IMPROVED FISH PROCESSING TECHNOLOGY (IFPT) UTILISATION IN SOUTH-SOUTH NIGERIA

Nkeme, K. K. and Frank, N. N.
Department of Agricultural Economics and Extension Akwa Ibom State University, Obio Akpa Campus
Correspondence contact details: kknkeme@yahoo.com

ABSTRACT

High post-harvest losses have been a major impediment to fisheries' contributions to the nation's economy. The panacea to this is an efficient and effective utilisation of improved fish processing technologies (IFPT). This study examined the utilisation of IFPT in the South-South region of Nigeria. A total of 240 fish processors were selected using multistage sampling procedure. While interview schedule was used for data collection, data were collected on socio economic status, sources of information as well as awareness IFPT. Frequency counts, percentages, means and inferential analytical techniques were used for data analysis. Result reveals that majority (82.1%) of the respondents were females, within the age range of 30-59 years, 85.6% were literate with a mean year of experience and household size of 20 years and 11 persons respectively. Results further shows that 57.6% of respondents were aware of improved technologies and the dominant information source was through friends (34.2%), then family member (16.7%) and radio (10%). The respondents were more familiar with Drum oven (1.97%), Chokor (1.96%) and Burkinade (1.77%), as IFPTs. Distribution by utilisation of IFPT shows Drum oven (51.9%), Chokor (15.66%) and Watanabe (10.9%) and the constraints to the respondents' use of the technologies were lack of capital (33.3%), epileptic power supply (20.4%) and unaffordability of equipment (16.3%) in that order. Respondent's age, sex, marital status, and education were significantly related to the fish processors' utilisation of improved technologies at 1and 10% respectively. It is recommended that the capital or zero-interest-loan should be provided to educated young, female but married fish processors who are the majority in this technology to motivate them to adopting IFPT, given the fish processing rural setting.

Keywords: Improved fish technologies, Fish processing, Radio, Extension communication method and Bookkeeping

INTRODUCTION

In spite of the growth in livestock, poultry and fish industries, protein deficiency still persists (Nkeme, Ndaeyo and Akpaeti, 2013) leading to malnutrition, thereby reducing efficiency and productivity and causing diseases and poor standard of living. Thus, preserved quality fish is relied upon to make up the deficit in animal protein supply. the Food and Agricultural Organisation (FAO, 2019) reported that fish protein contributes 50.0 kg caput/day to the protein intake of an average Nigerian. As such, fish is becoming one of the most important components of human nutrition consumed by large portions of the population in the country. Apart from fish being used as a major source of dietary protein and micronutrients lacking in plants for millions of people, it is also rich in macronutrients like iron, zinc, magnesium, phosphorous, calcium, vitamins (A, B_1, B_2, C and D) and iodine which aids in body neurological development (Abolagba and Nuntah, 2011). However, fish is a low acid food which is very susceptible to the growth of food poisoning bacteria. With this, it is an extremely perishable food material and hence susceptible to high post-harvest losses (Nkeme, 2008).

When large amounts of fish are lost in quality and quantity after harvesting, it translates into losses in nutritional contribution of fish to the total diet and health of populations (Getu, Misganaw, and Bazezew 2015). Losses due to rapid deterioration and spoilage of fish after being caught brings unpleasant taste, smell and texture which results in a range of different products, thus reducing consumer`s acceptability (Oyediran, Omoare, Oladoyinbo, Ajagbe and Dick, (2016). In this regard, over 80% of fish produced in Nigeria is sold live at not too profitable price, as poor quality fish constitutes an economic loss to fisher folks (Federal Ministry of Agriculture and Rural Development, FMARD, 2014).

The Fisheries subsector which occupies a unique position in the agricultural sector that makes up a sizeable portion of economic activities in Nigeria has over the years risen to the challenge of high incidence of post – harvest losses. The case is worst hit by the stunted developmental potential and technological know-how especially in boom seasons (Daramola, Fakoya, Apantaku, Alegbeleye, and Adekoya, (2008). The case is aggravated by the high concentration of the agricultural sector on crop production which accounts for 90% of output; while fishery, forestry and livestock account for the remaining 10% only (Olajide, 2012).

