The Effect of Preservation Strategies on Market Performance of Fish Sellers in Makurdi Local Government Area of Benue State, Nigeria

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Abstract

This study examined how preservation techniques affected fish vendors' market performance in Benue State, Nigeria's Makurdi Local Government Area. The sample size of 120 fish marketers in the sample area was chosen using a multi-stage selection methodology that included both purposive and simple random sampling. Data was gathered using a standardised questionnaire. Validation and reliability were assessed using the test-retest methodology. Descriptive and inferential statistics were used to analyse the acquired data. The result from the analysis showed that the majority (53.3%) of the respondents used the smoking method of preservation. Additionally, the market size was significant at the 1% probability level and positive with an R2 of 0.239. The study shows fish marketing is profitable, as evidenced by the gross margin analysis's positive mean profit of N218316.24. The survey also revealed that the main obstacles to fish marketing in Makurdi LGA were a lack of funding, spoiling, and consumer reluctance to purchase fish. According to the study's findings, fish vendors' market performance is positively impacted by preservation techniques. The study recommends educational programs on alternative preservation techniques like solar drying that may better retain nutritional value, reduce health risks, and improve the shelf life of preserved items.

Keywords: Preservation Strategies, Market Performance, Fish Sellers, Makurdi, Benue State, Nigeria

1.0   Introduction

Fish holds significant economic, social, and cultural value globally, especially as a vital component in sustainable food security (Odebiyi et al., 2013; FAO, 2021). In many countries, particularly in developing regions, fisheries and their associated activities such as processing and marketing are essential sources of livelihood and food security for coastal and rural communities (United Nations, 2014; Allison & Ellis, 2001). The importance of fish marketing has drawn substantial attention from scholars, particularly given fish's role as a key source of animal protein, providing more than 40% of the animal protein intake in Nigeria (Agbebi, 2010; Yusuf et al., 2016). Beyond nutrition, fish contributes significantly to national economies, boosting Gross National Product (GNP) and generating income through extensive production, processing, preservation, and marketing chains (Gomez et al., 2003). Expanding the marketing and accessibility of fish products remains a priority to maximize their potential in advancing food security, public health, and economic development (Adeyeye et al., 2018).

An estimated 45% of the world's catch is handled globally, and the global fish trade has been growing quickly in recent decades (The Fish Project, 2015). Fish products are also highly traded. Nigerians eat a lot of fish. An estimated 1.55 million tonnes of fish are needed annually. Rapid population growth, rising affluence, urbanisation, a greater awareness of the health benefits of eating fish, and advancements in processing, packaging, and distribution technologies are the main factors contributing to the rise in fish consumption (Anderson et al., 2017). Africa has not been able to maximise the social and economic benefits of fish trade due to a lack of proper market information, trade infrastructure, policy, and institutional frameworks, which

restrain intra-regional fish trade (Lokuruka, 2016). High rates of spoiling, ongoing food shortages, rising farm product prices, and significant import expenses are all consequences of substantial food marketing chain malfunctions (Ayinde et al., as cited in Ekine and Binaebi, 2018).

Typically, fish farms and other fish capture locations are situated distant from the marketplace, where there is a risk of fish deterioration and uncertainty over their marketability. Fish preservation becomes essential for their future usage when their numbers exceed the amount that can be consumed. Since fishes are extremely prone to degradation after harvest, it is crucial to process and preserve them to avoid financial losses (Okonta and Ekelemu, in George et al., 2013).

High tropical temperature causes bacteria, enzymes, and chemical oxidation of fish fat, which leads fish to spoil quickly after catch. In Nigeria, between 30 and 50 percent of fish collected are wasted as a result of improper treatment. The use of appropriate handling, processing, and preservation methods could reduce these losses (Bate and Bendall, as mentioned in Ugochukwu, 2017). Due to the lengthy distribution distance, some processing and storage are required because refrigerated preservation is not easily accessible.

2.0   Research Methodology

This study made use of primary data which was collected from 120 fish marketers in the study area using a questionnaire. Multistage sampling was employed to select the sample size. Makurdi local government was selected using purposive sampling and four (4) markets in the local governments were randomly selected which includes Wadata Market, Fiidi Market, Modern Market and Wurukum market. The study employed descriptive and inferential statistics to analyze the data. The hypothesis was tested using t-test.

