Aquaculture International (2025) 33:659
https://doi.org/10.1007/s10499-025-02346-5

RESEARCH

Investigation of gender roles and challenges in the tilapia value chain activities in Ogun State, Nigeria

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Received: 11 September 2025 / Accepted: 3 November 2025

Abstract

Tilapia (*Oreochromis niloticus*) production and distribution play a crucial role in providing essential animal protein and socio-economic benefits that support growth and development in riverine communities. This study examines the tilapia value chain (TVC) in Abeokuta, Ogun State, Nigeria, using a multistage sampling approach. A total of 195 actors were selected, including 3 fish seed producers, 3 feed suppliers, 3 grow-out tilapia farmers, 25 fish processors, 30 wholesalers, 30 retailers, and 101 consumers, with data collected via structured questionnaires. Results show that fish processing is primarily driven by women, with the majority of processors aged between 31 and 40 years. Likewise, fish marketing is predominantly managed by women, most of whom fall within the 41 to 50 age range. A considerable number of processors are members of cooperatives, work part-time, and rely on charcoal for smoking fish. Among fish marketers both wholesalers and retailers, 52.0% fund their businesses through personal savings, and 73.3% source fish directly from farmers. Additionally, 56.7% employ paid labor, and 66.7% operate within local markets. Gender roles are clearly defined along the value chain revealing that women mainly handle pre-processing activities such as washing, descaling, and degutting, while men dominate fish seed production, feed supply, and grow-out tilapia farming. Fish transportation is exclusively undertaken by men, whereas both men and women are involved in fish folding and sticking. Notably, there is no record of farmed tilapia being exported. Key challenges facing the sector include the high cost of processing equipment and fuel/charcoal, poor fish quality, and limited market information, all of which hinder effective fish processing and marketing. Furthermore, the high cost of fish feed remains a major constraint for fish seed producers, feed suppliers, and grow-out farmers.

Keywords Cage culture · Fish production · Gender equality · Tilapia culture · Value chain

Handling Editor: Gavin Burnell

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Introduction

The aquaculture industry contributes almost half of the world's fish production and remains the fastest-growing food production sector (Kaleem and Sabi 2020; Irabor et al. 2022). Galappaththi et al. (2020) noted four hundred and twenty-four (424) aquatic species are cultivated globally, benefiting millions of people through the provision of nutrition, food security, sustainable livelihood, and poverty reduction. Global fish production was 178.5 million tonnes in 2018, with China being the major fish producer, accounting for 35% of global fish production. Worldwide, fish provide 20% of the average per capita intake of animal proteins for more than 3.3 billion people (FAO, 2020).

Nigeria is the largest fish producer in sub-Saharan Africa, accounting for 52% of the total farmed fish production in the region (Adeleke et al. 2020; Agbugui et al. 2025). Nigeria's aquaculture focuses mainly on freshwater fish, with species of farmed catfish (*Clarias gariepinus*) accounting for 64% of aquaculture production in 2015 (WorldFish 2018). Tilapia (*Oreochromis niloticus*) is the second most farmed fish species in Nigeria (Fagbenro et al. 2010; Atanda and Fagbenro 2017; Kaleem and Sabi 2020; Agrifarming 2021). With over 150 tons of fish from cage culture systems in 2017 (Obwanga et al., 2018), Nigeria has not been able to meet domestic fish demand (Ozigbo et al. 2014; Marin et al. 2024; Akpalu and Nnaemeka 2025); hence, it is resorting to importing fish to make up the shortfall in fish supply to meet national per capita fish consumption.

In Nigeria, Ogun State is one of the major producers of tilapia, primarily through the cage culture system. Cage culture, which is ideal for tilapia production due to its prolific reproduction, is an underutilised fish farming system in Nigeria (Okomoda et al. 2025). It has the capacity to significantly increase annual aquaculture production if more investments are made to increase the available natural water bodies suitable for commercial tilapia farming and value chain development (Obwanga et al., 2018). Although tilapia fish is widely consumed, especially in the rural areas of the state, its production and value chain are not fully developed. Therefore, this study investigated the tilapia value chain to identify specific knowledge gaps on gender roles, production characteristics, other socio-economic dynamics and their impacts within the aquaculture sector in Ogun State, Nigeria.

Materials and methods

Study area

This study was conducted at Oyan Dam, located in Abeokuta North Local Government Area (LGA) of Ogun State, approximately 20 km northwest of the state capital, Abeokuta (Fig. 1). The dam spans the Oyan River, a tributary of the Ogun River (Adeosun 2016).

