



FACTORS INFLUENCING UTILIZATION OF NSPRI DEVELOPED COMPOSITE PACKAGING MATERIALS AMONG CATFISH PROCESSORS IN KWARA STATE, NIGERIA

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ABSTRACT

The examined the factors influencing the utilization of NSPRI developed composite packaging materials among catfish processor in Kwara State, Nigeria. A total of 68 registered catfish processors were randomly selected using a two stage sampling procedure. Data were obtained through the use of a well-structured questionnaire. Descriptive statistics and linear regression were used in analysing the data. Findings from the study showed that majority (60.3%) of the catfish processors were females with an average age of 47.3 years. The results also showed that majority of the processors (85.2%) operated at a small-scale level with an average experience of 8.2 years. More than quarter (26.7%) of the catfish processors were aware of the Nigerian Stored Products Research Institute (NSPRI) developed composite packaging materials, while 38.8% of the respondents had used either Polyethene-Paper or Polyethene-paper-polyethene for fish packaging. The results of the regression analysis revealed that production level, years of education, years of experience, and level of income had a significant positive relationship with utilization of NSPRI composite packaging materials. Respondents identified non-availability of the NSPRI designed composite packaging materials in the market, poor awareness of the relative advantage over polyethene or paper packaging materials and high cost of procurement as major constraints to utilization. The study concluded that level of production, years of education, experience in processing and income were significant in influencing the utilization of NSPRI composite materials among catfish processors' in the study area. Sensitization and training of processors and extension personnel on the advantages of using materials are some of the recommendations made towards increasing awareness and utilisation.

Keywords: NSPRI, Packaging, Catfish, Composite materials, preservation

INTRODUCTION

Fish is a major source of dietary protein with a high amount of micro and macro nutrients. It is a relatively affordable and accessible source of animal protein for people across all social strata, hence the continued increase in demand at both the local and international markets. The fisheries and aquaculture sector have been increasingly recognised for its contribution to global food security and nutrition. Global production of aquatic animals was estimated at 178 million metric tonnes in 2020, with capture fish and aquaculture accounting for 51 and 49 percent, respectively (FAO, 2022). In Nigeria's fish production data has reflected those 5,788,474 tonnes of fish was produced between 2010 and 2015 (NBS, 2017). The fisheries and aquaculture sector significantly contribute to socioeconomic growth, nutrition security, and the livelihoods of both rural and urban dwellers. It is estimated that about 600 million livelihoods depend at least partially on fisheries and aquaculture (FAO, 2022). In Nigeria, the sector contributes 1.09% of the country's Gross Domestic Product (GDP) (NBS, 2021) and provides direct and indirect



employment for about two million people (Odioko & Becer, 2022). Presently, Nigeria is the largest producer of aquatic products in Sub-Saharan Africa and the second largest in Africa (FAO, 2022). This is unconnected to the abundance of natural resources required for both captured and cultured fish production. The potential of the fisheries and aquaculture sector as a source of foreign exchange earnings cannot be overemphasised. The sector not only employs several actors along the value chain, but it also serves as a means of foreign exchange earnings for several countries, generating about 151 billion USD in 2020 amidst the COVID-19 outbreak (FAO 2022). Although, a major producer of fisheries and aquatic products, Nigeria is yet to fully exploit the potential of fish exportation, despite a potential annual revenue of \$296 billion as projected by the World Aquaculture Society. Given the increasing population of Nigerians in diaspora, there exists a huge market for smoked catfish, which fish farmers and processors have continued to make efforts to explore. However, the continued rejection of dried catfish at the international market has always been the bane of exportation. Rejection of smoked catfish due to the presence of polycyclic hydrocarbons, insect infestation, bad smoking techniques, and poor packaging has led to revenue loss for the fish processors. Olayemi *et al.* (2011) noted that the potential of smoked catfish exportation has not been fully exploited due to the use of inappropriate packaging materials, thus limiting the smoked fish business to remain at a small-scale level. Catfish is primarily exported in smoked form for convenient transportation and marketing. The smoked catfish is usually packaged in polyethylene bags, which predisposes the fish to contamination and deterioration. Research has shown that the use of polyethylene for packaging smoked fish provides minimum protection against microbial infection, insect attack, and nutrient loss (Olayemi *et al.* 2015). Hence, the use of appropriate packaging material plays a critical role in the exportation of dry fish, ensuring that the product reaches consumers in optimal condition.

