LINKAGE BETWEEN INDIGENOUS FISH PROCESSING PRACTICES AND SUSTAINABLE FISHERIES DEVELOPMENT: A CASE STUDY OF NORTHERN NIGERIA

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Abstract
Development efforts have tried to introduce improved knowledge and technologies to fish processors; these efforts take no cognizance of understanding the fishers' indigenous practices that have sustained production, hence fish processors continued to rely on indigenous fish processing practices to reduce post-harvest losses. The study ascertained types of indigenous fish processing practices and the profitability of indigenous fish processing practices that encouraged the use. The result was used to determine the linkage between Indigenous Fish Processing Practices (IFPP) and sustainable fisheries development. Purposive sampling procedure was used to select two States in Northern Nigeria based on the level of fish processing. Cluster sampling technique was used to select Local Government Areas and processing centers, while snowball technique was used to select 81 respondents. Qualitative data were also obtained through focused group discussions (FGDs) and In-depth interviews (IDIs). Data analysis was done using descriptive statistic, profitability analysis of IFFP. The mean age of the respondents was 59.9 years, 49.7% were female while 50.3% were males. Of these respondents, 65.3% were married, 68.9% had no formal education and 48.5% had non-formal education. The net profit at peak and lean season were found to be N1,449,231 and N358,483, respectively. However, for the fisheries sector to improve food security and make a significant contribution to sustainable fisheries and millennium development, the study suggests that the introduction of new technologies should be based on the types and profitability of indigenous fish processing practices (IFPP).

Key words: Linkage, Indigenous Fish Processing Practices, Fisheries, Development.

INTRODUCTION

In Nigeria, fish which is the cheapest source of animal protein depends on the artisanal fisheries sector. Faturoti (2010) reported that artisanal fisheries in Nigeria provided more than 82% of the domestic fish supply, giving livelihoods to one million fishermen and up to 5.8 million fisher folks in the secondary sector. However, processors in the post-harvest incur both physical and economic losses of animal protein available to the increasing population. The losses are estimated at between 35% and 45% of the total landed weight.

To curtail these losses, efforts must be put in place to reduce waste, increase and improve the processing ability of processors. These processors are important means of making fish available to consumers, especially those living in areas where fish is not produced. It is, therefore, imperative that emphasis is made on increased fish production and it must adequately match with post-harvest handling and preservation.

Adeogun (2011) stated that fish processors use indigenous fish processing practices. In order to achieve sustainable development in fish processing, it is necessary that the factors that encourage the use of indigenous knowledge practices in fish processing are identified, conserved, improved and documented. This would serve as a major source of indigenous knowledge resource and policy instrument for the decisions that will enhance sustainability in the sector.

The introduction of improved knowledge and technologies to fish processors does not take cognizance of understanding the fishers' indigenous practices that have sustained production, hence fish processors continued to rely on indigenous fish processing practices to reduce post-harvest losses, the features of indigenous fish processing practices that encouraged the use, and the results were used to determine the linkage between Indigenous fish processing Practices (IFPP) and sustainable fisheries development. This paper assesses the linkage between indigenous fish processing practices (IFPP) and fisheries sustainability. As a result, the features of IFPP and profitability are analysed.

RESEARCH METHODOLOGY

Two States were selected based on the level of fish processing. Cluster sampling technique was used to select Local Government Areas and processing centers, while snowball technique was used to select 81 respondents. Qualitative data were also obtained through focused group discussions (FGDs) and In-depth interviews (IDIs). Descriptive statistics such as frequency and percentage was used to analyze the socio-economic characteristics of the fish processors and problems facing them. Profitability analysis such as gross margin, net return and marketing margin analysis was used to determine the characteristics that will enhance linkage to fisheries sustainability.

RESULTS AND DISCUSSION

Age

The respondents' ages ranged between 19 and 70 years. Results from specific States showed that (41%) of respondents from Borno location and (30%) from Niger are between 21-30 years. This could be as a result of the tedious nature of fish processing that dissuaded them from the activity. This finding agrees with that of Adewale (1994), Ipaye (1995), Ige (2000), Adu (2000) and Adu (2007) that intimated that the medium aged group dominates the farming population.

Sex

The table 1 shows that 71.0% females were active in Niger State, and this is attributable to the socio-cultural factors and the nature of the work. Processing is done by women in most parts of Nigeria because the activity is done alongside other household chores and taking care of the family (Spore, 1993). Also, Morna *et al* (1992) recognised women as work forces that combine farm work and domestic work. A variation to the above trend was, however, found in Borno location where 80.0% of the respondents were male. This could be due to their religious belief; i. e women in "pudah" and culture because men are expected to provide for the household while women stay at home to take care of the children.