Ogun State offers several factors that enhance its suitability for Tilapia production. Its tropical climate, with relatively stable annual temperatures ranging from 24 °C to 32 °C, falls within the optimal range for tilapia growth (25 °C–30 °C), enabling year-round production. The state is rich in freshwater resources, including the Ogun River, various dams, and tributaries flowing across Abeokuta. This makes Ogun State one of

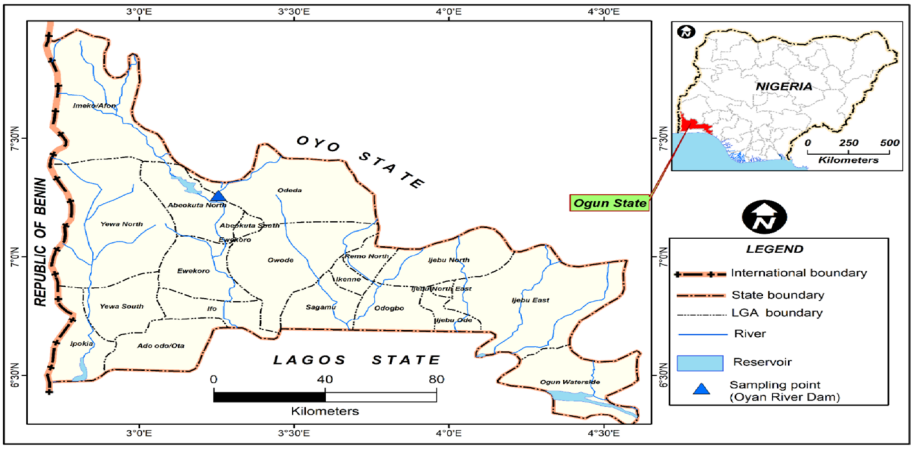


Fig. 1 Map of Ogun State showing the location of Oyan dam, Odeda. Source: Field survey, 2022

Nigeria's leading tilapia producers. Additionally, its proximity to major markets like Lagos and Ibadan further supports Tilapia production, making it an ideal microcosm for this study.

Data collection

A multi-stage sampling procedure was employed for this study. In the first stage, the entire population within the study area was divided into subgroups. These subgroups were formed based on key factors such as age, gender, scale of production (large, medium, and small), purchasing power, return on investment, and specific constraints. This ensured that all categories of key actors and relevant variables were considered to minimize bias.

Considering the already well-randomized subgroups, the second stage entailed purposive selection of 3 producers specialized in the commercialization of Tilapia fish production in Oyan Dam. The third stage involved a random selection of 6 input suppliers (3 hatcheries and 3 feed suppliers), and the fourth stage involved the random selection of 30 wholesalers, 30 retailers, and 25 tilapia fish processors from the host communities. The final stage involved the random selection of 101 Tilapia fish consumers selected from three communities (Abule Sikiru, Ibaro, and Abule Tuntun) due to their proximity to Oyan Dam, Ogun State.

A total of 195 actors along the tilapia value chain were selected for the study based on criteria such as their active involvement, geographical location, and experience within the chain. To gather comprehensive data, five questionnaires incorporating both closed- and open-ended questions were developed and administered. These questionnaires targeted specific value chain actors—including fish seed producers, grow-out farmers, processors, and marketers—to obtain detailed information on their socio-economic characteristics, key activities within the tilapia value chain (see Fig. 2 below), information flow related to tilapia products, sources of information, and their constraints.