In recent years, the innovative approach to food product packaging has been the use of composite packing materials due to their relative advantages. Consequently, the Nigerian Stored Products Research Institute (NSPRI), a parastatal of the Agricultural Research Council of Nigeria (ARC), developed various composite packaging materials to address challenges associated with the use of polyethylene for packaging (Olayemi *et al.* 2017; Olayemi *et al.* 2011). The composite materials were made from a combination of different materials, such as cardboards paper, and films, and have been empirically proven to preserve the quality of smoked catfish for about six (6) months. It comes in six variants and is laminated with thin film, which prevents the fish oil from smearing the paper bag from inside and offers protection against water and other environmental factors that could destroy the package. Composite packaging materials protect the packaged products from light that can cause rancidity, and they have a see-through opening for viewing the content (Fig. 1). The utilisation of any technology is determined by end-users' perceptions of the relevance and benefits associated with its use. Kumar *et al.* (2018) observed that a favourable perception of an innovation significantly enhances the likelihood of utilisation and eventual adoption. Hence, it becomes pertinent to ascertain the perception of catfish processors on the use of composite packaging materials and the factors that influence utilisation. Specifically, the study ascertained catfish processors' awareness of NSPRI developed composite packaging materials; examined the frequency of usage; ascertained their perception of the composite packaging materials, and identified the constraints to utilisation.



METHODOLOGY

Study Area

The study was carried out in Kwara State, Nigeria. The state is geographically located between latitude 7° 20' and 11° 05' north of the equator longitude 2° 05' and 6° 45' east of the prime meridian (Ogunlade *et al.* 2009). It is located in the North Western Nigeria and because of this unique geographical location; the state is referred to as the “gateway” between the north and south of the country. In Kwara state, artisanal fishing is a prominent activity along the lower River Niger Basin. Aquaculture of catfish is also prominent at both subsistence and commercial levels in the urban and peri-urban areas (Omotesho *et al.* 2017). Thus, the presence of a thriving catfish value chain with several active actors ensuring the sustainability of the sector.

Sampling Technique and Sample Size

The study population comprised all registered members of the catfish processors in Kwara State. A two-stage random sampling technique was used in selecting the respondents for the study. The first stage involved the purposive selection of catfish processors in Ilorin metropolis. Secondly, a random selection of 25% of the registered catfish processors giving a sample size of 68 processors.

Data Collection and Analysis

A well –structured questionnaire was used to collect information from the respondents. Data was analysed using both descriptive and inferential statistics (Linear regression). Frequency counts, percentages and means were used to present the results. The frequency of usage the composite packaging materials was measured using a 3-point Likert scale of Never (1), Rarely (2) and Always (3). The mean scores were a measure of utilisation. A mean score of 2.0 was taken as the cut-off point, such that respondents with a mean score of 2.0 and above were regarded as frequently utilizing the composite packaging materials, while those with a mean score below 2.0 were regarded as rarely utilizing. a negative at-130

Respondents ‘perception of the composite packaging materials was measured using a 3-point Likert Scale. The respondents were exposed to a 13-item perception on a 3-point Likert scale graduated as follows; Agreed=3, Undecided= 2, Disagreed=1. The respondents were required to indicate the extent to which they agreed or disagreed with the statements. The thirteen statements when added together, adequately sums up the catfish processors’ perception. An Individual scores were computed for each respondent, and the scores were converted to mean scores. The mean scores were a measure of the respondents’ perception. A mean score of 2.0 was taken as the cut-off, such that respondents with a mean score of 2.0 and above were regarded as having a favourable perception, while those with a mean score below 2.0 were regarded as possessing an unfavourable perception.

The constraints to utilization of composite packaging materials were measured by presenting a list of possible constraints to the respondents, who indicated the severity using a 3-point Likert-type scale of: Very Severe=4, Severe=3, Not Severe=1. The mean of the response values, which is 2.0, was taken as the benchmark, such that constraint items with a mean score equal to or greater than 2.0 were regarded as severe, while those with a mean score of less than 2.0 were regarded as less severe constraints.