Table 1: Summary of the sampling procedure and sample size

S/No.	Markets	Sample Frame	Sample Size (10%)
1.	Fiidi	380	38
2.	Wurukum	350	35
3.	Wadata	220	22
4.	Modern Market	250	25
Total			**120**

Source: Author's Computation.

Measurement of Variables

Age: was measured as the chronological age of the farmer in years

Sex: was measured as a dummy variable (male = 1 and female = 0)

Marital Status: was measured as single =0, married =1, divorced =2, widowed or widower =3

Household size: was measured as the number of persons in the household

Educational level: was measured as the number of years spent acquiring formal education

Main Occupation: Producer =1, Processor = 2 and Marketer =3 (Nominal level)

Preservation Strategies: was measured as dummy with value of 1 for each strategy indicated and zero otherwise;

Challenges of Marketing of Fish: was measured as dummy with value of 1 for each indicated and zero otherwise;

Years of experience: was measured as the number of he/she has in fish production, preservation and marketing

Market size: was measured as the number of fishes normally produced or purchased for re-sale.

Model Specification

Multiple Regression Analysis

This was used to examine the effect of preservation strategies on market performance of fish sellers. The model is specified as follows:

The implicit form of the model is specified as:
$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10} + U_i)$ ....(4)
Y = Dependent variable

X_{1-10}= Explanatory variables
U_i = Error term
The explicit form of the model is stated hereunder

Linear function:
$Y_i = \beta_0 + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i} + b_4 X_{4i} + b_5 X_{5i} + b_6 X_{6i} + b_7 X_{7i} + b_8 X_{8i} + b_9 X_{9i} + b_{10} X_{10i} + U_i$

Semi-Log function:
$Y_i = \ln a + b_1 \ln X_{1i} + b_2 \ln X_{2i} + b_3 \ln X_{3i} + b_4 \ln X_{4i} + b_{5i} \ln X_{5i} + b_6 \ln X_{6i} + b_7 \ln X_{7i} + b_8 \ln X_{8i} + b_9 \ln X_{9i} + b_{10} + \ln U_i$

Double log function:
$\ln Y_i = \ln a + b_1 \ln X_{1i} + b_2 \ln X_{2i} + b_3 \ln X_{3i} + b_4 \ln X_{4i} + b_{5i} \ln X_{5i} + b_6 \ln X_{6i} + b_7 \ln X_{7i} + b_8 \ln X_{8i} + b_9 \ln X_{9i} + b_{10} + \ln U_i$

Where;
Y_i= **[Net] returns of selling fish (Naira) or Return on Investment (ROI) = Net profit/Total investment x 100**

β_o-β_5= Unexplained variables
X_{1i}= Smoking (Yes =1, otherwise =0)
X_{2i} = Canning (Yes =1, otherwise = 0)
X_{3i} = Salting(Yes =1, otherwise = 0)
X_{4i} = Freezing (Yes =1, otherwise = 0)
X_{5i} = Chilling(Yes =1, otherwise = 0)
X_{6i} = Drying (Yes =1, otherwise = 0)
X_{7i} = Type of fish sold (=1, otherwise = 0)
X_{8i} = Years of experience (years)
X_{9i} = Market size (number of fishes bought at a time for resale)
X_{10i}= Total Investment (Naira)
Value of coefficient of determination (R^2), the number of significant variables in conformity to apriori expectation.

Gross Margin Analysis (GMA)
This market income (revenue), expenses (cost) and return on investment was estimated using GMA. Gross margin model is specified as follows:
GM = GR-TVC..(5)
Where;
GM = Gross Margin
TVC = Total Variable cost

Return on Investment (ROI)
ROI was used to analyze the market performance of fish sellers.
ROI = Net profit/Total investment x 100

3.0   Result and Discussion

Preservative Strategies Adopted in the Study Area
According to the results gathered from the study and shown in Table 2, most (53.3%) of the respondents adopted or used smoking as a preservative strategy, 22.5% used the drying method, 20.0% used the freezing method, 11.7% used the salting method, 5.0% used caning method while few (3.3%) adopted chilling as a preservative strategy. Most respondents used smoking because of the availability of firewood in the study area. This finding disagrees with Onyango et al. (2017) and UNESCO (2011) which showed that technological drying of fish is the most preferred fish preservation strategy.

