

## INNOVATIVE CATFISH PROCESSING AND ITS EFFECTS ON THE PERFORMANCE OF CATFISH MARKETING IN DELTA STATE, NIGERIA

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### ABSTRACT

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*Barbeque is a product of processing innovation that is fast becoming one of the key drivers of the growth and sustainability of fisheries-based industry in Nigeria. Yet there is the dearth of empirical information on its effect on the performance of catfish marketing. It is important to deepen our understanding of the contribution of innovative processing technology (Barbeque) to the performance of catfish agribusiness. This study therefore examined the effect of processing innovation on the performance of catfish marketing in Delta State, Nigeria. Primary data were collected with structured questionnaire to 120 respondents that were selected through multi-stage sampling procedure. The sample was split into 2 sub-samples (i.e. 60 smoked catfish marketers and 60 barbeque marketers) Descriptive statistical tools (i.e. mean, standard deviation, percentage and frequency distribution table), inferential statistics (t- statistics and OLS technique of multiple regression analysis) and enterprise budget were used to analyze collected data. The results show that educated young female (31-40 years) dominated the marketing of smoke catfish and barbeque marketing in Delta State, Nigeria. The result of the multiple regression analysis showed that sex, age, educational level, quantity traded, packaging cost, transport cost, smoking cost, were significant determinants of profit earned by catfish marketers. The mean profitability of barbeque were ₦37, 348.33 is higher than the mean profitability of smoked catfish was ₦19,381.66 indicating that barbeque marketing is 48.11% more profitable than smoked catfish marketing. The research hypothesis of a significant difference ( $P < 0.05\%$ ) in the profit levels was accepted. Further finding shows several constraints affecting catfish marketing. Based on the results, it was recommended that, Government and cooperative organizations should assist catfish marketers to have access to improve modern processing and storage facilities for barbeque. More innovations in cat fish value chain should be encouraged to drive development of the catfish industry in Nigeria*

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**KEYWORDS:** Processing, Innovation , Performance, Catfish, Marketing, barbeque

## INTRODUCTION

In Nigeria, the annual demand for fish far exceeds local production leaving a deficit of about 2 million metric tonnes (NBS, 2017 and FCWC, 2016) such that according to the Federal Bureau of Statistics, over 800,000 metric tonnes of fish are imported. Fish and fish products contribute more than 60% of total protein intake in adults especially in rural areas (Adekoya and Miller 2014). Agricultural innovation systems are a set of agents that jointly and/or individually contribute to the development, diffusion and use of agriculture-related new technologies which directly or indirectly influences the process of technological change in agriculture by improving its productivity (Tugrul and Ajit, 2012). Delta State is a fish producing and marketing location; diverse actors are involved in fish marketing. Innovation system study thus helps to identify the actors involved in fish marketing, determines their roles and gives an understanding of how they (actors) interact to generate, share, transfer knowledge and adopt new ideas so as to improve marketing performance (Madugu, et al., 2019). Innovation system brings about social interaction where different actors collectively introduce a new idea or improve on an existing idea. However, in Delta State, such collective interaction among actors in the fisheries sub-sector has not been identified, rather, focus of previous studies has been on the economic aspect of fish productivity and marketing.

An innovative catfish marketing is central to agricultural development and the overall growth and development of the economy. Previous studies have shown that efficient marketing system stimulates agricultural production (Awoyinka and Ikpi, 2015; Adescope, Ajiebefun, and Akeremale 2015). As important as marketing is, most of the studies on fish have concentrated on production (Inoni, 2007; Zabbey, 2010). Available information shows that few of the studies on fish marketing did not investigate the evidence of innovation and its effect on profitability in catfish marketing (Gaya, Mohamed and Bawa

2010). Improvement in fish processing and marketing such as barbeque, has the potentials of stimulating catfish production in the country.



