict of interest

The authors declare that this research work has no conflicting interest with other existing works as at the phase of conceptualization to the point of completion.

Author contribution

OJE=38% (conceptualization, data collection, reporting)
AAI=23% (supervision, content review)
JSP=27% (data coding and analysis)
MQC=12%(reporting)

References

Alabi, O. T., Olaoye, O. J., George, F. O. A., Adeola, A. A., Alabi, J. O. and Ojebiyi, W. G. (2020). Awareness and adoption levels of improved smoking oven among fish processors in Lagos Lagoon, Nigeria. *Ghana Jnl Agric. Sci.*, 55(2), 39 – 58.

Amos, S. O. and Ibrahim, P. (2017). Assessment of smoked fish quality using two smoking kilns and hybrid solar dryer on some commercial fish species in Yola, Nigeria. *Journal of Animal Research and Nutrition*, *2*(1:6): 1-8.

Castillo, M. and Freer, M. (2018). Revealed differences. *Journal of Economic Behavior & Organization*, *145*, 202–217.

Chiwaula, L. S., Chirwa, G. C., Binauli, L. S., Banda, J. and Nagoli, J. (2018). Gender differences in willingness to pay for capital-intensive agricultural technologies: the case of fish solar tent dryers in Malawi. *Agricultural and Food Economics*, *6*(1), 1–15.

Food and Agricultural Organization [FAO]. (2017). *An innovative way of fish drying and smoking: FAO Thiaroye Processing Technique (FTT-Thiaroye). Policy brief No. 1.* Rome, Italy

Food and Agricultural Organization [FAO]. (2020). *Study on the profitability of fish smoking with FFT- Thiaroye kilns in Côte d'ivoire. FAO Fisheries and Aquaculture Circular No. 1155.* Rome, Italy.

Girei, A. A., Kigbu, A. A. and Boyi, A. (2019). Gender Role of Women in Fisheries Operations in the Fishing Communities of Doma Dam of Doma Local Government Area of Nasarawa State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, *29*(1), 1–9.

Githukia, C. M., Drexler, S., Obiero, K. O., Nyawanda, B. O., Odhiambo, J. A., Chesoli, J. W. and Manyala, J. O. (2020). Gender roles and constraints in the aquaculture value chain in Western Kenya. *African Journal of Agricultural Research, 16*(5), 732–745.

Kruijssena, F., McDougallb, C. L. and van Asseldonk, I. J. M. (2017). Gender and aquaculture value chains: A review of key issues and implications for research. *Journal of Aquaculture*, *493*, 328–337. https://doi.org/Elsevier

Nagoli, J. and Chiwona-Karltun, L. (2017). Uncovering human social networks in coping with Lake Chilwa recessions in Malawi. *J. Environ. Management*, 192, 134–141.

Nwabeze, G. O., Faleke, S., Tanko, M. and Malgwi, Y. Y. (2019). Strategies used by smoked fish marketers in Kainji Lake Basin, Nigeria. *Journal of Agricultural Extension*, 23(1), 54–65.

Nwabeze, G. O., Ibeun, B. A., Faleke, S., Omeje, J. E., Belonwu, N. E., Igene C. A., Ogbonna, K., Nwanjoku, V. A. and Ighoro, A. (2017). Information needs of fish-feed entrepreneurs in Kainji Lake Basin Nigeria. *Journal of Agricultural Extension,* 21(3), 46–55.

Oduwale, A. O. (2019). Comparative analysis of smoked and frozen fish marketing in Benin metropolis, Edo State, Nigeria**.** *FUDMA Journal of Sciences, 3*(3), 168-176.

Omeje, J. E. (2021). *Assessment of gender mainstreaming in financial intervention strategies within the aquaculture value chain in Kainji Lake Basin, Nigeria.* Department of Agricultural Economics, University of Nigeria Nsukka.

Omeje, J. E., Achike, A. I., Arene, C. J., Faleke, S. A., Manuwuike, Q. C. and Usman, G. A. (2021). Socio-economic determinants of net-income in fish farming in Kainji Lake Basin, Nigeria. *Global Journal of Agricultural Sciences*, *20,* 53-61.

Omeje, J. E., Achike, A. I., Arene, C. J., Ifejika, P. I. and Ifejika, L. I. (2020). Participation of stakeholders in aquaculture value chain of the West Africa Agricultural Productivity Programme in Nigeria. *Journal of Agricultural Extension, 24*(4), 39-52.

Onogwu, G. O., Edoh, A. S. and Akise, O. G. (2019). Economic Viability of Fish Smoking and Marketing: Evidence from Ibi, Taraba State, Nigeria**.** *Journal of Marketing and Consumer Research*, 52, 33-46.

Onyekuru, N. A., Ihemezie, E. J. and Chima, C. C. (2019). Socioeconomic and profitability analysis of catfish production: a case study of Nsukka Local Government area of Enugu State, Nigeria. *Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension*, 18(2), 51–58.

Puke, S. and Galoburda, R. (2020). Factors affecting smoked fish quality: A review. *Research for rural development*, *35*, 132-139.

Singh, N. P. and Bagga, M. (2019). The effects of capital structure on profitability: An empirical panel data study. *Jindal journal of business research*, *8*(1), 65-77.