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ROLES OF ACTORS, ADOPTION OF INNOVATION, AND CHALLENGES WITHIN THE FISHERIES INNOVATION SYSTEM AMONG PRODUCERS IN ADAMAWA STATE NIGERIA

ABSTRACT

The study examined the roles of actors, adoption of innovation, and challenges within the fisheries innovation system in Adamawa State Nigeria. Data were collected from 200 respondents through field survey and analyzed using descriptive statistics. The findings revealed that the fisheries innovation system is characterized by the active participation of multiple actors, with the major roles including training manpower (25.0%), production and sales of fish (24.0%), training of other actors (17.5%), supply of funds and credit facilities (7.5%), technology generation (8.0%), and dissemination of generated technologies (7.0%). The study also showed that fish farmers, marketers, extension agents, researchers, feed millers, transporters, and drug dealers each contribute in different ways to the functioning of the system. Results further indicated that 97.0% of respondents were willing to adopt and implement innovations in fish production and marketing, suggesting a high potential for innovation uptake in the study area. However, several constraints were identified as major barriers to effective innovation, including poor access to capital, unfavorable government policies, insecurity/insurgency, inadequate capital, poor access to information, low literacy level, gender bias, and cultural factors. Among these, poor access to capital and insecurity were the most severe challenges. The study concludes that although the fisheries innovation system in Adamawa State has strong actor participation and high adoption potential, its performance is constrained by financial, institutional, and socio-cultural limitations. It is recommended that government and stakeholders improve access to credit, strengthen extension services, enhance security, provide supportive policies, and promote inclusive participation to improve the sustainability and productivity of the fisheries sector in Adamawa State.

Keywords: Roles, Actors, Adoption, Innovation, Challenges, Fisheries

INTRODUCTION

Fish production plays a vital role in global food security and is an essential part of the agricultural sector, particularly through fish farming. It helps combat nutritional deficiencies and reduce poverty, especially in developing countries (FAO, 2020; Kallem & Sabi, 2021).

Modern fish farming in Nigeria began during World War II, and today, Nigeria is the leading aquaculture producer in Sub-Saharan Africa, contributing significantly to employment, income generation, and food security. In 2022, Nigeria produced 275,645 metric tons of aquaculture fish, with catfish being the dominant species (FAO, 2022). Despite this growth, Nigeria's fish production falls short of domestic demand, with a deficit of 2.5 million tons that is met through imports. Fish remains a primary source of protein, contributing to nearly 40% of the country's protein intake. However, fish consumption in Nigeria is still lower than the regional average (Babatunde *et al.*, 2021). The innovation system of fish marketing in Adamawa State plays a crucial role in addressing these challenges by enhancing efficiency in the supply chain and improving the roles of various actors involved in production, handling, and distribution.

The marketing process in Adamawa State involves multiple actors, from fish producers to marketers, each contributing to the value chain. However, the interactions among these actors and their roles in fostering innovation through knowledge exchange, new ideas, and improved practices—have not been fully explored. Innovation in this context does not only stem from research and development but also from the practical knowledge and processes applied by farmers and marketers on the ground (Abdullahi *et al.*, 2022). The need for innovation in the fisheries sub-sector is clear, as actors must improve efficiency, eliminate waste, and adapt to increasing demand driven by population growth (UNPF, 2010; Ajibefun & Daramola, 2020).

The study of the innovation system in fish marketing in Adamawa State aims to identify the key actors, understand their roles, and examine how they interact to improve the marketing of fish. Effective innovation in this sector is crucial for enhancing productivity, overcoming challenges of perishability, and ultimately achieving food security and poverty reduction.

METHODOLOGY

This study was carried out in Adamawa state which is located at the Northeastern part of Nigeria. It lies between latitudes 7° – 11° N of the equator and between longitudes 11° – 14° E of the Greenwich meridian (Adebayo and Tukur, 2020). The State consists of twenty one Local Government Areas (LGAs). These are further divided into four agricultural development projects (ADP) zones: zone 1, 2, 3 and 4 as shown in figure 3.1. It shares a common boundary with Taraba State in the south and west, Gombe State in the Northwest and Borno State in the North; it also has an International boundary with Cameroon Republic along its eastern borders (Adebayo *et al.*, 2012; Adamawa State Diary, 2020). Annual rainfall in the state ranges from 900 to 1600mm while annual maximum temperature ranges between 39°C and 45°C. Majority of the populace are farmers; others are fishermen, civil-servants, marketers and people of various trades. Adamawa State is one of the leading producers of crops like Maize, Rice, Cowpea, Sorghum, groundnuts and cotton (Adebayo and Tukur, 2020) while major animals produced include cattle, other small ruminants and monogastric birds (Babale, *et al.*, 2012).