Fig. 1a: Smoked catfish



Fig. 1b: Barbequed catfish

The major goal for fish marketing is to maximize profit earned by the various participants (i.e. wholesalers and retailers). Research has shown that there is continuous increase in the number of participant in fish marketing as a result of growing population of the country (Ali et al., 2011). This is an inkling of the profitability of the enterprise as only profitable activities could be attracting increasing number of participants (Gaya et al., 2010). The economy and the marketing system of Nigeria are still undergoing development. This has imposed a lot of challenges on marketing of catfish in the country. Gbigbi and Achoja (2019) investigated the constraints to the growth of catfish value chain to include inadequate credit access and high expenditure of inputs. It has been argued that lack of innovative agricultural marketing would result in high rate of spoilage, poverty and unaffordable food prices by consumers. However, not many studies have empirically evaluated the validity of these hypotheses in fish marketing. Awoyinka (2011) stated that marketing of food in Nigeria is characterized by multitude of deficiencies such as lack of innovations. These deficiencies cut across processing, preservation, packaging, distribution and transportation in fish marketing (Rural Sector Enhancement Programme, RUSEP, 2012). In fish marketing, problems of shortage of supply, price fluctuations, low availability of water, spoilage in transit and lack of innovation have been identified in

Nigeria (Ali et al., 2011).Olagunju, (2019) Agbebi and Adetuwo, (2018) studies revealed that fish marketing is efficient and lucrative. However, constraints faced by the marketers include; inadequate storage facilities, price instability, inadequate capital, lack of access to credit, distance to market among others. Agbebi and Adetuwo, (2018) therefore recommended that effective agricultural policies and programs should address marketers' easy access to credits, infrastructural facilities such as good storage and processing facilities, electrification, good feeder roads should be provided in the area to reduce spoilage and unprofitable sales. Osuji, Anyanwu, Oshaji and Onyemuwa, (2017) and Nwali et al., (2017) studies indicated that socioeconomic characteristics have influence on the profitability of catfish marketing. Eze, Onwubuya and Ezeh (2010), identified inadequate processing skills, produce deterioration and lack of storage facilities as the major constraints perceived by women fish marketers.

A study conducted by Adebo and Toluwase (2014) compared profitability of fresh and smoked fish marketing in Ondo and Ekiti States, Nigeria, The marketing of both fresh and smoked fish is profitable, however, smoked catfish marketing is found to be more profitable than fresh catfish marketing. Though the mean variable cost of processing and marketing smoked catfish (₦537.60) is higher than that of fresh catfish (₦262.50), the return on investment of smoked catfish (0.60) is higher than that of fresh catfish (0.48). This however shows that, the marketing of smoked catfish is efficient and worthwhile in the long run when compared to fresh catfish. Adebo and Toluwase (2014) recommends; introducing more smoking kilns and guarantee minimum price policy for catfish production; effective utilization of catfish farmers associations for credit accessibility and scale up production and capacity building of farmers in smoking kiln utilization.

As a response to the ever increasing changes in the taste and lifestyle of fish consumers, Recent innovation in catfish processing has introduced a new product (barbeque) into

catfish market in Delta State, Nigeria. It is important to investigate the contribution of barbeque to the profitability of catfish marketing.

The availability of catfish to consumers in the right form, requires an effective and innovative marketing system (Achoja, Gbigbi, Ikpoza. and Denghan 2020). Catfish marketing system must develop innovative services to satisfy ever changing consumer taste and preferences. There is strategic search for research work that aid innovation and effects on performance of processed catfish marketing in Delta State, Nigeria it is hoped that the findings of this work will be useful to students, the private sector, policy makers and all participants in production, processing, marketing of catfish.

The broad objective of this study was to examine the effect of innovation on performance of catfish marketing in Delta State, Nigeria.

The specific objectives are to:

- i. determine the profitability of marketers of Barbecue and smoked catfish
- ii. determine the effect of innovation on performance (profitability) of catfish marketing
- iii. estimate the factors that influence profitability in catfish marketing, and
- iv. identify the major constraints that militate against catfish marketing.