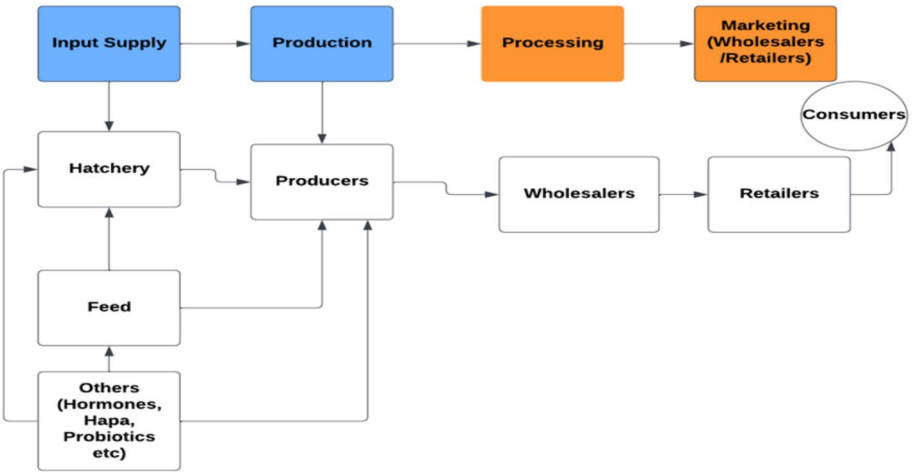


Fig. 2 Tilapia value chain (TVC) flowchart. Source: Author's visualization

Table 1 Number of respondents in the Tilapia value chain

Key players	Number of respondents
Fish seed producers	3
Fish feed suppliers	3
Grow out farmers	3
Processors	25
Wholesalers	30
Retailers	30
Consumers	101

Data analysis Data collected using the five questionnaires was labelled, and variables were analysed using descriptive statistics in SPSS version 20.0 and presented using frequency counts, percentages, and charts.

Results

Socio-economic and production characteristics of the different tilapia value chain actors

The key actors identified in the tilapia value chain in Ogun State, Nigeria, were input suppliers (fish seed producers and feed suppliers), producers (Grow-out), processors, marketers (wholesalers and retailers), and consumers. The total number of respondents surveyed in the study is presented in Table 1 (Table 2).

Table 2 Socio-economic characteristics of the different Tilapia value chain actors

Characteristics	Fish seed producers	Feed suppliers	Farmers	Processors	Marketers
Age (years)					
< 30				12	15
31–40	100	66.7	33.3	52	15
41–50	-	33.3	66.7	36	63.3
51–60	-	-	-	-	6.7
Gender					
Male	100	66.7	100	44	23.3
Female	-	33.3	-	56	76.7
Marital status					
Married	100	100	100	44	25
Single	-	-	-	56	75
Educational level					
Primary	-	-	-	32	46.7
Secondary	-	-	-	20	33.3
Tertiary	100	100	100	48	20
Household size					
1 – 5	66.7	66.7	100	76	25
6–10	33.3	33.3	-	24	75
10–15	-	-	-	-	-
Farming experience (years)					
1–5	33.3	33.3	-	8	1.7
6–10	66.7	66.7	33.3	52	40
11–15	-	-	66.7	40	58.3

Fish seed producers

The input suppliers identified were fish seed producers (hatcheries) and feed suppliers, all operating commercially and owned by aquaculture association members aged 31–40 (Table 3). Catfish was the primary species, with most hatcheries producing both catfish and tilapia, while some specialized in tilapia. Most producers had 6–10 years of experience. Hatchery systems varied between recirculating systems with hapa nets and hapa nets in earthen ponds, all on purchased land. Most hatcheries were outdoor, with some integrating indoor facilities. All produced sex-reversed all-male tilapia fingerlings (1–5 g) for direct farm gate sales. Broodstock was mainly imported from Thailand, with some sourced locally. Producers consistently used hired labour, reservoir water, and imported feed (Table 4).

Fish feed supply characteristics

Most fish feed suppliers are members of aquaculture associations and cooperatives, with several years of experience, and primarily use personal savings to start and operate their

Table 3 Fish seed producers' characteristics

Category	Frequency ($n=3$)	Percentage (%)
Age of fish seed producers		
31–40 years	3	100
Ownership of hatcheries		
Individually owned	3	100
Association membership		
Members of aquaculture-related associations	3	100
Financing source		
Personal savings	3	100
Species raised by hatcheries		
Catfish and other species	2	66.7
Only Tilapia	1	33.3
Purpose of fish seed production		
Commercial scale production	3	100
Years of experience		
6–10 years	2	66.7
1–5 years	1	33.3
Culture facility management Systems used		
Recirculating systems and hapa net	2	66.7
Hapa net in earthen pond	1	33.3
Type of hatchery		
Outdoor type	2	66.7
Combined indoor and outdoor type	1	33.3
Production of fingerlings		
Sex-reversed all-male tilapia fingerlings	3	100
Broodstock sourcing		
Imported	2	66.7
Locally	1	33.3
Source of water supply		
Reservoir	3	100
Labour used		
Paid hired labour	3	100
Feed used in hatchery		
Imported feed	3	100

businesses. The majority focus on selling imported feed, while a smaller portion sells locally produced commercial feed.