Data for this study was obtained majorly from primary source with the aid of well-structured questionnaire which were administered to the Actors via the use of Kobo Collect that was installed on mobile devices. Khan, *et al.*, (2017), Hamisu, *et al.*, (2024) and Madugu *et al.*, (2024).

A multistage, simple random sampling and snow ball sampling techniques were employed to arrive at obtaining the total sample frame of two hundred (200) for this study. Finally, the data that were

collected were further analyzed with the use of descriptive statistically approach which included: the use of frequencies, percentages and tables.

RESULTS AND DISCUSSION

Roles of Actors in Innovation System

The result revealed the roles of actor in the innovation system majority of respondents contributions are training man power, (25%), followed by production and sales of fish (24%), (17.5%) training other actors, (7.5%) seeking government/private sector intervention and Supply of Fund and Credit Facility, (8%) technology generation, (7%) dissemination of generated technology, and lowest is (3.5%) other, in the study area. This implies that capacity building and market-oriented activities are the dominant functions within the innovation system, highlighting the importance of human capital development and active participation in fish production and marketing as key drivers of innovation. in the study area. This finding is consistent with the work of Madugu and Edward (2011), who reported that capacity building, knowledge sharing, and market participation are key functions performed by actors in agricultural innovation systems. Their study emphasized that training and human capital development enhance the ability of farmers and other stakeholders to adopt improved technologies, while effective market engagement strengthens income generation and sustainability within the system. Thus, the prominence of training and production-related activities in this study underscores the critical role of knowledge dissemination and economic participation in driving innovation in the fisheries sector.

Table 1. Distribution of Responses of Roles Actors in the Innovation System

Roles	Frequency	Percentage (%)
Training Man Power	50	25.00
Training of other Actors	35	17.50
Technology Generation	16	8.00
Dissemination of Generated Technology	14	7.00
Supply of Fund and Credit Facility	15	7.50
Seeking Government/Private Sector Intervention	15	7.50
Production and Sales of Fish	48	24.00
Others	7	3.50
Total:	200	100

Source: Field Survey, 2025.

Major Role of the Actors in Fishery Innovation System among producers in Adamawa State

The results revealed that the roles played by different actors within the fishery innovation system of Adamawa State, highlighting the interdependence of stakeholders involved in fish production, distribution, and innovation. The results reflected a multi-actor innovation system, where each participant contributes uniquely to the overall performance, sustainability, and resilience of the fisheries sector.

The results also revealed that Fish rearers/breeders play a central role by producing fish for household consumption and market supply, thereby contributing directly to food security and income generation. Their position as primary producers places them at the core of the innovation

system, as they are the main adopters of new technologies and management practices. This finding aligns with the Agricultural Innovation Systems (AIS) framework, which identifies producers as the nucleus around which innovation activities revolve (World Bank, 2018). Similar observations were reported by FAO (2022), which emphasized the role of small-scale fish farmers in enhancing protein availability and rural livelihoods in sub-Saharan Africa.

The results also shows that Fish marketers are responsible for distributing fish to consumers, ensuring product availability and market access. Their role strengthens market linkages and price transmission within the value chain, which is essential for incentivizing production and innovation. According to Reardon *et al.* (2020), efficient marketing systems improve value chain coordination and reduce transaction costs, thereby enhancing the performance of agricultural innovation systems, including fisheries.

The results revealed that the Feed millers supply nutritious fish feed, which is critical for fish growth, health, and productivity. The availability and quality of feed directly influence production efficiency and profitability. This finding is consistent with Tacon and Metian (2020), who identified feed quality and accessibility as major determinants of aquaculture productivity and innovation adoption globally.

Also, it can be seen observed from the results that Extension agents facilitate the transfer of technologies and best management practices to fish producers. Their role in bridging the gap between research and practice is essential for innovation diffusion. However, studies such as Anderson and Feder (2020) have noted that the effectiveness of extension services in many developing countries is constrained by limited funding and human resources, which may affect the intensity of their impact within the innovation system.

