SOCIO-ECONOMIC IMPACTS OF SELECTED PROCESSING METHODS AMONG ARTISANAL FISH PROCESSORS AROUND RIVER GBAKO, NIGER STATE, NIGERIA

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ABSTRACT
The study was carried out to look at the socio-economic implications of the use of solar tent dryers and smoking/sun-drying methods among the artisanal fish processors around river Gbako, Niger State, Nigeria. The study examined the socio-economic characteristics of artisanal fish processors in the area, being a major tributary from River Niger. Structured questionnaire was designed to elicit information from forty (40) respondents that were randomly selected. Analytical tools used were descriptive statistics such as percentages, profitability analysis and regression. The results showed that 87.5 % of females were involved in fish processing. The profitability analysis indicated that 27.5 % of the fish processors make profit of between ₦1,001 and ₦1,500. The regression results showed that the variables were significant at 1% and 5 % levels. Although, 75 % of the fish processors adopt smoking method as a practice to process fish, their living standard and socio-economic wellbeing could be better if other processing methods such as solar tent dryers are incorporated. It is therefore recommended that Government and non-governmental organizations should review the policy of input subsidization and production credit to small-scale fishers to boost their fish business.

Keywords: economic empowerment, post harvest technology, poverty reduction.

INTRODUCTION

Globally, fish is considered to be one of the most important and cheapest sources of animal protein. Flake and Nzeka (2007) noted that fish is the cheapest source of animal protein. Ndanitsa (1993) also submitted that fish protein is the only protein source that can "rival" egg protein. It represents a significant proportion of animal protein in the diets of many in developing countries including Nigeria. However, fish is a highly perishable biomaterial. Fish quality deteriorates rapidly after harvest, just as any other dead tissue and biological materials and the potential keeping time is shortened. 20-50% of fish are lost post harvest (Eyo, 2001) This colossal waste has been attributed to poor and under developed post harvest processing and preservation practices (Oyero *et al.*, 2012). This has also, resulted to fish becoming expensive source of animal protein contrary to the global belief of its cheapness

Though, fish production accounts for about 35 % source of animal protein in Nigeria but the total production of fish per annum in Nigeria was about 452,146 metric tonnes while demand was 2,168,000 metric tonnes(FAO, 2002). Such a gap in fish production is expected to have a significant impact on about 90 % of the 38 million people recorded globally to be involved in as small-scale fisheries (FAO, 2004). This is in addition to more than 100 million people who are estimated to be involved in small-scale post-harvest activities (Bene *et al*., 2007). Though, there is no acceptable definition of small-scale fisheries world-wide and other terms such as traditional or artisanal are sometimes used interchangeably to describe activities in the sector Berkes *et al*., (2001). However, small-scale fisheries impact on global fish production and provision of employment for men and women in the processing, distribution and marketing of fish and fish products cannot be overemphasized (FAO, 2004).

In Niger state, Nigeria, artisanal fish production and processing through smoking and sun-drying /solar drying are major vocations and they make significant contributions to the livelihood of fishing communities by supplying food, and generating income and employment. Between 1991 and 2004, fish processed in Niger state was between 11,591 to 26,038 metric tonnes. One of the major contributors to these fish products were the fishermen and processors around River Gbako, Niger State. As such, this study was carried out to compare the socio-economic impact of solar tent dryers and smoking/sun-drying methods among artisanal fish processors, identifying their socio-economic characteristics and determining the costs and returns as well as profitability in artisan fish processing and identifying factors that affect fish processing by the two methods in the study area.