Table 2: Preservative Strategies Adopted in the Study Area

Variables	Frequency	Percentage (%)	Rank
Salting	14	11.7	4th
Canning	6	5.0	5th
Smoking	64	53.3	1st
Freezing	24	20.0	3rd
Drying	27	22.5	2nd
Chilling	4	3.3	6th

Source: Field Survey, 2023

Effect of Preservation Strategies on market performance of fish sellers

The result in Table 3 below shows the estimate of the multiple regression analysis of the effects of preservation strategies on the market performance of fish sellers in Makurdi area.

The exponential (with superscript [b]) was selected as the lead equation because it had high R^2 and more significant coefficients that align with the a priori expectation.

The R2 of 0.302 implies that 30.2% of the variation in the market performance is explained by the changes in the independent variables. Furthermore, the F-statistic (5.278) was significant at the 1% probability level. Therefore, the Null Hypothesis which states that "there is no significant effect of preservation strategies on the market performance of fish sellers in the study area is rejected. This implies that preservation strategies significantly affect the market performance of fish marketers. This is because if fish is not properly preserved or handled it leads to spoilage.

The result revealed that market size (0.239) was positive and significant at a 1% level of probability. This implies that a unit increase in market size increases the market performance (revenue) by 0.239 units while holding other variables constant. This result agrees with the findings of Eyo et al. (2004), which state that increases in market size led to an increment in the number of fish available for sale which connotes an increase in income. The result further shows that the use of drying as a preservation strategy has a positive effect on market performance, though it shows a moderate level of statistical significance at the 10% probability level. This suggests that drying, while helpful, might not always lead to consistent outcomes. However, it still aids sellers by extending the shelf life of fish, reducing spoilage, and enabling access to broader markets, which together improve profitability. On the other hand, chilling appears to have a more consistent and stronger impact on market performance, with significance at the 5% probability level. This implies that chilling, perhaps due to its effectiveness in maintaining freshness and quality, leads to better market outcomes. By preserving fish in a chilled state, sellers are likely able to attract more buyers who value freshness, and they can sell the product at higher prices, thus increasing revenue stability.

Finally, total investment in the business emerges as the most influential factor, with a very high level of significance at 1%. This means that the amount of capital invested in the business is directly correlated with improved market performance. Higher investment often translates to better preservation methods, enhanced logistics, and the ability to handle larger quantities, all of which contribute to maximizing profits and expanding market reach.

Table 3: Effect of Preservation Strategies

Valuables	Linear	Double log[b]	Exponential[b]
Type of fish	40.041 (0.604)	0.327 (0.223)	0.126 (0.412)
Market size	-0.007 (0.201)	-0.002 (0.981)	0.239 (0.000)**
Salting	132.045 (0.517)	-1.154 (0.298)	0.017 (0.967)
Caning	285.225 (0.297)	2.310 (0.231)	0.774 (0.156)
Smoking	157.235 (0.323)	0.018 (0.984)	0.180 (0.569)
Freezing	292.104 (0.060)*	0.632 (0.483)	0.192 (0.531)
Drying	451.369 (0.0122)**	-0.976 (0.688)	0.642 (0.071)*
Chilling	857.374 (0.005)*	-0.976 (0.133)	1.480 (0.015)**

Total investment	0.000 (0.021)**	2.577 (0.000)**	1.443 (0.000)***
Constraint	90.593 (0.679)	12.355 (0.000)***	4.953 (0.000)***
F	2.375	4.559	5.278
p>f	0.17	0.000	0000
R-square	0.163	0.213	0.302
Adjusted R-square	0.094	0.094	0.244

*** ** and * significance at 1%, 5% and 10% level respectively. Values in parenthesis represent P-values.
Source: (field survey, 2023)

Cost and returns of fish marketing

The results of the fish marketing analysis reveal that the Total Variable Cost (TVC) is approximately N179,662.09, which is predominantly made up of the cost of purchasing fish, estimated at N176,983.33 (about 99% of TVC). This also includes smaller portions for transportation costs and salaries for workers. On the revenue side, the total income from fish sales is N397,978.33. By subtracting the TVC from this revenue, we arrive at a gross margin of N218,316.24. This positive gross margin suggests that fish marketing is indeed profitable, yielding a significant return over costs.