Linear regression model was used to identify factors influencing the utilization of composite packaging materials.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Catfish Processors

Table 1 presents the socio-economic characteristics of the respondents. As shown in Table 1, the mean age of the respondents was 47 years. Majority (76.5%) of the respondents were below 50 years of age. This age distribution of the respondents may give them more leverage in catfish farming as they generally fall within their active and more productive years. The results obtained showed that there were more females (60.3%) involved in catfish processing than their male (39.7%) counterpart. This might be as a result of the nature of catfish processing which does not require much physical strength. Moreso, processing of agricultural products has always been associated to the female gender. Similarly, Babalola *et al.* (2015) also observed that women are more involved in fish processing. The level of education is expected to influence innovativeness and ability to make decisions. Education is therefore highly important for sustainable agricultural growth and development. All the respondents were literate albeit at different levels. This finding corroborates that of Omotesho *et al.* (2019) that majority of catfish processors in Kwara state had tertiary education. As shown in Table 1, 48.5% had tertiary education while 35.3% and 16.2% had secondary and primary education, respectively. This implies that the respondents are not likely to have much difficulty in understanding and adopting modern technologies. The result of this study as presented in Table 1 shows that most (95%) of the respondents had catfish processing experience of more than ten years. This indicates that the processors have some years of reasonable experience. Also, 39.7% of the respondents were primarily involved in fish processing as others had other primary occupations and merely engaged in catfish processing as an alternative or additional source of income. This may have implications for their level of commitment and dedication to fish farming due to the competition for their time by their other occupations. Extension contacts can improve agricultural technologies utilization and adoption. However, only 17.6% of the respondents had contact with extension agents. The awareness and adoption of new agricultural practices are associated with greater contact with extension field staff. All (100%) the fish processors depended on their personal savings as source of capital, majority (85.3%) operated on a small-scale level and had an average income of ₦53,000. This is typical of several agribusiness in Nigeria which is made up of small and medium scale enterprises. This is in line with the findings of Olaoye *et al.* (2015), who reported that fish processing although operated on a small-scale level is a profitable business venture. About 76.5% of the processors marketed all their products locally while 23.5% of the respondents marketed both locally and internationally. All (100%) the respondents utilised polyethylene (nylon) for packaging fish while majority 73.5% were not aware of NSPRI developed composite packaging materials. This indicates that respondents are not aware of NSPRI developed composite materials. This could be due to non-availability of the composite pm in the market to purchase by intending users. On the contrary processors utilised polyethylene (nylon) which is readily available.



Table 1: Distribution of the Respondents according to Socio-economic Characteristics (n=68)

Variables	Frequency	Percentages
Age		
≤40	14	20.6
41- 50	38	55.9
≥51	16	23.5
Mean	47.3	
Sex		
Male	27	39.7
Female	41	60.3
Marital Status		
Single	6	8.8
Married	60	88.2
Widowed	2	2.9
Religion		
Christianity	42	61.8
Islam	26	38.2
Level of Education		
Primary	11	16.2
Secondary	24	35.3
Tertiary	33	48.5
Primary Occupation		
Fish farming	9	13.2
Fish marketing	27	39.7
Fish processing	20	29.4
Civil Servant	12	17.6
Membership of Association		
Yes	68	100
Years of Experience		
≤5	7	10.3
6 – 10	18	26.5
≥10	43	63.2
*Source of capital		
Personal savings	68	100
Friends and relative	14	20.6
Cooperative/thrift society	31	45.6
Micro-finance banks	17	25.0
Production level		
Small-scale	58	85.3
Medium	7	10.3
Large	3	4.4
Extension Contact		
Yes	12	17.6
No	56	82.4I
Income from fish Processing (₦)		
≤50,000	16	23.5



50,001- 100,000	40	58.8
≥100,000	12	17.7
Mean	₦53000	
Marketing of Products		
Local	52	76.5
International	7	10.3
Both	9	13.2
Percentage of produce exported		
≤25%	2	12.5
26% - 50%	9	56.3
≥50%	5	31.2
*Packaging materials utilised		
Paper	12	17.6
Nylon	68	100
Composite materials	11	16.2
Awareness of NSPRI composite packaging materials		
Yes	18	26.5
No	50	73.5