MATERIALS AND METHODS

Niger state is comprised of 25 constitutionally recognized local government areas with Minna as its state capital. The state occupies a total land area of 92,800 km^2, which is about 10 % of the total land area of the nation. The state has a population figure of 3,950,249 people National Population Commission (NPC, 2006). This study however, was restricted to the zone I Agricultural zone of Niger state in consonance with the design of the state Agricultural Development Project (ADP) and the river course of river Gbako. The Local Government Areas (LGAs) affected in this case include Katcha, Gbako, Lemu, Agaie, Mokwa and Lavun. Primary data for the study were collected from a cross-section of fish processors using interview schedules that were collected by the researchers. Multi-stage sampling procedure was used to draw samples for the study using simple random sampling technique. The first stage involves the selection of five (5) LGAs followed by selection of two (2) fishing communities and finally the selection of four (4) fish processors from ten (10) communities to give a total sample size of 40. The 4 fish processors selected included two (2) respondents using smoking/sun-drying method and two (2) respondents using solar tent dryer method. There were no cases of non-response and inadequate information questionnaires. Thus, data from 40 respondents were used for the analysis. Data collected included socio-economic characteristics, production (processing) data and expected economic life of the processing facilities. Furthermore, data on problems and availability of processing facilities were also obtained. The survey was conducted between November 2010 and March, 2011.

Model specification and Estimation

The postulated econometric model shows that the volume of processed fish either by solar tent drying method or smoking/sun-drying method of artisanal fishermen is determined by socio-economic variables. The general model is of the form:

Q = f (E, H, P, K, L, F, Y, M, G, T, S, U)…….equation 1 Olayemi (1998)

Where Q = Quantity of fish processed (kg) by both methods.
E = Level of formal education attained by respondents coded as 1, no formal education; 2, primary education; 3, secondary education; 4, tertiary education;
H is household size of respondents;
P is fish processing experience measured as number of years in fish processing,
K is depreciation of capital inputs used in processing such as the dryers, smoking pans and other accessories,
L is labour input measured as number of hours spent on processing;
F is cost of firewood/kerosene/electricity bill etc;
Y is non-fish processing income, that is income from sources other than fish processing.
M is cost of food, repairs and maintenance.
G is gender of respondents (Male=2, Female=1);
T is type/method of fish processing (solar tent dryers =2, smoking/sun-drying= 1);
S is dummy variable for season (dry season=2, rainy season = 1);
U is stochastic error term.

Different functional forms of the above model were fitted to the data, but the logarithmic model (co lob-Douglas) has the best fit, and is specified below:

$$Log\ Q = logB_0 + B_1 logE + B_2 logH + B_3 logP + B_4 logK + B_5 logL + B_6 logF + B_7 logY + B_8 logM + B_9 logG + B_{10} logT + B_{11} logS \ \ldots\ldots\ldots\ldots equation\ 2\ Olayemi\ (1998)$$

The logarithmic function is one of the most widely used in empirical studies because the regression coefficients are measure of direct elasticities (Baba, 1989; Olayemi, 1998; Almeida *et al.*, 2001).

RESULTS

Socio-economic characteristics of Artisanal fish processors

Table 1 shows the socio-economic characteristics of the fish processors. Although both male and female were involved in the enterprise, the table however reveals that female were more dominant in number (87.5 %). Table 1 also reveals that the processors had relatively large house hold size ranging between 10 and 18 persons and is a characteristic of the poor in the rural areas (Eboh, 1995). The processors had some form of education or the other (52.5 %). Table 1 similarly reveals that the mean educational attainment for all the fish processors was primary education. The number of years spent in fish processing/preservation is also shown in Table 1. It reveals that the years of experience ranges from 1-15 years with a mean experience of 7 years. The result also shows that 62.5 % of the fishers have been engaged in fish processing/preservation for between 1 and 6 years while 37.5 % have been in the enterprise for 7-15 years. The fishers processed/preserved fish products 2 or 3 times per week depending on the number of catches or weight of catches which is between 158-4,453 kg, with an average annual processed output of 1,391.51 kg.