The following hypotheses were tested to guide the study

Hoi: Processing innovation has no significant effect on the profitability (wealth creation) in catfish marketing

Hoi; There is no significant difference in the profitability of Barbecue marketing and smoked catfish marketing.

## **MATERIALS ANDMETHODS**

### **Study Area, Sampling Technique and Sample Size**

The study was carried out in Delta state, Nigeria. Its population stood at 206,600 (NP, 2016). It occupied a land area of 816km<sup>2</sup>. It lies between latitudes 500 48I'N and 50060'N of the equator and longitudes 600 08I E and 60032IE. The major occupations of the people were farming, fishing (fish farming and artisanal) and trading. The major crops cultivated were cassava, yam, okra, garden egg, cocoyam, rice, maize, palm, rubber and sweet potatoes. Delta State was chosen for the study because the terrain is understood by the researchers as well as the roadmap, culture and language; also, there are many catfish marketers in the study area.

The target population were catfish marketers. All the five major communities namely; Kwale (Utagba-Ogbe), Utagbe-Uno, Ogume, Abbi and Onicha-Ukuwani was purposively selected for the study. The second stage was the random selection of 24 catfish marketers (12 marketers of smoked catfish and 12 marketers of barbecue) from each of the community giving a total of 120 catfish marketers that were studied.

### **Data Collection Techniques**

The primary data used for the study, were collected through the administration of structure questionnaire aimed towards realizing the objectives of the study. The questionnaire which was structured for the survey consist of: information on the socio-economic characteristics of respondents, effect of innovation in the performance of catfish marketing (barbecue and smoked catfish), the effect of modern catfish marketing (barbecue) on profitability, structure of catfish marketing, factors that influence profitability of catfish marketing and the major constraints that militate against profitability in catfish marketing.

### Method of Data Analysis

A descriptive statistics such as mean, percentage count and frequency were used to determine objective 1.

### Budgetary Technique

The budgetary technique involve the cost and return analysis. It was used to determine the profitability of catfish marketing in the study area.

### Model Specification

$$\Pi = TR - TC \dots \dots \dots \text{Equation 2}$$

$$TR = PQ \dots \dots \dots \text{Equation 3}$$

Where

$\Pi$  = Total Profit (N)

TR=Total revenue (N)

TC= total Cost (N)

P= Unit price of output (N)

Q= Total quantity of output (N)

### The Regression Model

In order to determine the factors that militate against catfish marketing, a regression analysis was estimated.

The implicit form of the model is specified as follows

$$\Pi = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$$

The model was explicitly specified as followed

$$\Pi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e_i$$

$X_1$  = age (years)

$X_2$  = sex

$X_3$  = Education (years spent in school)

$X_4$  = Quantity traded (kg)

$X_5$  = Cost of transportation (naira)

$X_6$  = Packaging (dummy 1 if modern package, 0 otherwise)

$X_7$  = Cost of processing (naira)

$e$  = Error term

**T-test**

$$t = \frac{X_1 - X_2}{\frac{SD_1 + SD_2}{N_1 N_2}}$$

Where

$X_1$  = profitability in Barbecue marketing

$X_2$  = mean profitability in smoked catfish marketing

$SD_1$  &  $SD_2$  = Standard Deviation

$n_1$  &  $n_2$  = sample size

## RESULTS AND DISCUSSION

### Profitability of barbeque Marketing

The result of the profitability of barbecue in the study area presented in Table 1 indicated that cost of fresh fish accounted for the highest cost incurred followed by cost of labour. The overall result showed that there was 53.4% return to investment which implies good level of profitability.