The findings align with Abah et al. (2013), which demonstrated that both wholesalers and retailers in fish marketing achieved positive profit margins, emphasizing the profitability of the fish trade in this context.

Table 4: Cost and Returns in fish marketing

Variables	N	Mean	%
Cost of buying fish	120	176983.33	98.5
Transportation cost	120	770.42	0004
Salaries to workers	120	1908.33	0.01
Total variable cost	120	179662.09	10000
Revenue from fish sales	120	397978.33	
Gross margin (Revenue-TVC)	120	218316.24	

Source: (field survey, 2023)

Constraints on fish marketing

Table 5 highlights several key challenges faced by fish marketers in the study area, with inadequate capital, spoilage of products, and customer reluctance to buy as the most pressing constraints. Specifically, 60.8% of respondents reported insufficient capital to sustain or grow their business, 40.8% indicated spoilage issues, and 39.2% faced challenges with customers being unwilling to purchase. The capital constraint, reported by over half of the respondents, points to a significant barrier, as fish marketing often requires substantial investment in equipment, transportation, and preservation techniques to maintain product quality. Spoilage, which affects nearly 41% of respondents, further compounds these financial challenges. Limited preservation facilities or unreliable transportation may lead to fish deteriorating before reaching customers, resulting in lost revenue and wasted resources. Additionally, 39.2% of respondents cited customer reluctance to buy, which may be due to various factors, such as perceived quality issues or affordability.

These findings align with the studies by Phukan, Mall, and Mishra (2015), who observed similar constraints in fish marketing, noting the lack of local government support and the challenge of low prices at the farm level. Likewise, Jasbin and Radhika (2016) identified storage and transportation as critical problems for fish marketers, reinforcing the importance of effective infrastructure and support in mitigating these challenges. Together, these issues underscore the need for better financial resources, enhanced storage options, and supportive local policies to improve the efficiency and profitability of fish marketing.

Table 5: Constraints Facing Fish Marketers in Study Area

Constraint	Frequency	Percentage (%)	Rank
Inadequate capital	73	60.8	1st
Unavailability of sales help	26	21.7	6th
High cost of fresh fish	32	26.7	4th
Spoilage	49	40.8	2nd
Inadequate of supply of fresh fish	20	16.7	8th
Unwillingness of customers to buy	47	39.2	3rd
High cost of transportation	29	24.2	5th
Distance from the market	21	17.5	7th

Source: field survey, 2023

4.0   Conclusion and Recommendations

Conclusion

The study examined how different preservation strategies affect the market performance of fish sellers in Makurdi Local Government Area of Benue State. The study found that fish marketing is a profitable business, as evidenced by a positive mean gross margin of N218,316.24, indicating strong profit potential in the area. However, fish sellers face significant challenges, with inadequate capital, spoilage, and customer reluctance to buy identified as the main obstacles to successful fish marketing in Makurdi. The analysis showed that the F-statistic result of 5.278 was highly significant at the 1% probability level, reinforcing the reliability of these findings. Additionally, the study revealed that smoking is the most widely adopted preservation method among fish sellers, with 53.3% of respondents using this technique. Smoking appears to be a preferred choice due to its effectiveness in extending fish shelf life, though it may still leave room for other preservation improvements to mitigate spoilage and attract more customers. These insights highlight both the potential profitability and operational challenges within the local fish market, suggesting the need for support in capital access and preservation facilities to optimize market outcomes for fish sellers in Makurdi. It it is recommended that local authorities and financial institutions consider providing accessible funding options to fish sellers to help alleviate capital constraints. Additionally, investments in improved preservation facilities, such as subsidized cold storage or enhanced smoking techniques, could reduce spoilage rates.

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