Structure of costs in Artisanal fish processing

Table 2 shows the structure of costs in artisanal fish processing/preservation. The average artisanal fixed costs per respondent in the entire study area were ₦403. 35 kobo while the average variable cost ranged between ₦ 2,000.00 to above ₦7,000.00. Meanwhile, 37.5 % of the respondents expend between ₦4,000.00 to ₦5,000.00 for processing/preservation. The costing items include cost of firewood, kerosene, labour (both family and hired labour), charcoal and payment of electricity bill (for those using oven/solar dryers). Table 2 also shows the profitability analysis and reveals that Net margin/profitability per fisher per year ranged from ₦1,000.00 to ₦3,000.00. Most of the fish processors (27.5 %) make a profit of between ₦1,001.00 to ₦1,500.00. However, only 10 % of the processors make a higher profit of ₦2,500.00 to ₦3,000.00.

Regression Results

Table 3 is a summary of explanatory fact affecting fish processing. The logarithmic function was adjudged the lead equation. It has an R^2 value of 0.80 with 8 explanatory variables that were statistically significant. The table further reveals that house hold size has a positive influence on fish processing/preservation and is in consonance with a *priori* expectations. Other socio-economic factors like educational level, year of experience, season, and availability of credit among others were also statistically significant and were also in line with the *prior* expectations.

Table 1: Distribution of socio-economic characteristics of Artisanal fish processors (n=40).

Parameter	Frequency	Percentage
Gender		
Male	5	12.5
Female	35	87.5
Total	40	100.0
Household size		
4-6	3	7.5
7-9	10	25.0
10-12	14	35.0
13-15	12	30.0
16-18	1	2.5
Total	40	100.0
Educational level		
Non formal Education	19	47.5
Primary Education	9	22.5
Secondary Education	10	25.0
Tertiary Education	6	15.0
Total	40	100.0
Fish Processing Experience (in years)		
1-3	10	25.0
4-6	15	37.5
7-9	12	30.0
10-12	2	5.0
13-15	1	2.5
Total	40	100.0

Field survey (2011)

Table2: Various processing/preservation methods, labour and processing output

Parameter	Frequency	Percentage
Labour (processing period per week)		
Twice	8	20.0
Thrice	12	30.0
Four times	16	40.0
Five times	4	10.0
Total	40	100.0
Fish processing output (kg)		
158-873	15	37.5
874-1589	10	25.0
1590-2305	6	15.0
2306-3021	4	10.0
3022-3737	3	7.5
3738-4453	2	5.0
Total	40	100.0
Fish processing/preservation method		
Solar tent dryers	2	5.0
Sun drying method	8	20.0
Smoking method	30	75.0
Total	40	100.0
Average cost of fish for processing/preservation (₦)		
2,000.00-3,000.00	7	17.5
4,000.00-5,000.00	15	37.5
6,000.00-7,000.00	5	12.5
Above 7,000.00	13	32.5
Total	40	100.0
Average profit from processed product (₦)		
Below 1,000.00	7	17.5
1001.00-1,500.00	11	27.5
1,501.00-2,000.00	10	25.0
2,001.00-2,500.00	8	20.0
2,501.00-3,000.00	4	10.0
Total	40	100.0

Source: Field survey (2011).

₦ is the Nigerian currency, the naira.

Table 3: Regression results of determinants of output in artisanal fish processing method around river Gbako, Niger state.