The Research institutes and universities on the other hand, contribute through the development of improved technologies and the training of skilled manpower. Their involvement ensures the generation of context-specific innovations and capacity building among actors. This supports findings by Klerkx *et al.* (2021), who emphasized that strong research–producer linkages enhance innovation system performance and technological learning.

The results showed that the Transporters facilitate the movement of fish from production sites to markets, thereby reducing post-harvest losses and maintaining product quality. Efficient transportation systems are particularly important for perishable commodities such as fish. FAO (2023) reported that improved logistics significantly reduce spoilage and increase returns along fisheries value chains in developing economies.

The results revealed that Government agencies play regulatory and supportive roles, including policy formulation, industry promotion, and the provision of funds and credit facilities. Their involvement is crucial for creating an enabling environment for innovation through infrastructure development, financial support, and institutional coordination. This finding aligns with Spielman *et al.* (2021), who emphasized the importance of public sector facilitation in strengthening agricultural innovation systems.

The results revealed that Fish drug dealers provide essential veterinary inputs for disease prevention and management, which is vital for sustaining fish health and minimizing production risks. Adequate access to fish health inputs supports biosecurity and productivity, as highlighted by Bondad-

Reantaso *et al.* (2020), who stressed the importance of aquatic animal health services in sustainable aquaculture systems.

Table 2. Distribution Major Role of the Actors in Fishery Innovation System among producers in Adamawa State

Actors	Roles
Fish Marketers	- Training man power - Training of other actors - Sales of fish to consumers
Fish Farmer/Producer	- Training man power - Training of other actors - Dissemination of generated technology - Production and sales of fish
Fish Seed Miller	- Training man power - Training of other actors - Supply of feeds to farmers/producer
Fish Drug Dealer	- Training man power - Training of other actors - Dissemination of generated technology - Supply of drugs to farmers/producers
Transporter	- Transporting fish to another location - Provision of means of transport to mover fish to another location - sale of fish
Extension agent	- Disseminating generated technologies others actors in the innovation system - Organizing awareness campaign, door to door visit and demonstration - Provision of information to all other actors in the innovation system
Research institutes	- Generating new ideas (innovation). - Training manpower in various disciplines

Source: Field Survey, 2026.

Actors that will adopt and implement an innovation in fish production

The result revealed that the actors that willing adopt and implement an innovation in fish marketing which were (97.00%) of the respondent and those that will not adopt and implement innovation in fish marketing were (3.00%). This implies that there is a very high level of willingness among actors to adopt and implement innovations in fish marketing, suggesting a strong potential for successful diffusion of improved practices, enhanced efficiency, and increased productivity within the fish

marketing system. According to Bolorundo and Adesehenwa, (2014), stated that the adoption and implement an innovation in fish marketing depend on cost availability of recommended inputs and case of handling.

Table 3. Distribution Actors that will adopt and Implement an Innovation in Fish production

Actors	Frequency	Percentage (%)
Yes	194	97.00
No	6	3.00
Total:	200	100

Source: Field Survey, 2026.

Multiple Responses of Challenges of Fisheries Innovation System among producers in Adamawa State

The problems faced by fisheries innovation system in the study area were ranked according to their severity stated by the respondents. The revealed that the multiple responses on challenges of problems of fisheries innovation system in Adamawa state was lack of poor access to capital were (19.18%) unfavourable government policies with (16.46%) and Insecurity/Insurgency (14.42%) respectively and were ranked 1st, 2nd and 3rd which indicating that these are the most pressing and severe issues negatively affecting the innovation process. Cultural factors (2.86%) were ranked 10th were culture, belief and religion of the area restrict the interaction of males and females that are not spouses; the females doing that are commonly classified as uncultured and irresponsible. This lead to gender biasness, implying that females do not have the opportunity to contribute to the innovation process which further decreases the participation of actors in the innovation process. This finding is consistent with Madugu et al. (2019), who reported that limited access to finance, policy constraints, and socio-cultural barriers significantly hinder agricultural innovation systems in developing regions. Their study further emphasized that gender inequality and cultural restrictions reduce the participation of women, thereby weakening knowledge exchange, collaboration, and the overall efficiency of the innovation process.