Fish farmers' characteristics Fish farming activities such as site selection and pond construction are exclusively male-dominated, with men also playing major roles in stocking, sorting, feeding, water management, harvesting, and sales. All tilapia farmers practice monoculture and sell their fish primarily to wholesalers at the farm gate. Most farmers source feed from private outlets, predominantly relying on imported feed, and many use fingerlings from personal hatcheries. Paid labour and reservoir water

Table 4 Fish farmers characteristics

Category	Frequency ($n=3$)	Percentage (%)
Corporative societies	3	100
Source(s) of funds		
Personal savings	3	100
Purpose of fish seed production		
Table size production	3	100
Practical culture method		
Monoculture	3	100
Culture facilities		
Cage culture	3	100
Culture management system		
Intensive system	3	100
Source(s) of feeds		
Private feed outlets	3	100
Source(s) of fish seeds		
Own hatchery	2	66.7
Types of fish seed stocked		
Fingerlings	3	100
Cage size		
6 m × 6 m × 5 m	2	66.7
Types of fish feed used		
Imported only	2	66.7
Number of cycles per year		
1	-	-
2	3	100

are commonly used. Additionally, most respondents across the tilapia value chain have tertiary education.

Fish processing characteristics Fish processors are predominantly women with several years of experience, mainly engaged in gutting, scaling, icing, and smoking (Table 5). They primarily finance their activities through personal savings or loans from friends and relatives. Fresh fish is sourced from personal or spouse-owned farms, purchases from fish farmers, or traders. Most processors handle 300–400 kg monthly and package products using imported cartons. Many leased lands for processing and universally use charcoal as fuel. Entry into fish processing often comes through university training, family influence, or friends. Besides tilapia, nearly half also process other species like *C. gariepinus*. Women's involvement in fish processing is significant across Nigeria, with many relying on traditional methods and facing challenges such as limited capital and inadequate facilities, but they benefit from cooperative memberships and formal education that support their participation.

Fish marketers' characteristics Fish marketing is predominantly conducted by women and involves both wholesalers and retailers. Many marketers belong to cooperative societies or fish marketers' associations (Table 6). Funding for their businesses comes mainly from personal savings, cooperatives, and loans from friends, relatives, or microfinance institutions. Most have

Table 5 Fish processors characteristics

Category	Frequency ($n=25$)	Percentage (%)
Corporative societies	23	92
Source(s) of funds for fish seed		
Personal savings	13	52
Mode of fish processing		
Part time	20	80
Purpose of fish processing		
Commercial sales	24	96
Other species processed		
Catfish	12	48
Source of fresh fish		
Purchased from fish farmers	10	40
Mode of fish preservation		
Freezing	7	28
Degutting	11	44
Fish processing method		
Smoking	25	100
Number of days/weeks		
3—6 days in a week	24	96
Quantity of fish processed per time (kg)		
300–400	15	60
Method of fish storage		
Imported cartons	15	60
Type of fuel used for processing		
Charcoal	25	100
Type of smoking kilns used for processing		
Modern improved	25	100
Engagement in fish processing		
University training	15	60

several years of experience and primarily trade in local markets. Fish are commonly transported by bus, car, or motorcycle, with marketers employing a mix of paid labour, self-labour, and family labour. Entry into fish marketing often occurs through friends, extension agents, parents, or education. Fish are usually packaged in small basins, baskets, or paper cartons during transport, and measured by weight or size during sales. Most marketers own storage facilities.

Tilapia value chain (TVC) flowchart Results revealed that TVC is short and simple with four key actors identified viz input suppliers, grow-out farmers, fish processors, marketers (wholesalers and retailers). There is no form of exportation of farmed tilapia fish in the study area. Fish processing and marketing are largely female-driven, while men dominate other parts of the value chain, such as input supply and production. The TVC flowchart which showed interaction between the various key actors is presented in Fig. 2.