VARIABLE n =40	SEGMENTS Solar tent dryers (Linear function)	Smoking/sun-drying methods (Linear function)	Entire study area (logarithms function)
Educational level	65.75	78.31	0.05
	(1.45)	(1.65)	(0.84)
Household	5.53	52.62	0.20
	(0.38)	(3.08)**	(2.31)**
Gender	328.96	385.51	0.45
	(3.46)**	(2.99)**	(4.51)**
Fish processing experience	156.90	75.39	0.34
	(6.55)**	(2.84)**	(4.01)**
Season	272.88	383.73	0.35
	(2.63)**	(2.87)**	(3.24)**
Processing credit	-	-	0.33
			(3.76)**
Labour	236.98	271.58	0.82
	(4.91)**	(5.03)**	(6.75)**
Depreciation of capital inputs	0.0009	0.003	0.27
	(0.65)	(1.64)	(2.48)**
Food, repairs and maintenance	0.005	0.0005	-0.08
	(1.98)*	(0.01)	(-1.13)
Fuel and lubricants/charcoal cost	-0.001	-0.001	-0.01
	(-1.14)	(-0.79)	(-1.47)
Non-fish processing income	-0.007	-0.006	-0.10
	(-4.04)**	(-2.81)**	(-2.90)**
Adjusted R-square	**0.87**	**0.83**	**0.80**
D-W Statistic	**1.93**	**2.04**	**1.74**
F- Statistic	**62.92**	**50.04**	**71.13**

Figures in parenthesis are t-statistics.
** Significant at 1 % level, *significant at 5 % level
Source: computed from survey data, 2009.

DISCUSSION

The study reveals that the artisanal fishers in the study area were generally small-scale operators of fish processing/preservation. They employ little capital into the business that is they process low capital investment. Most of the processors still depend on crude facilities and family labour for operation. They have large family sizes which accounted for a significant proportion of the total labour force used in processing/preservation (Olube, 1998). However, Baba and Etuk (1993) and Baba and Wando (1998) explained that the implication of the large family sizes is that family expenditure tends to draw more on family income so that only a meager sum is saved and invested eventually on farming. The low literacy rate which is prevalent in the area has a serious implication for the adoption of innovations into the modern processing/preservation. No wonder, most of the respondents are involved in using old operational facilities like sun-drying and smoking method (90 %) and only 5 % were into using solar tent dryers. According to Biswanger (1989), educated farmers tend to be more likely to adopt modern agricultural practices.

The distribution of fish processors/preservation in the area reveals that the fishers were relatively young in the business and probably a factor responsible to the low processing frequency per week. This has resulted in low, low savings and investment which plunged the fishers in to poverty level. The study also reveals low income earned by the fishers. The income structure is a clear indication that the respondents were small-scale operators in the industry.

The result of the regression analysis also reveals that all the explanatory variables play great role in artisanal fish processing and preservation. For instance, the highly significant effect of house hold size on fish processing and preservation is an indication that it is a critical input in fish processing/preservation and marketing. The estimated regression results for the solar tent dryers

and smoking/sun-drying methods are also shown in Table 3. They are similar, as the same set of six independent variables significantly determines fish processing methods.

CONCLUSION AND RECOMMENDATION

The contribution of the artisanal fishery sub-sector to food security, employment and income generation at both the community and national level is well known and recognized. However, the capacity of artisanal fishery to play this triple role depends on the profitability of fish processing operations, and the sustainable and efficient management of fisheries resources. Although, small-scale fish processing was found to be profitable, the low operating margin, particularly among its practitioners is a cause for concern due to high cost of processing, dwindling catches and need to guarantee the livelihood of fishing communities. Owing to the contribution of artisanal fishing and fish processing in food security and poverty alleviation at both the household and national level, there is the need for both the government and non-governmental organization to review the policy of input subsidization and production credit to small-scale fishers. Artisanal fish processing in developing economies like Nigeria is laborious and labour intensive. Therefore, as the supply of labour increases, other things being equal, fish processing will increase. Thus, given existing fish stock, the input of labour in artisanal fishing will have to be raised if fish processing output must be increased to meet the widening local demand.

REFERENCES

Almeida,O.T., Megrath,D., Arima, E. and Ruffino, M.L. (2001). "Production Analysis of commercial fishing in the lower Amazon. *Journal of Fisheries Management and Ecology"*. 8:196-214.

Baba, K.M. (1989). Economics of resources used in irrigation agriculture, a case study of pump systems in Western zone of Bauchi state Agricultural Developmemt Programme, Nigeria. Unpublished M.Sc. Thesis, Department of Agricultural Economics and Extension, A.B.U., Zaria.