This is against the fact that Nigeria has only met about 40% of her total fish needs while importing frozen and canned fish to supplement the deficit (Bolorunduro and Adesehinwa, 2005). This is at the expense of scarce foreign exchange and at times unverified hygienic conditions. The south-south region of Nigeria, which by implication housed the artisanal fish-rich copious waters in the country, is not excluded. According to the Federal Department of Fisheries (FDF, 2017), the quantity of fish available for consumers in the south - south

region is on a decrease with high estimated post – harvest and exponential population growth.

Many studies, Eyo (2013); FAO, (2015) and Oyediran, *et. al*. (2016) estimated post – harvest fish losses in their different works to be 30% - 65%. They all agreed that losses have not only contributed significantly to the decline in the quantity of fish available to consumers, it has reduce to a very great extend the quality of fish and fish products in the country.

Sequel to the afore-mentioned cases and more, International and Government Organisations have risen to the aid of the fishers. These they have done in form of efforts to fund research institutions to develop technologies and innovations to check post – harvest losses that had been disseminated by extension agencies to fisher-folks **(**Nkeme, *et al.*, 2013). However, most of these technologies and innovations have not gone to the fisher-folks because of their remote enclaves and spatial distributions and, for the fact that this component of value addition is exclusively handled by the Women-in-Agriculture (WIA).

Be that as it may, fish had long been processed within the riverine communities of the south-south. Smoke-drying had been the integral processing method in the South-South (Effiong and Tafa, 2015). Other traditional methods include but not limited to salting, smoking, sun-drying, fermentation, grilling and frying (Nkeme, 2008). These traditional methods of fish processing according to Nkeme, *et al.*, (2013) have not effectively and efficiently prevented microbial spoilage of harvested fishes. This invariably means that post-harvest losses of fish cannot be effectively eliminated using traditional processing methods. The shortcomings of these traditional methods of fish processing in Nigeria led to the introduction of improved fish processing technologies (Kamaldeen, Isiaka, Arowora and Awagu; 2016). The new technologies are effective and efficient and can significantly retain fish freshness, reduce fish spoilage, improve their nutritional values, taste and market quality thereby prolonging the fish shelf life.

World Development Report (WDR), (2018), emphasises on the importance of agricultural technologies and innovations. They reported that mutually supportive, often knowledge intensive, innovations enable country's agricultural producer to move up the value chain in international agricultural export markets. In the same vein, Jamilah, Azril, Jegak, Asiah and Azman *et al*; (2017) noted that when knowledge is successfully transformed, it can yield innovation, which in turn enhances the competence, productivity, competitiveness and livelihoods of agents in the value chain addition. Now that there are new technologies for the reduction or total eradication of post-harvest losses, Extension services delivery should step up their action since it is the only grass rooted agricultural structures for dissemination of time tested and proven value chain technologies. This clarion call is against the backdrop of the effective extension service roles which includes facilitating the development of technology, supporting its adoption and utilisation by end users, fostering linkages with relevant service providers and institutions and providing feedback for further improvement of the system (Vignare, 2013). The provision of such relevant services requires proper assessment of the effective and efficient utilisation of extension agents contact strategies to the fish processors. Given the importance of fish, potentials and the possibility of exploiting, harnessing and exceeding the current gain in the fish value chain addition level in Nigeria, there is need to investigate the level of utilisation of this improved processing technologies by fish processors in the South-South region of Nigeria. Specifically, the study sought to:

1. described the socio-economic characteristics of the respondents
2. identified processor's sources of information
3. ascertained respondents' awareness of improved processing technologies
4. identified improved processing technologies used among the fish processors and
5. examined constraints to utilisation of the technologies by fish processors.
6. examine the relationship between socio-economic characteristics of the respondents' and level of utilisation of IFPT

The hypothesis of the study was stated that there is no significant relationship between socio-economic characteristics of the respondents' and level of utilisation of IFPT in the study area.