Marital Status

Marital status is a symbolic phenomenon in the rural and urban community. The level of responsibility could be measured by the marital status. This will give opportunity for assistance from family members as indicated by World Bank (2000) and Adu (2007) that

marriage provided additional hands on the farm. In Borno State, 71.0 % of the respondents were married and 80% of the respondents in Niger State were women.

Household Size of Respondents

Household size stands as one of the encouraging factors assisting fisher folks in their fishing and fish processing activities. The size of the household could determine assistance gained and possibly the output of fish processed. Table 1 shows that 65.6% of the respondents had between 1 and 4 household members (including wife, husband, children and dependants). It was noticed that respondents from Borno State had household sizes above 17 members who may assist in fish processing activities and this is consistent with what Kolawole (2001) and Ajala (2004) stated that farmers had an average of 10 members in farming household in Nigeria.

Respondents Educational Level

Education is an essential tool for development; it helps in making decisions concerning way of doing things including adopting improved practices in fish processing and farming. Table 1 indicates that 41.2% and 79.5% in Niger and Borno respectively had no formal education. The implication of high level of no-formal education of users of indigenous practices for commerce in Borno location is that, it may affect their understanding of what the economy is saying about their product, bargaining power and decision for disposal of produce (processed fish) and this may tend to affect their income and livelihood.

Also, this can affect their adoption of new fish processing practices as there is sometimes relationship between education and adoption of new practices. According to Kilpatrick (2000) beneficial innovations are likely to be adopted by farmers with higher levels of education.

Non- formal education is based on the use of senses, and elements from within non-formal education is learning by doing, by observation as well as unconscious learning and this affected change in attitude, skills and knowledge of processors. This type of education is relevant to farmers as through this type of education they get the knowledge required to change their attitude and skills that would cause a positive change towards improved production.

Non- formal education such as short extension courses, vocational training, religious education, farmer innovative ability on new ideas is important in adoption of practices. According to Odebode (1997) it is an essential factor for effecting desirable changes in attitude, skills and knowledge of individual. Respondents that had vocational education were 45.0% in Niger and 4.3 in Borno. Religious education was 25.0% in Niger and 68.1% in Borno. None had extension education. Majority (68.1%) of the respondents in Borno location had religious education and this helped their literacy ability in reading and writing Hausa and numeracy and that affected their ability to make decisions objectively.

It was observed that, bias in the field of specialization of the extension agents affected extension information in fisheries and fish processing in particular. This could be part of the reasons why limited number of respondents had extension education.

Respondents Experience in Fish Processing

Processors' experience in fish processing is important in ascertaining linkage between IKP and fisheries development. The experience is eminent to know the indigenous ways of processing, difficulties encountered over the years which can help researchers focus on how to assist processors to better build on their experience.

The table also shows that respondents from Niger and Borno states had varying years of processing experience. However, Niger State had new entrants making up about 29.4% of the respondents while in Borno, 11.4% of the respondents had 1-5 years of experience. Meanwhile, 8.8% and 29.6% of respondents in Niger and Borno State respectively had been in the business, acquired skills of processing fish for 21 years and above and had specialized in the business. The implication is that more youth should be encouraged to take up fish processing business in Borno to encourage adding value, reduce fish post harvest losses and increase fisheries sustainability.

Table 1: Distribution of Respondents' Personal and Socio Economic Characteristics

Age	Niger	Borno
< 20	6 (17.6)	4(8.5)
21-30	7 (20.6)	18 (38.3)
31-40	7 (20.6)	8 (17.0)
41-50	7 (20.6)	11 (23.0)
51-60	3 (8.9)	3 (6.4.0)
>60	4 (11.7)	3 (6.4.0)
Sex		
Male	10 (29.4)	38 (80.9)
Female	24 (70.6)	9 (19.1)
Marital Status		
Single	5 (15.0)	10 (21.2)
Married	27 (80.0)	31 (66.0)
Separated	-	-
Divorced	-	1 (2.1)
Widowed	2 (5.0)	2 (4.3)
Household Size		
1-4	31(41.9)	17(36.2)
5-8	11 (14.9)	8(17.0)
9-12	3 (4.1)	5 (10.0)
13-16	-	4(8.5)
>17	-	10(21.2)
No Formal Education	14 (41.2)	37 (79.5)
Formal education	20 (58.8)	9 (20.5)

Non Formal Education Vocational Education Religious Education Extension Education	15(45.0) 9(25.0) _	2 (4.3) 32(68.1) _
Experience in fish processing 1-5years 6-10years 11-15years 16-20years 21-25years 26 years and above	 10 (29.4) 5(14.7) 4(11.8) 12(35.3) _ 3(8.8)	5 (11.4) 14(31.9) 7(15.9) 8(17.8) 5(11.4) 8(18.2)

Field Survey 2006 (Figures in parenthesis = percentages)

Types of IFPP used by fish processors

The indigenous practices used in the study area are as a result of survival and subsistence scale, which is related to their geographical situation and based on collective wisdom over the years (Motard, 2007 and Raman, 1985).