Baba, K.M. and Etuk, E.G. (1993). Resource use efficiency and constraints in irrigated agriculture, empirical evidence from Bauchi State, Nigeria. *Journal of Agricultural Technology*, Abubakar Tafawa Balewa University, Bauchi, pp1-6.

Baba, K.M. and Wamdo, M.A. (1998). "Impact of membership of Fadama users Associations on resource-use, crop yield and farm incomes: a case study from two Local Government Areas in Niger State". *Nigeria Journal of Basic and Applied Sciences* 7: 31-41.

Bene, C., Macfadyen, G. and Allison, E.H. (2007). "Increasing the contribution of small-scale fisheries in poverty alleviation and food security". FAO Fisheries Technical paper No.481.FAO, Rome; 125p.

Berkes, F., Mahon,R., McConney, P., Pollnac, R., and Pomeroy, R. (2001). Managing small-scale Fisheries: alternative directions and methods. International Development Research centre,Oltawa, Canada.

Biswanger,H. (1989). Brazilian policies that encourage aforestation in the Amazon Environment Development, working paper 16, the world bank, Washinton Dc.

Eboh, E.C. (1995). Poverty, population growth and Environmental Degradation, the vicious cycle of Human misery", in Eboh,E.C., Okoye,C.U. and Ayichi,D. (eds). Rural Development in Nigeria: Concepts, processes and prospects. Auto-century publishing company, Enugu, Nigeria.pp274-285.

FAO (2002). The state of World Fisheries and Aquaculture 2002. Food and Agricultural Organization, Rome.pp47.

FAO (2004). The state of the World Fisheries and Aquaculture. Food and Agricultural Organization, Rome. Pp64.

FAO (2004b). Advisory committee on Fisheries Research, 2004. Report of the second session of the working party on small-scale Fisheries, Bangkoko, Thailand, 18-21 November, 2003. FAO Fisheries Report No. 735, FAO, Rome, 21p.

Flake,L. and Nzeka, U. (2007). Nigeria Fishery Products: Nigeria's Fish Market, USDA Foreign Agricultural service, GAIN Report Global Agricultural Information Network No. N17026, 1-11.

Kester, C.T., Osofero, S.A., and Daramola, J.A. (2007). Fisheries Potential Assessment of Ero Reservoir, Ekiti state, Nigeria. *Agricultural Journal*, 2(6):721-725.

Mabawonku, D.A.F. (1980). Economic survey of Artisanal Fisheries in Bendel, Cross-river, Lagos, Ogun and Rivers states. Proceedings of the National Seminar on "Integrated Development of Artisanal

and Inshore Fisheries in Nigeria". Federal Department of Fisheries, Lagos.

National Population Commission NPC (2006). Provisional census figures, National Population Census, National Population Commission, Abuja, Nigeria.

Ndanitsa, M.A. (1993). Economicsof Fish production and marketing in Lavun Local Government Area of Niger state. Unpublished B.Sc. project, Faculty of Agriculture, Usman Danfodiyo University , Sokoto, Nigeria.

Olayemi, J.K. (1998). Elements of Applied Econometrics. Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.

Olube, J. (1988). "Resource productivity in food production in some selected villages of Oyi Local Government Area, Kwara State, Nigeria". Unpublished B. Agric. Project. Dept. of Agric Econs and Farm management , University of Ilorin, Nigeria.

Ukoh, F.A., Taher, K., Egbagbe,E., Lomotey,M., Oguike, T., Akumabor, P., Osime, U. and Bech, B. (2009). Association of self-reported consumption of cooked meat, Fish, seafood and eggs with prostrate cancer risk among Nigerians. Proceedings from the second Annual International African-Caribbean Cancer Consortium Conference, Miami. F.I. U.S.A.