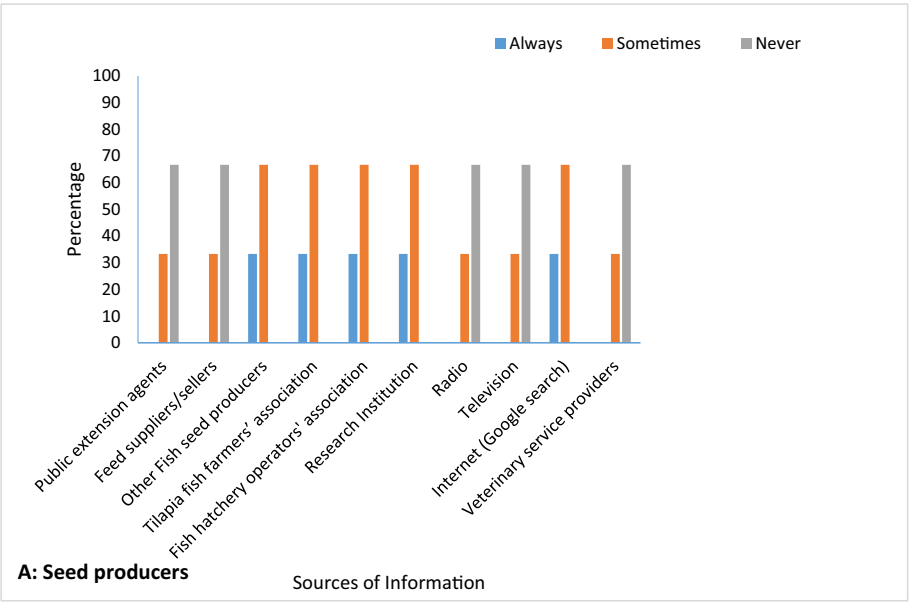
Flow of Tilapia information among value chain actors The flow of information among the tilapia value chain actors revealed distinct patterns shaped by their roles and preferences. Fish

Table 6 Fish marketers' characteristics

Category	Frequency ($n=60$)	Percentage (%)
Level of your marketing		
Wholesalers	30	50
Fish marketers' association	24	40
Source(s) of funds for fish seed		
Personal savings	26	43.3
Mode of fish marketing		
Part time	48	80
Marketing of tilapia fish		
Yes	46	76.7
Other species traded		
Catfish	41	68.3
Source of fish		
From fish farmers	44	73.3
Form of fish traded		
Fresh fish	38	63.3
Trading location		
Local markets	40	66.7
Weekly sales		
Daily	44	73.4
Quantity of fish sold per time		
25 kg–100 kg	52	86.7
Means of transportation		
Bus	34	57
Involvement in fish marketing as a business		
Friends	22	36.7

seed producers rely on fellow producers, research institutes, and the internet for information. This reliance on peer networks and research-based sources highlights their preference for informal and knowledge-driven channels over formal advisory services. Similarly, fish feed suppliers rarely use private or public extension agents but often obtain information from other feed suppliers, fish seed producers, and various aquaculture associations, reflecting a strong dependence on industry networks rather than formal extensions.

In contrast, fish farmers show a selective approach by sometimes using private extension agents but not utilizing public agents, feed suppliers, seed producers, associations, and social media platforms like Facebook and WhatsApp. This suggests that farmers primarily depend on private advisory services while underutilizing other potential sources of information. Fish processors demonstrate a more diversified information network. While their use of private and public extension agents varies—with some never using them and others sometimes or always relying on them—they consistently depend on fish merchants and processors' associations. Additionally, processors frequently engage fellow processors and utilize traditional media such as radio and television, alongside digital platforms like Facebook and WhatsApp, indicating a broader acceptance of both conventional and modern communication channels.