**Table 1. Profitability Analysis of Barbeque Marketing**

Variable input(₦)	Amount (₦)
Cost fresh fish	55,000
Transportation cost	1,886.66
Packaging cost	5,220.00
Smoking cost	3,351.70
Labour cost	4,458.30
<b>Total cost</b>	<b>69916.66</b>
Revenue	107264.66
Profit	37,348.00
Return on investment	0.534



### Net profit margin

According to corporate finance institute, the Net Profit Margin is an overall indicator of production profitability performance. It is a strong indicator of a market's overall success and is usually stated as a percentage.

Net Profit Margin = total revenue – total cost

$$= 107264.66 - 69916.66$$

$$= 37,348.00$$

i.e for each ₦1 of each revenue the marketing earns ₦0.53 in net profit.

The high net profit means that the innovation in barbeque has delivered high value.

Therefore the marketing of barbeque in the study area is profitable.

$$\text{Net Return on Investment (ROI)} = \frac{\text{Net Return}}{\text{Total Cost}} \times \frac{100}{1}$$

$$= \frac{37,348}{69,916} \times \frac{100}{1}$$

$$= 0.53 (53\%)$$

A high net profit means that the production is able to control its cost and/or provide service at a significantly higher than its costs. Therefore the marketing of barbecue in the study area is profitable.

### Profitability of Smoked Cat Fish Marketing

The result of the profitability of smoked cat fish in the study area presented in Table 2 indicated that cost of fresh fish accounted for the highest cost incurred followed by smoking cost. The overall result showed that there was 46.0% return to investment.

**Table 2.**

Variable input(₦)	Amount (₦)
Cost of fresh fish	40,000
Transportation cost	333.33
Packaging cost	401.67
Smoking cost	800.00
Labour cost	103.33
<b>Total cost</b>	<b>41,638.33</b>
Revenue	61,020.00
Profit	19,381.67
Return to investment	0.47 (47%)

Net Profit Margin = Total Revenue – total cost

$$= 61,020.00 - 41,638.33$$

$$= 19,381.67$$

i.e for each ₦1 of each revenue the marketing earns ₦0.47 in net profit.

A high net profit means that the market is able to control its cost and/or provide service at a significantly higher than its costs. Therefore the marketing of cat fish in the study area is profitable.

$$\begin{aligned}
 \text{Net Return on Investment (ROI)} &= \frac{\text{Net Return}}{\text{Total Revenue}} \times \frac{100}{1} \\
 &= \frac{19,381.67}{41,638.33} \times \frac{100}{1} \\
 &= 0.47 (47\%)
 \end{aligned}$$

### **Relationship between socio-economic characteristic of respondents and profitability of smoke fish**

To assess the effect of socio-economic characteristics on profitability of smoke catfish marketers, multiple regression was performed. The overall model fit was 94.7% ( $R^2 =$

0.947,  $p < 0.05$ ) (see Table 4.5 and 4.6). This means that the variables can correctly predict level of profitability by 94.7%.

### Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.973 <sup>a</sup>	.947	.940	1793.21574

a. Predictors: (Constant), S Constant, Amount sold, Total cost, Age, Sex, Packaging cost, educational level

### ANOVA<sup>a</sup>

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	2990617453.976	7	427231064.854	132.861	.000 <sup>b</sup>
Residual	167212379.358	52	3215622.680		
Total	3157829833.333	59			

a. Dependent Variable: PROFIT

b. Predictors: (Constant), S Constant, Amount sold, Total cost, Age, Sex, Packaging cost, educational level

### Socio-Economic factors influencing smoke cat fish profitability

This was achieved through the use of multiple regression model to analyse the socio-economic factors influencing profitability of smoke catfish. However, the results of the linear multiple regression analysis in Table 3 showed that out of the seven independent variables namely sex, age educational level, amount sold, packaging cost, transport cost, smoking cost two (Educational level and amount sold) were positive and statistically significant determinants of profitability of smoked catfish in the area. This indicated that the higher the level of education and amount of smoked catfish sold, the higher the profit.