Fish smoked after partial sundry

The table revealed that majority of the respondents (60.2%) engaged in the practice of 'fish smoked after partial sundry'. This practice is mostly used as a result of the weather condition that favors sun-drying and compensates for the low availability and quantity of fuel wood. Respondents at *Doro-baga (Borno State)* had this to say:

> *"You can see that in this part of the country, we do not have too*
> *much fuel wood. The wood available is expensive and not*
> *easily accessible to processors. So when you get your wood,*
> *you manage it to go round the volume of fish to be processed.*
> *We then first put the fish out in the sun on the banda to dry after*
> *which we now make fire to smoke it"*

Fish smoked coiled

This practice involves coiling the fish into shapes before processing. The fish is coiled into an 'O' shape with the tail inside the mouth of the fish or just meeting the head and held together with a wooden pin-like material. Another shape is when fish is coiled half way and held together with a stick as support from tail through the gills or mouth. Fish processors that engaged in the use of the practice of 'fish smoked coiled' were 59.0% of the respondents in the study area.

Fish smoked flat whole

This is a simple practice that is carried out by fish washing, descaling, degutting or processed with gut and placed on the smoking kiln horizontally. The smoking kiln is then fired from below. The study found that 28.2% of the fish processors use the practice and this could be as a result of the easy-and-fast nature of the practice in getting fish ready and its preference by consumers in the area. This practice is very popular in the study area.
At *Doro-Baga* in *Borno State*, the spokesman for the processors said:

> *"I can say we met our parents coiling big fish and smoking very*
> *small fish straight. I think they do this to create space for fish*
> *on the 'banda' and to reduce breakage. Though we have improved*
> *on this practice-we now sprinkle groundnut oil on the fish to prevent*
> *it from sticking to the wire mesh and then cover fish on the 'banda'*
> *to allow fish get smoked faster which our fore-fathers were not doing*
> *at that time."*

Sundry on raised net

Fish is washed, drained and spread on a raised net or floor platform for about four hours before turning for even drying. This is repeated the following day for proper drying. Findings also revealed that 12.8% of the respondents in the study area use 'sundry on raised net'. This practice is used mainly for species of a particular type of fish called '*worogi*' (clupeid) which is a tiny fish species, because it can be lost to fire due to its tiny nature. Report of the key informant says that this practice is peculiar to Niger State.

Fish smoked and cut into chunks

Fish is washed, descaled, degutted or cut into chunks depending on the market demands. Some small chunks are tied with string after cutting to avoid disintegration. The cut chunk is then placed on smoking kiln with the cut face on the kiln. Fish smoked and cuts into chunks was preferred by 6.4% of respondents in the area. The reason for the use of this practice is for aesthetics reason, easy drying and space on smoking kiln. On the aesthetic reason, a respondent in Niger location said:

> *"After cutting into small chunks, we also use string to tie them*
> *together to avoid disintegration during smoking. This makes*
> *this practice preferred by customer as they do not cut fish before*
> *cooking".*

Bunt fish in grasses

Fish is washed, degutted, poured on a bed of grasses and covered with another layer. The grasses will then be set ablaze to burn the fish inside, after the fire is out, the fish will be picked and further smoked or dried to ensure proper processing. The study also revealed that, 'bunt fish in grasses was practised by 3.2% respondents in the study area. Niger location is

where the practice is prevalent for processing of '*Chrysicthys nigrodigitatus*,' otherwise known as 'dameimeo.' The key informant's response as to why processors burnt fish says:

> *"Processors burnt this type of fish because the fish is small and can easily be destroyed by fire if not properly monitored. Apart from this the women have small sized kiln that may not take adequate quantity of fish at a time, to prevent spoilage they first burn to reduce the infestation of decaying organism and later dried or smoke properly before taking the fish to the market'.*

It was observed by the researcher that fish processed this way looks blackish and not attractive.

Fried fish in hot oil
'Fried fish in hot oil' was another practice observed during the study. This particular practice was found to be common in Niger State. Only 5.1% of respondents in Niger State use this practice. The reason for this development was the quest to get fish ready quickly for the travelers that pass through the route. The practice is fast and yield returns quickly.

The result of IFPPs above is at variance with the findings of Akinola *et al* (2006) on drying, smoking, freezing, chilling and brining; Davies (2009) on salting, sun-drying, smoke drying and frying; Kolawole *et al* (2010); and Akpabio and Ekanem (2008) on smoke drying; smoking, drying, salting, frying and fermentation.