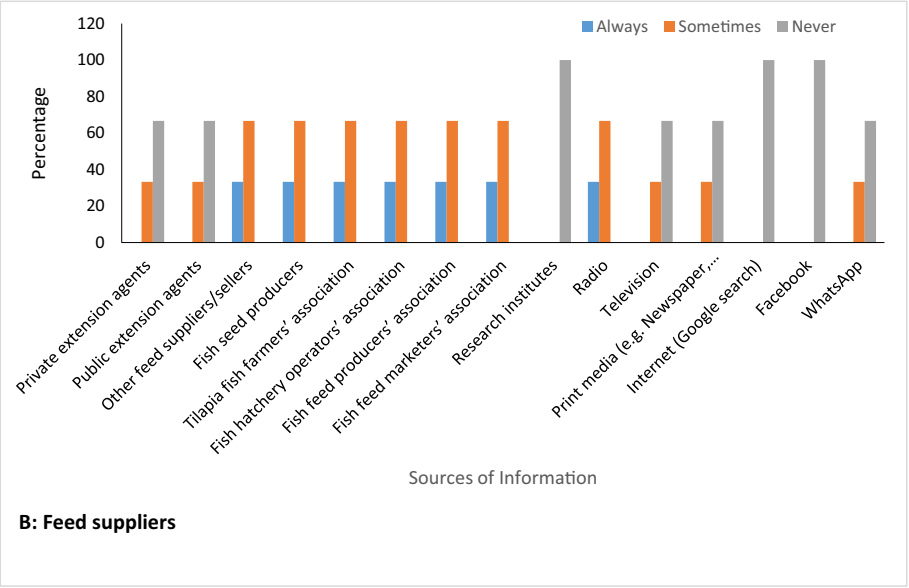
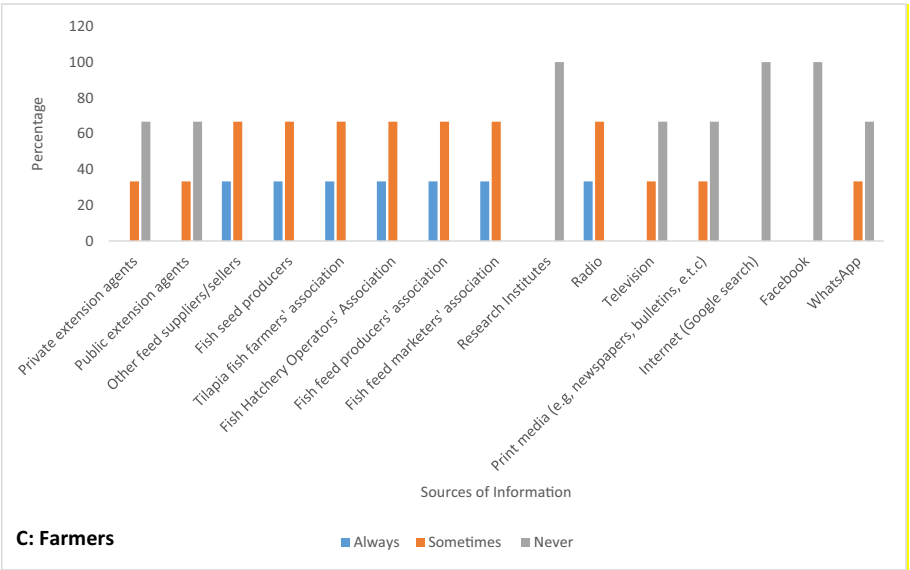


Fig. 3 Sources of information for the various key players in the Tilapia value chain. **A** Seed producers. **B** Feed suppliers. **C** Farmers. **D** Processors. **E** Marketers

Fish marketers, on the other hand, tend to use public extension agents more regularly than private ones and consistently source information from fish merchants and farmers, occasionally involving fishermen and processors. They heavily rely on traditional mass media like radio and television but largely avoid internet-based sources such as Google, Facebook, and WhatsApp. This preference underscores their



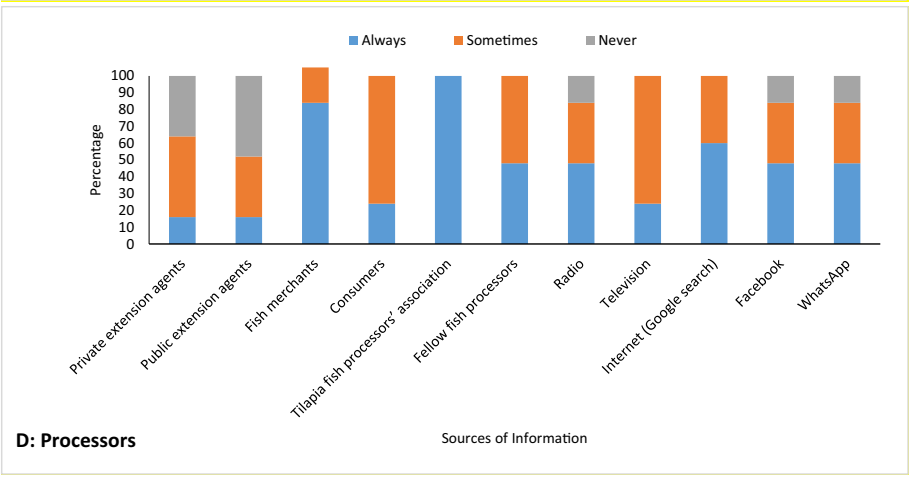


Fig. 3 (continued)

inclination toward direct stakeholder communication and established media rather than digital platforms.