Methodology

The study area was South –South region of Nigeria which lies at the point where river Niger meets Atlantic Ocean through the Gulf of Guinea. It has an average annual rainfall of 1,200 to 2,500mm. The South-South region is made up of six (6) States of the Federal Republic of Nigeria; namely; Akwa Ibom, Bayelsa, Cross River, Edo, Delta and River States. Fish processors in the south-southern states constituted the population for the study. A multi-stage sampling procedure was used in the selection of the respondents. Fifty percent of the six states in the south-south geopolitical zone (Akwa Ibom, Cross River and Rivers) were randomly selected for the study. Akwa Ibom has 6 zones, 40 blocks and 226 cells, Cross River has 3 zones, 18 blocks and 144 cells while Rivers has 3 zones, 24 blocks and 192 cells. From the three selected states, two agricultural zones each were purposively selected because of their high involvement in fish processing, totalling 6 zones. Two agricultural blocks from each

of the selected agricultural zones which are notable for their fishing occupation were purposively sampled. From each of the selected blocks, two agricultural circles where fish processors dominate were selected purposively. Lastly, ten fish processors were randomly selected from the selected agricultural circles to give 240 respondents. Utilisation of IFPT as a variable was analysed using a 3-point categorisation rating scale with response options of mostly utilised, utilised, and not utilised scored as 3, 2, and 1. Mean score of 2.0 and above were adjudged highly utilised and mean scores below 2.0 were adjudged lowly utilised. Structured questionnaire were used in collecting data from the respondents. Data were analysed using descriptive (frequency, percentages and means) and P-value inferential statistics.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 1 presents the mean age of the respondents to be 43.5 years. This implies that most of the respondents were within the economically and active age brackets. Majority (82.0%) of the respondents were women. This corroborates the findings of FAO (1999), Bolorunduro (2004) and Nkeme, (2008) and Azeza, (2009), Getu, Misganaw and Bazezew, (2015) that women were primarily responsible for post-harvest activities. Specifically, Oyediran *et al*. (2016) reported that women were highly involved in every aspect of fish processing and marketing in the rural areas and this contributes to their economic empowerment, food security and poverty reduction. By implication, women who participated in fish processing were motivated to adopt new technologies that offer nutritional benefits. Most (72.0%) were married thus, presumed to have responsibilities to their families. These responsibilities according to Olawepo, *(*2010), would likely make them willing to seek processing technologies to increase their income-earning capacity and improve their standard of living. This implies that majority of the fish processors have family responsibilities, and this requires more financial commitment which serves as a motivation for them to utilise improved fish processing technology so as to enhance their income. In terms of household size, 74.5% had household sizes of 6 persons or more. Overwhelming majority (85.6%) of the respondents had attained different stages of formal education. The implication of this result is that majority of the respondents have the capability to adopt and utilise new fish processing technologies. This is because education creates a positive rational approach for the acceptance of new ideas and practices. The study agrees with the findings of Vignare, (2013), Akpabio, (2014) and Effiong and Tafa, (2015) who reported that the higher level of educational attainment of respondents enhances ready adoption and utilisation of technology through information sharing, distribution and access innovation within a short time. The findings also agree with Olajide, (2012), Nkeme, *et al*, (2013); Akpabio, (2014), Jamilah, *et al*; (2017); which affirmed that education is crucial for easy understanding of improved methods of agricultural production. The result also shows that most (58.8%) of the respondents had relatively high experience in fish processing; which they acquired over a long period. This places them in a good position to utilise and appreciate the improved processing technologies. Most (74.5%) of the respondents did not have extension contacts in their locality. The inadequate and ineffective extension delivery system coupled with the spatial habitation within the coastal areas may be the reason why majority of them had no extension contacts but got information of the improved fish processing technology from fellow fish processors. This implies that extension education impact within the study areas on fish processing units is low. Poor extension contacts often result in poor utilisation of relevant information on improved agricultural technologies and could be a discouraging factor for the fish processors. The frequency of extension contacts determines the level and rate of adoption and utilisation in any extension programme.

Table1: Distribution of respondents by their socioeconomic characteristics (n=240)

Socioeconomic variables	Percentage	Mean value
Age range (years)		
Below 30	14.7	
31 – 40	27.5	
41 – 50	32.5	45.5
51 – 60	21.6	
61 and above	7.9	
Sex		
Female	82.1	
Male	17.9	
Marital Status		
Married	72.5	
Single	11.6	
Divorced	17 .9	

Socioeconomic variables	Percentage	Mean value
Household size (persons)		
1 – 5	33.3	
6 – 10	45.4	10.5
11 – 15	19.2	
16 and above	2.1	
Level of Education		
No formal education	20.4	
Primary education	33.7	
Secondary education	26.3	
Tertiary education	19.6	
Years of experience		
1-20 years	7.9	
21-40 years	58.8	30.5
41 years and above	33.3	
Income (₦)		
10,000 – 50,000	44.6	25.5
51,000 – 100,000	22.1	
101,000 – 150,000	20.0	
Above 150,000	13 .3	
Extension contacts		
No visit	74.5	
Once	22.5	
Twice	2.9	
Thrice	0.0	
Membership of organisations		
Yes	42.9	
No	57.1	
Total	100.00	