Table2: Types of IFPP used by fish processors

IKPs Used	Frequency	Percentage (n=81)
Fish smoked coiled	46	59.0
Fish smoked cut into chunks	5	6.4
Fish smoked flat whole	22	28.2
Fish smoked after Partial sundry	47	60.2
Fish sundry partially burnt	6	7.7
Sundry on raised net	10	12.8
Fried fish in hot oil	4	5.1
Burnt fish in grass	6	7.7

Profitability of Indigenous Practices
Table 3 showed the profitability of fish processors using Indigenous Practices. The table shows the rate of return on investment. Output from the use of IKP in fish processing is a function of the inputs used. The level of output depends on variable and fixed inputs. The fixed inputs do not change in quantity with change in the level of production. The variable inputs are used at once to produce outputs. The cost varies according to production; the net profit (133329263) is gross income minus total cost. Yield variation is caused by low labour, low input, type of fish, practices used, number of batches, smoking equipment, etc. The fisheries sector is seen as a potentially important sector of agriculture because of its important contribution to employment and gross domestic product.

As the Government is advocating increasing production in the fisheries sector, there should be equal attention given to processing of fish to reduce losses. The mean net profit is (1,449,231). The mean profitability in fish processing provides the basis for considering prospect for investment in this industry.

Table 3: Profitability of Use Indigenous knowledge practices at peak season.

Profitability of Use of indigenous knowledge practices at peak season.					
	Sum (ton)	**Mean (ton)**	**Maximum (ton)**	**Minimum (ton)**	**Std. Dev.**
Consumables	585390	6363	23800	100	3962.833
Cost of fish	144050400	1565765	7200000	19200	1341938.8
Variable cost	144635790	1546907	7210200	0	1337524
Depreciation (Fixed costs)	605347	6580	18333	167	3106.555
Total cost (N/ton)	145241137	1553381	7221867	0	1339549.5
Gross Income(N/ton)	278570400	3027939	52224000	48000	4431510.2
Net Profit (N/ton)	133329263	1449231	48311333	2833	3704734.6

Source: Field survey, 2006

Table 3 shows the profitability of the processing enterprises of those who used IKP in fish processing during the lean period and this is noteworthy. The mean net profit is (358483), the minimum net profit is at negative (-235900). This revealed that fish catch and processing activities are low at this period of the year. This low catch is responsible for low returns because the fixed material and consumables for processing are constant. To augment their net profit, the income generating activities engaged in during this period should be promoted by extension to improve their livelihood.

Table 4: Profitability of   Use Indigenous knowledge practices at lean season.

Profitability of Use of indigenous knowledge practices at lean season.					
	Sum (ton)	**Mean (ton)**	**Maximum (ton)**	**Minimum (ton)**	**Std. Dev.**
Consumables	585390	6363	23800	100	3962.833
Cost of fish	64732800	703617	3456000	0	453888.7
Variable cost	65318190	698590	3465700	0	454632
Depreciation (Fixed costs)	605347	6580	18333	167	3106.55
Total cost (N/ton)	65923537	716560	3473033	8067	457519.1
Gross Income (N/ton)	98904000	1075043	8400.000	0	868061.2
Net Profit (N/ton)	32980463	358483	7659867	-235900	594015

Source: Field survey, 2006

CONCLUSION

Fish processing activities are very important means of making fish available to consumers, especially those living in environments where fish is not produced. The personal and socio-economic characteristics of processors and different types of fish processing practices employed were identified. Profitability of use of Indigenous Fish Processing Practices (IFPP) was also established. The study revealed that fish processing activities were dominated by (80.9%) male in Borno State and (70.6%), female predominate fish processors in Niger State. Majority of the respondents (79.5%) had no formal education. However, some have a form of non-formal education such as vocational education (45.0%) and religious education (68.1%) that is relevant to get the knowledge required to change their attitude and skills and improve production.

The Major types of IFPP used by fish processors were Fish smoked after Partial sundry (60.2%) and Fish smoked coiled (59.0). These practices were chosen by processors as a result of the weather condition that favors sun-drying and reduced quantity of fuel wood used and coiling allowed for more fish on the processing kiln per processing batch.

For the fisheries sector to improve food security and make a significant contribution to sustainable fisheries and contribute to the millennium development goal, it is, therefore, recommended that: Attention should be given to the development of the Indigenous Fish

Processing Practices identified in the Northern Nigeria area; extension agencies should develop a programme that will educate processors and strengthen their weakness in the practices used; and harness the profitability of IFPP for the development of fish processing to its full potential in Northern Nigeria.

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