Source: Field survey, 2024 *Multiple Response

Catfish Processors' Awareness of Composite Packaging Materials

Awareness is the consciousness and level of enlightenment which an individual or group possess about a particular concept Awareness is the first stage in the process of adoption of any innovation (Ogunremi and Olatunji, 2020). Table 2 presents the catfish processors' awareness of NSPRI developed composite packaging materials. Results as shown in Table 2 reveals that out of the six types of NSPRI developed composite packaging materials designed by the institute, the catfish processors were mostly aware of aware of Polyethene-Paper (100%) and Polyethene-Paper Polyethene (83.3%).

.Table 2: Catfish Processors' Awareness of Composite Packaging Materials

TYPES	AWARENESS	
	Yes	No
	F (%)	F (%)
Paper -Polyethene (PaPe)	14(77.8)	4(22.2)
Polyethene-Paper (PePa)	18 (100)	0(0)
Polyethene-Paper Polyethene (PePaPe)	15(83.3)	3(16.7)
Cardboard line with Polyethene (CN)	13 (72)	5(27.8)
Polyethene lined with Cardboard (NC)	8(44)	10(55.6)
Polyethene-Cardboard-Polyethene (NCN)	9 (50)	9(50)

Source: Field survey, 2024

Frequency of Usage Composite Packaging Materials

Table 3 presents the frequency of usage of NSPRI developed composite packaging materials. Results as shown in Table 3 reveals the frequency of usage of the NSPRI

developed composite packaging materials. Going by the benchmark of 2.0, all the composite packaging materials had a mean less than 2.0. this indicate that none was frequently utilised by the processors. This could be a limiting factor in the ability of catfish processors to maximise the international demand for smoked catfish.

Table 3: Frequency of Usage Composite Packaging Materials

Types	Frequency of usage			Mean
	Never	Rarely	Often	
Paper -Polyethene (PaPe)	12	5	1	1.39
Polyethene-Paper (PePa)	8	5	5	1.80
Polyethene-Paper-Polyethene (PePaPe)	17	1	0	1.70
Cardboard lined with Polyethene (CN)	9	9	0	1.50
Polyethene lined with Cardboard (NC)	10	7	1	1.50
Polyethene-Cardboard-Polyethene (NCN)	15	1	0	0.94

Source: Field survey, 2024

Catfish Processors' Perception of NSPRI Developed Composite Packaging Materials

Table 4 presents respondents' perception of NSPRI developed composite packaging materials. Results as shown in Table 4 reveals that respondents showed favourable perception to nine out of the thirteen perception statements presented. The most favourably perceived statement is composite packaging materials are stronger and durable ($\bar{x}=2.43$), it can be tailored made to desired size ($\bar{x}=2.20$) and it prevents odour permeation and physical damage ($\bar{x}=2.17$) ranked second and third respectively. This implies that processors are favourably disposed to the composite packaging materials and this could be leveraged upon to push for adoption. Perception and adoption Specifically, Adrian *et al.* (2005) have shown that a confident attitude towards the use of a variety of technologies, combined with the perceptions of associated net benefits, positively influenced farmers' intentions to adopt novel technologies.

Table 4: Catfish Processors' Perception of NSPRI Developed Composite Packaging Materials

Perception Statements	Agreed	Undecided	Disagreed	Mean	SD
Composite packaging material helps to preserve the quality and freshness of smoked fish.	20	30	18	2.03	0.63
Composite packaging materials are stronger and durable.	41	9	18	2.34	0.71
It gives protective barrier against external factors such as moisture and microbial contamination.	28	24	16	2.18	1.02
It can be tailored made to desired size.	33	21	14	2.27	0.84
Composite packaging materials are recyclable and eco-friendly.	36	7	25	2.16	0.60
It maintains products freshness and extends shelf Life.	25	18	25	2.0	1.21
It provides resistance against punctures and tears especially during handling, transportation and storage.	31	16	21	2.15	0.78
It prevents odour permeation and physical damage.	25	32	11	2.20	0.92
It maintains the nutrient/ quality of dried fish.	32	16	18	2.15	1.15
It improves the marketability of products	24	15	29	1.95	1.32
It can protect smoked dried fish for a period of 3 to 6 months from physical, chemical and biological damage.	9	11	45	1.38	1.04
It is light weight and easy to transport	23	19	26	1.95	1.27
It enhances consumers acceptance.	1	11	56	1.20	0.96