Source: Field Survey, 2020

Processors' sources of information on Improved Fish Processing Technology (IFPT)

Table 2 shows that 50.9% of respondents received their information from friends (34.2%), radio (10%), television (1.7%), extension agents (8.8%) and posters (4.5%). The implication is that fish processors would find information from fellow fish processors more credible. This is in consonance with the reports of FAO (2010) and Davies and Davies (2009) that respondents value their ties with friends, neighbours, family members and fellow fish processors. However, Extension agents as source of information scored 8.8% only which question processors-Agents synergy. This is contrary to Akpabio, (2014) report which states that Agricultural Extension agents are the real sources of agricultural information. However, they do that through rural local leaders and "contact" fish processors selected among the array of fish processors for dissemination of improved technologies within their locality. Radio as a source of information shows scored 10.0% and ranked third. Be that as it may, radio according to Nwachukwu (2018) is another important source of agricultural information dissemination because its affordability. Field survey shows that these processors are well experienced and that may have accounted for the 22.9%

Table 2: Distribution of respondents by sources of IFPT information

Sources of information	Percentage
Friends	34.2
Radio	10.0
Television	1.7
Extension Agents	8.8
Posters	4.5
Magazines	0.0
Extension bulletins	1.7
Family Members	16.7
All of the above	0.0
None of the above	22.9

Source: Field survey, 2020

Fish processors' awareness on improved fish processing technology

The result in Table 3 reveals that respondents were aware of Watanabe ($\bar{X}$=1.59), Altona ($\bar{X}$=1.58), Chokor ($\bar{X}$=1.96), Burkinade ($\bar{X}$=1.77), Drum oven ($\bar{X}$=1.97) and Mechanical smoking kilns ($\bar{X}$=1.50) improved fish processing technologies. This may be because the improved processing technologies aided their economic stability, increases cash flow, enhances good quality of fish, reduce post –harvest losses and labour. This is corroborated by Nkeme, *et al,* (2013).

Table 3: Distribution of respondents by level of awareness of IFPT

Improved technologies	Mean
Watanabe smoking kiln	1.59
Altona smoking kiln	1.58
Chokor smoking kiln	1.96
Kainji gas kiln	1.42
Burkinade kiln	1.77
Drum oven	1.97
Solar drier	1.00
Banda	1.42
Mechanical smoking kiln	1.50

Source: Field survey, 2020

IFPT used by the respondents

Table 4 reveals that most popular IFPT used by the respondents was the drum oven (51.9%), this was directly by Chokor smoking kiln (15.66%), watanabe smoking kiln was next with 10.9%, Kainiji gas kiln was 8.8%, and Altona smoking kiln was 7.5%. This result corroborates Oyediran, *et al* (2016) who stated that adoption and utilisation of improved fisheries technologies has been relatively low. The findings conform to Fakoya, *et.al* (2012) and Eyo, (2013) that rural women dominate the processing and marketing of fish in Nigeria using traditional methods and equipment in their trades. One may deduce that the impact of Research-Extension-Farmers-Inputs-Linkage-Systems (REFILS), the platform that brings all the actors in the technology development, adaptation, dissemination and utilisation together was rather weak in the development of improved fish processing techniques. Tobor, (1993) concluded that fish processing methods generally practice in Nigeria are traditional and consist of sun drying, salted and sun drying, smoke drying.

Table 4: Distribution of respondents by utilisation of IFPT

Improved technologies	Akwa Ibom State	Cross River State	Rivers state	Total
Watanabe smoking kiln	3.8	2.9	4.2	10.9
Altona smoking kiln	2.8	1.8	2.9	7.5
Chokor smoking kiln	5.25	4.31	6.1	15.66
Kainji gas kiln	2.9	1.8	4.1	8.8
Burkinade kiln	0.8	0.11	0.9	1.81
Drum oven	16.2	15.3	20.4	51.9
Solar drier	0	0	0	0
Banda	0.61	0.21	0.43	1.25
Mechanical smoking kiln	0.72	0.56	0.9	2.18
Total	33.08	26.99	39.93	100