These distinct patterns revealed that seed producers and feed suppliers favour peer and association networks, farmers rely mainly on private extension, processors utilize a wide mix of sources, including media and social platforms, and marketers prefer public extension and traditional media while keeping away from the use of digital information channels. Understanding these peculiarities is crucial for designing effective, tailored information dissemination strategies that address the unique needs and behaviours of each actor within the tilapia value chain (Fig. 3).

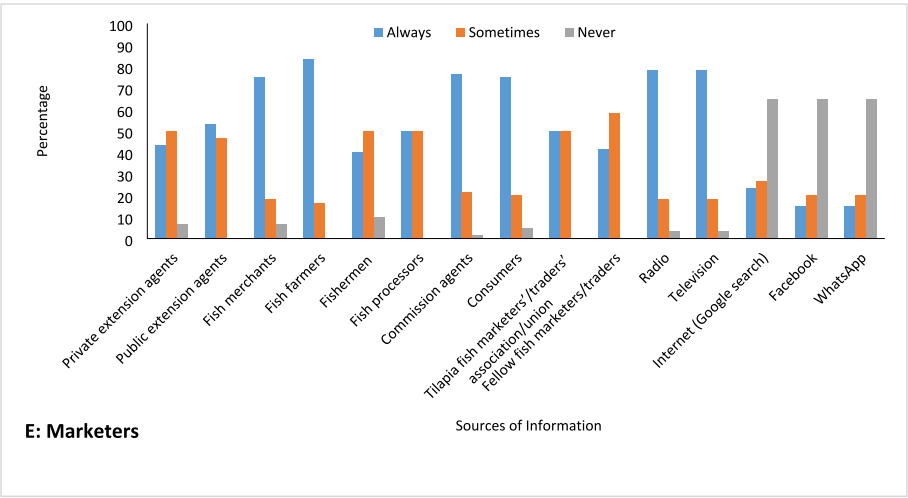


Fig. 3 (continued)

Table 7 Constraints faced by key actors in TVC

Constraints	Mean	SD
Fish seed producers		
high capital intensity	4.68	2.51
high cost of nursery feeds	3.82	2.48
low demand for tilapia fish seeds	3.51	2.48
Fish feed suppliers		
high cost of fish feed ingredients	4.11	2.29
high maintenance cost	3.57	2.72
capital-intensive	3.66	2.84
Tilapia grow-out farmers		
high cost of fish seeds	3.65	2.94
high cost of fish feeds	3.47	2.98
low profitability of Tilapia fish farming	3.39	1.97
scarcity of quality fish feeds	3.36	1.97
Fish processors		
high cost of processing equipment	3.63	1.23
high cost of energy	3.48	1.09
unavailability of improved smoking kilns	3.39	1.09
health hazards resulting from heat and smoke	3.35	1.35
Fish marketers		
poor quality of fish	3.45	1.19
inadequate market information	3.41	1.65
insufficient Tilapia processors	3.38	2.21
unavailability of improved smoking kilns	3.35	2.48

Constraints faced by value chain actors Some major constraints faced by the various key actors in TVC are presented in Table 7.

Discussion

Gender roles among different tilapia value chain activities

The study revealed that gender significantly influenced roles within the Tilapia value chain. Men dominated selection and hatchery construction, while both men and women shared responsibilities in sorting fish seeds. Key tasks such as feeding, water management, brooder replacement, and selling fish seeds were primarily handled by men. Also, men are more involved with a dominant role in logistics and feed sales within the value chain compared to women. However, both genders are equally involved in staff supervision and investment decisions, but men are more engaged in labour-intensive tasks like staff recruitment and feed packaging. These patterns align with Omitoyin et al. (2021), who noted that women are often considered not to be as strong physically as their male counterparts. This further hinders their active participation in activities considered to be rigorous.

Fish farming activities

The study revealed that all grow-out tilapia farmers practiced monoculture and sold their fish directly at the farm gate, mainly to wholesalers. These farmers generally possessed substantial experience in tilapia farming, often having been involved in the industry for many years. Feed for the tilapia was consistently sourced from private outlets, with most farmers relying exclusively on imported feed. Gender dynamics within fish farming were also evident. The male gender dominated fish farming activities in the study area, which aligns with findings by Deji and Koledoye (2013) and Adam et al. (2025) that men are more involved in various stages of fish production. However, this pattern contrasts with processing and marketing activities, where women constitute the majority, highlighting a gender-based division of labour within the fish value chain.