Table 4 Distribution of multiple Challenges Encountered in Fisheries Innovation System Among producers in Adamawa State

Problems	Frequency	Percentage (%)	rank
Lack of Access to Capital	141	19.18	1 st
Unfavorable Gout Policies	121	16.46	2 nd
Insecurity/Insurgency	106	14.42	3 rd
Inadequate Capital	79	10.75	4 th
Poor Access to Information	74	10.07	5 th
Low Literacy Level	71	9.66	6 th
Competition with other Actors	57	7.76	7 th
Low Participation in Innovation Process	41	5.58	8 th
Gender Biasness	24	3.27	9 th

Cultural Factor	21	2.86	10 th
Total:	735	100	

Source: Field Survey, 2026.

Major Challenges of Fisheries Innovation System in Adamawa State

The result revealed that the major problems fisheries innovation among producers in Adamawa State. The highest major's problem of fisheries innovation system in the study area were Lack of Access to Capital (28%) Which was as a result of inadequate sources of finance and the problem of collateral before obtained loan. This was ranked the first which implies that respondents have limited access to formal credit, often relying on non-governmental organizations (NGOs) and commercial bank loans. However, insecurity/insurgency were (24%), were ranked second which was in line with the findings of Ali et al. (2018), who reported that insecurity in northern Nigeria significantly disrupts agricultural activities, discourages investment, and limits the participation of actors in production and marketing systems. Inadequate Capital (17%) ranked third of the innovation problems limiting operation and expansion of marketing activities in the study area. The problem in accessing credit was mainly related to absence of collateral, high interest rate of commercial bank and lowest were poor access to information and low participation in innovation process were (3.5%) ranked at 7th and 8th respectively. Which is not in line with report presented by (Abdul & Olawale 2020). The majority of fishermen fishing at sea and in major lakes have expressed concerns about theft and lack of security while fishing. Fishermen are being attacked and even killed by thieves trying to steal their gear and boats.

Table 5. Distribution Challenges of Fisheries Innovation System among producers in Adamawa state

Problems	Frequency	Percentage (%)	Rank
Lack of Access to Capital	56	28	1 st
Insecurity/Insurgency	48	24	2 nd
Inadequate Capital	34	17	3 rd
Unfavorable Govt Policies	20	10	4 th
Low Literacy Level	16	8	5 th
Competition with other Actors	12	6	6 th
Poor Access to Information	7	3.5	7 th
Low Participation in Innovation Process	7	3.5	8 th
Total:	200	100	

Source: Field Survey, 2026.

CONCLUSION AND RECOMMENDATIONS

The study examined the roles of actors, adoption of innovation, and challenges within the fisheries innovation system among producers in Adamawa State. The findings revealed that the innovation system is highly participatory, involving multiple actors such as fish farmers, marketers, extension agents, researchers, feed millers, transporters, and input suppliers, each contributing significantly to

the overall performance of the sector. Training of manpower and production/sales of fish emerged as the most prominent roles, highlighting the importance of capacity building and market-oriented activities in sustaining the system.

The study further established that there is a high willingness among actors (97%) to adopt and implement innovations in fish production and marketing, indicating a strong potential for technological advancement and improved productivity in the sector. However, despite this positive disposition, several constraints continue to hinder the effectiveness of the fisheries innovation system.

Based on the findings of the study, the following recommendations are proposed to strengthen the fisheries innovation system in Adamawa State:

- i. Government and relevant stakeholders should improve access to affordable credit facilities for fish farmers and marketers by reducing collateral requirements and interest rates, as well as promoting microfinance and cooperative-based lending schemes.
- ii. There is a need for the provision of basic infrastructure such as good roads, electricity, water supply, and cold storage facilities to enhance fish production, preservation, and marketing efficiency.
- iii. Extension services should be strengthened through increased funding, recruitment, and training of personnel to ensure effective dissemination of innovations and improved linkage between research institutions and producers.
- iv. Policies that support fisheries development should be formulated and properly implemented, ensuring a stable and enabling environment for innovation and investment in the sector.
- v. Security measures should be enhanced to address insecurity and insurgency, thereby encouraging active participation of actors and facilitating smooth market operations.
- vi. Capacity-building programs, including training and awareness campaigns, should be intensified to improve the knowledge and skills of all actors within the innovation system.
- vii. Efforts should be made to promote inclusiveness by addressing cultural barriers and gender bias, ensuring that women and other marginalized groups actively participate in fisheries innovation activities.

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