The implication of these findings is that marketers experience increase, through their level of knowledge and skill acquisition and utilization of modern marketing strategies. The result also shows that one (smoking cost) was negative and statistically significant determinants of level of profitability of smoked catfish in the area. This implies that change or increase smoking cost will lead to increase in profitability. The result also showed that sex, age, packaging cost and transportation cost had no significant ( $p>0.05$ ) effect on smoked fish profitability.

**Table 3. Socio-economic factors influencing smoke cat fish profitability**

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	-32365.053	5498.020		-5.887	.000
Sex	181.893	1931.825	.003	.094	.925
Age	-16.978	40.840	-.019	-.416	.679
Educational level	-859.020	372.605	-.107	-2.305	.025
Amount sold	.887	.036	.851	24.585	.000
Packaging cost	.851	1.765	.017	.482	.632
Transport cost	.016	2.280	.000	.007	.994
Smoking cost	-1.128	.100	-.413	-11.237	.000

a. Dependent Variable: Profit

**Relationship between socio-economic characteristic of respondents and profitability of barbeque fish**

To assess the effect of socio-economic characteristics on profitability of barbeque marketers, multiple regression was performed. The overall model fit was 71.9% ( $R^2 = 0.719$ ,  $p < 0.05$ ) (see Table 2 and 3). This means that the variables can correctly predict level of profitability by 94.7%.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848 <sup>a</sup>	.719	.681	9924.38323

a. Predictors: (Constant), Smoking cost, Amount sold, Total cost, Age, Sex, Packaging cost, educational level

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13121413938.678	7	1874487705.525	19.032	.000 <sup>b</sup>
	Residual	5121655894.655	52	98493382.590		
	Total	18243069833.333	59			

a. Dependent Variable: PROFIT

b. Predictors: (Constant), S Constant, Amount sold, Total cost, Age, Sex, Packaging cost, educational level

**Socio-economic factors influencing barbeque fish profitability**

This study also examined barbeque marketer socio-economic characteristics on profitability of barbeque in the study area. This was achieved through the use of multiple regression model to analyze the socio-economic factors influencing profitability of barbeque.

However, the results of the linear multiple regression analysis in Table 4.6 showed that out of the seven independent variables namely sex, age educational level, amount sold, packaging cost, transport cost, smoking cost one (amount sold) was positive and statistically significant determinants of profitability of barbeque in the area. This indicated that the higher the amount of barbeque sold, the higher the profit.

The result also shows that one (smoking cost) was negative and statistically significant determinants of level of profitability of barbeque in the area. This implies that change or increase smoking cost will lead to increase in profitability. The result also showed that sex, age, educational level, packaging cost and transportation cost had no significant ( $p>0.05$ ) effect on barbeque profitability.

**Table 5          Socio-economic factors influencing barbeque fish profitability**

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	17081.190	15994.815		1.068	.290
	Sex	-1855.029	5537.185	-.027	-.335	.739
	Age	-445.199	289.028	-.128	-1.540	.130
	Educational level	-1178.637	1754.018	-.052	-.672	.505
	Amount sold	.423	.040	.840	10.468	.000
	Packaging cost	-.237	1.140	-.017	-.208	.836
	Transport cost	-.934	1.278	-.058	-.731	.468
	Smoking cost	-1.430	.455	-.241	-3.140	.003

a. Dependent Variable: PROFIT

**Means Scores of Challenges Confronting Catfish Marketing**

Information in Table 6 shows that eight (8) out of the 11 constraints investigated by the study were considered as serious constraints affecting catfish marketing. These are Inadequate finance ( $M=3.35^{**}$ ), Acquiring space (land) for processing of catfish ( $M=3.5^{**}$ ), Lack of processing equipment ( $M=2.5^{*}$ ), Lack of technical support from

government/local authorities (M=3.65\*\*), Lack of extension agents (M=2.84\*), Lack of storage facility (M=3.04\*\*), High price of catfish from producer (M=2.51\*), and High cost of transportation (M=3.56\*\*).