Fish processing and marketing activities

The study highlights the significant involvement of women in the Nigerian fish value chain, particularly in processing and marketing roles. It was found that many fish processors fall within the age range of 31 to 40 years, supporting previous research that emphasizes the active participation of women in fish value chains in Lagos State (Makinde et al. 2015). This dominance of women in fish processing aligns with Odediran and Ojebiyi (2017), as well as Obasohan et al. (2012), who consistently report female predominance in processing activities. However, there are contrasting reports, such as findings by Okwuokenye and Onemolease (2011), which observed a higher proportion of male fish processors. Regarding specific roles, the study found that female fish marketers are heavily involved in sourcing fish, while both males and females participate in other marketing activities. Many

female respondents were engaged as fish processors and participated in marketing activities, including loading and offloading fish. Additionally, a considerable number of female fish marketers were involved in record-keeping and distribution, which aligns with previous literature by Babalola et al. (2015) and Olaoye et al. (2015), emphasizing women's substantial contributions to these aspects of the value chain but contradicts Madugu and Edward (2011) who reported that 50% of fish marketers were males and females, respectively.

Constraints faced by tilapia value chain actors

The key constraints identified across the tilapia value chain include high costs of fish feed for both nursery and grow-out stages, high costs of aquaculture inputs, limited capital, weak/poor extension service delivery to tilapia production. These factors significantly impact fish availability, nutritional value, quality, efficiency and overall profitability agreeing with the findings of Odefadehan et al., (2015) who highlighted that inadequate access to extension services and financial resources is one of the major constraints affecting tilapia farming. Similarly, Wade et al., (2024) study confirmed that high cost of fish feed, cost of inputs and lack of capital pose serious challenges to the value chain. Atanda and Fagbenro (2017) also emphasized the high cost of fish feed as a critical constraint to the development of tilapia farming in Nigeria. Other constraints mentioned include unavailable tilapia seeds, high costs of transportation and low customer preference for tilapia products, which culminate in low market demand for tilapia and profitability. Despite women's dominance in post-harvest activities such as processing and, marketing, the study identifies persistent gender-specific constraints. Women often face limited access to productive resources, mobility challenges and insufficient capital. These barriers limit their ability to benefit fully from the tilapia value chain and restrict their participation in more lucrative nodes such as fingerling and table-sized fish production, which are typically male-dominated. Addressing these interconnected challenges is essential for improving the productivity and sustainability of tilapia farming in Nigeria.

Conclusion

Production characteristics revealed that the tilapia value chain is dominated by privately owned farms and linkage operations, which are crucial for promoting sustainability, partnerships, and effective policy development. The sector relies heavily on imported floating feeds and broodstock from Thailand, with production methods ranging from cage culture to Hapa systems and earthen ponds, typically employing paid labour. Farm gate sales remain the primary marketing channel. Gender roles are distinct: women are mainly involved in processing and marketing, while men handle input supply and grow-out production. Key challenges—such as high feed costs, low demand for fish seeds, limited access to improved smoking kilns, health risks, and low profitability—continue to hinder sustainable growth. These insights underscore the need for targeted interventions to improve local input supply, enhance processing technologies, and support gender-inclusive policies for a more resilient tilapia value chain.

Acknowledgements The authors express gratitude to the Department of Fisheries and Aquaculture Technology, The Federal University of Technology, Akure, Nigeria for their technical support during the project fieldwork. Also, the authors sincerely appreciate the trained enumerators for their help administering questionnaires.

Author contributions **Olaniyi Ajibola Abeni**: Conceptualization; Investigation; Methodology; Writing—original draft, Writing—review and editing. **Adeleke Lydia Mosunmola**: Conceptualization; investigation; resources; writing—review and editing. **Fagbero Oyedapo Adewale**: Data curation; Investigation; Methodology; Project administration; Writing—review and editing. **Irabor Arnold Ebuka**: Writing—original draft; writing—review and editing.

Funding Open access funding provided by Swedish University of Agricultural Sciences.

Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval The survey was approved after proper scrutiny by the expert from the Faculty of Agriculture, Federal University of Technology, Akure due to the non-existence of a formal research ethical committee. The consent of respondents was also received by reading out the consent statement and getting approval to commence the interviews or surveys.

Conflict of interest The authors declare no competing interests.

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