Source: Field survey, 2020

Constraints militating against fish processors' utilisation of improved fish processing technologies (IFPT)

In Table 9 the respondents identified lack of capital (33.3%), epileptic electricity (power supply, (20.4%), un-affordability of improved fish processing equipment (16.3%), high cost of transportation (11.3%) and lack of training by extension personnel (9.2%) as their most pressing obstacles to the effective utilisation of improved fish processing technologies. Other problems identified by the respondents were high cost of fresh fish (5.4%) and inadequate monitoring (4.2%). According to Aniebeze (1997), these problems have been observed to be the major reasons for high incidence of post–harvest losses, scarcity of fish and high cost of fish products. Moreover, Daramola *et al*. (2008); Yvette (2013); Getu *et al* (2015) and Oyediran *et al*. (2016) in their findings reported that these were lingering problems that are yet to be addressed by the government and stakeholders in the fisheries sector.

Table 5: Distribution of respondents based on constraints to utilisation of improved fish processing technologies (IFPT).

Problems	Percentages (%)
Lack of capital	33.3
Epileptic power supply	20.4
Unaffordable equipment	16.3
High transportation	11.3
Lack of Extension personnel	9.2
High cost of fresh fish	5.4
Inadequate monitoring	4.2

Table 6 reveals the results of inferential analysis of respondents' socioeconomic characteristics and utilisation of improved fish technologies. It shows there was a significant relationship between respondents' ages (χ^2 =12.67; p= 0.005), Sex (χ^2 =14.38; P = 0.001), marital status (χ^2=2.136; P=0.25) educational level (χ^2 =23.74; P =0.37) and utilisation of improved fish processing technologies. This indicates the respondents' age was significant to the use of improved fish processing technologies. This was expected because younger processors (as seen with the mean age of 45.5 years) would readily embrace innovations to cushion drudgery. This is in line with Akpabio, (2014) who reported that younger fish processors would likely embrace innovations. Equally, sex was significant at 1% to the use of improved fish processing technologies. This is in line because the sector was predominantly flooded by women and the curiosity of women couple with their youthful age lends to this finding. Kamaldeen *et al.* (2016) findings in Kano supported this assertion. Marital status was significant at 25% level. This may not be unconnected with enormous financial family responsibilities as every family is interested in the education and wellbeing of their siblings. Jamilah *et al,* (2017) agreed to the fact that responsibilities of work life affect work performance and functions. Education of all other socio-economics characteristics was significant. This was expected because education is synonymous with positive changes, and it is the educated that are apt to embrace positive changes in life. This is agreed to by Nkeme, (2008) who stated that education is the bedrock to acceptance and trail of fish processing innovations.

Table 6: Relationship between selected socioeconomic characteristics and level of processors' utilisation of fish improved processing technologies

Socioeconomic characteristics	χ^2	df	p-value
Age	12.67***	3	
Sex	14.38***	1	
Marital Status	2.136*	3	
Educational Level	23.74*	3	

Source: Survey data 2020.
***, **, * = 1%, 5% and 10% levels of probability

Conclusion

The study concludes that majority of fish processors were young married women, lettered and of good years of experience. They relied mostly on friends, family members and radio for their fish processing information. They are aware of the improved fish processing technologies highlighted in the study. The technologies listed are: Watanabe smoking kiln, Altona smoking kiln, Chokor smoking kiln, Drum oven, Kainji gas kiln etc. However, it was the drum oven that was the most utilised of all the improve fish processing technologies. The most pressing constraints as enumerated by the respondents was lack of investible capital seconded by epileptic power supply. Be that as it may, the respondents' age, sex, marital status and education were significant to the utilisation of these improved fish processing technologies.

It is recommended that the relevant agents should make investible capital available at a very low interest rate and affordable collateral; channelled through functional fish processor's cooperatives for the educated young, female but married respondents. Equally, power supply should be stepped up at the riverine suburbs and fish processors should be encouraged to join functional co-operative societies in order to access fish processing information and credit facilities. Equally, effective Research-Extension-Farmers-Inputs-Linkage-Systems (REFILS), the platform that brings all the actors in the technology development, adoption, dissemination and utilisation should be strengthen. Appointment of contact agents among fish processors to train more fish processors on IFPT as well as full implementation of a well – designed capacity building programme so as to maintain a sustainable extension service delivery system.

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