Source: Field survey, 2024 Likert Scale: Agreed=3, Undecided=2, and Disagreed=1. Benchmark for perception is 2.0. Decision rule: Mean score = 2.0 and above (favourable perception), Mean score = less than 2.0 (unfavourable perception)

Constraints to Adoption of Nspri Designed Composite Packaging Materials

Table 5 shows that non-availability of the NSPRI designed composite packaging materials in the market (\bar{x} =2.85), inadequate awareness of the relative advantage over polyethylene or paper packaging materials (\bar{x} =2.50), high cost of procurement (\bar{x} =2.31) and bulkiness of the composite packaging materials (\bar{x} =2.17) were considered as the severe constraints to utilisation.

Table 5: Constraints to Adoption of NSPRI Designed Composite Packaging Materials

Constraints	Not Severe	Severe	Very Severe	Mean
High cost of procurement.	29			2.31
Non-availability of the NSPRI Designed Composite Packaging Materials (NDCPM) in the market.				2.85
Inadequate awareness of the relative advantage over polyethylene or paper packaging materials.				2.50
Poor knowledge and skills on usage.				1.05
Reduced Consumers' acceptability				1.92
Bulkiness				2.17

Source: Field survey, 2024 Note: Likert Scale: very severe=3, severe=2, and Not severe=1. Bench mark for constraint is 2.0. Decision rule: Mean score = 2.0 and above (severe constraint), Mean score = less than 2.0 (less severe constraints)

Table 6: Factors Influencing the Adoption of NSPRI Developed Composite Packaging Materials

Variables	B	Standard error	Beta	T	sig
Constant	97.143	12.125		6.235	0.000
Age	-1.325	1.110	-.210	-.906	0.612
Sex	-3.303	5.126	-.144	-.769	0.409
Contact with Extension Agents	1.922	2.556	.961	.783	0.912
Production Level	1.731	2.899	.105	.601	0.051*
Years of education	1.28	1.511	.078	.741	0.002*
Group membership	-.048	.187	-.080	-.957	0.401
Years of experience	-4.217	2.004	-.165	-1.947	0.022*
Income	.520	.2110	-.288	2.686	0.008*
R-Square	.451=45.1%				
Adjusted R Square	.56= 56%				
F- Statistics	3.114				

Source: Field survey, 2024 *Significant at 5% level of probability

The result of linear regression analysis as presented in Table 6 shows that production level, years of education, years of experience, and level of income had a significant positive relationship ($P < 0.10$) with utilisation of the NSPRI developed composite packaging materials. The positive coefficients connote a direct relationship between the variables and utilisation. Therefore, an increase in these variables will significantly increase utilisation among the processors. However, age, sex, contact with extension agents and group membership had no influence on utilisation. Fadeyi *et al* (2022) also confirmed that social, economic and financial are some of the factors that influence technology adoption and utilization in Africa.

CONCLUSION AND RECOMMENDATION

The study concluded that catfish processors operated on a small-scale level. They were majorly unaware of the Nigerian Stored Products Research Institute (NSPRI) developed composite packaging materials hence utilisation of composite packaging materials is low.



Polyethene-Paper and Polyethene-paper-polyethene were the most utilised composite packaging materials. Production level, years of education, group membership, years of experience, and level of income had a significant positive relationship with utilisation. Non-availability of the composite packaging material for purchase and inadequate awareness of its relative advantage were some of the constraints to utilisation.

Based on these findings, the following recommendations were made:

- Sensitization of extension personnel on the advantages of using the composite packaging materials.
- Public and private partnership in providing agricultural extension services to processors.
- Sensitization of processors on the relative advantage of the composite packaging materials.
- Training of processors on the production of the composite packaging materials.
- The composite packaging material should be patented and trademarked.

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