Insufficient extension contact as one of the major constraints in the study area, simply implies that information regarding catfish marketing is not made available to agricultural marketers due to the absence of extension agents. This is in line with Odoemenem and Obinne (2010) who both pointed out that constant meeting /frequency of extension contact between the extension personnel and farmers would enlighten them and create better awareness for the potential gains of improved agricultural innovations.

**Table 6. Means Scores of Challenges Confronting Catfish Marketing**

Issue	Not serious	Moderately serious	Serious	Very serious	Mean
Inadequate finance	0(0.0)	4 (6.7)	31(51.7)	25 (41.7)	3.35**
Acquiring space (land) for processing of catfish	0(0)	0(0)	30 (50.0)	30 (50.0)	3.5**
Lack of processing equipment	14 (23.3)	6 (10)	35 (58.3)	5 (8.3)	2.5*
Lack of technical support from government/local authorities	0(0.0)	0(0.0)	21 (35.0)	39 (65.0)	3.65**
Lack of extension agents	7 (11.7)	14 (23.3)	19 (31.7)	20 (33.3)	2.84*
Lack of storage facility	6 (10.0)	5 (8.3)	30 (50.0)	19 (31.7)	3.04**
High price of catfish from producer	12 (20.0)	16 (26.7)	21 (35.0)	11 (18.3)	2.51*
Low numbers of off taker	48 (80.0)	4 (6.7)	5 (8.3)	3 (5.0)	1.30
Lack of marketing experience	31 (51.7)	29 (48.3)	0(0.0)	0(0.0)	1.49
Low level of demand	11 (18.3)	14 (23.3)	30 (50.0)	5 (8.3)	2.48
High cost of transportation	2(3.3)	0(0.0)	20 (33.3)	38 (63.3)	3.56**

## Hypothesis Testing

### Profitability Differentials

The mean profitability of barbeque was 37348.33 which means that their profitability is higher, while the mean profitability of smoked catfish was 19381.66 which means that their profitability is lower. The result showed that there is a significant ( $p < 0.05$ ) difference between the profitability of barbeque and smoked catfish in the study area. The implication is that barbeque were better in terms of marketing than smoked catfish.

Hypothesis I: The hypothesis states that there is no significant difference in the profitability of Barbecue and smoked catfish marketing. However, the results of the T-test analysis in Table 7 show that there is significant difference between the profitability of barbeque and smoked catfish. So, the null hypothesis was therefore rejected while alternate hypothesis was accepted

**Table 7. Profitability Differentials in Barbeque and Smoked Fish Marketing**

Enterprise	Mean profit	Df	Std. Deviation	T-value	Remark
Smoked catfish marketing	19,381.66	59	7315.91	16.452	Significant
Barbeque marketing	37,348.33	59	17,584.21		

### Conclusion and Recommendations

The study examined barbeque marketing as an innovative method of catfish marketing compare to the conventional method (smoked catfish) and this shows from the study that more profit is accrued as a result of innovation. The overall result shows that without



barbeque innovation there was a profitability of N19,381.6667 with a 47.0% return on investment. But with barbeque innovation return on investment of 53.4% with a mean profitability of 37348.33 were realized. This therefore shows that innovation has positive effect on the performance (profitability) of catfish marketing. Profit is the reward for risk taking, it is the reward for performing marketing functions. Marketers of barbeque realized more reward for performing marketing function than the marketers of smoked catfish.

The present study has buttressed the fact that innovation drives performance.

Based on the results, the following recommendations are proffered,

1. Government and concerned organizations should help marketers to have access to improve modern storage facilities To preserve unsold barbeque.
2. Extension agent should be made accessible as much as possible to create awareness on barbeque marketing in the study area.
3. Government should provide soft loan to assist the catfish marketers
4. Government should provide land (space) to encourage their participation in fish marketing.

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