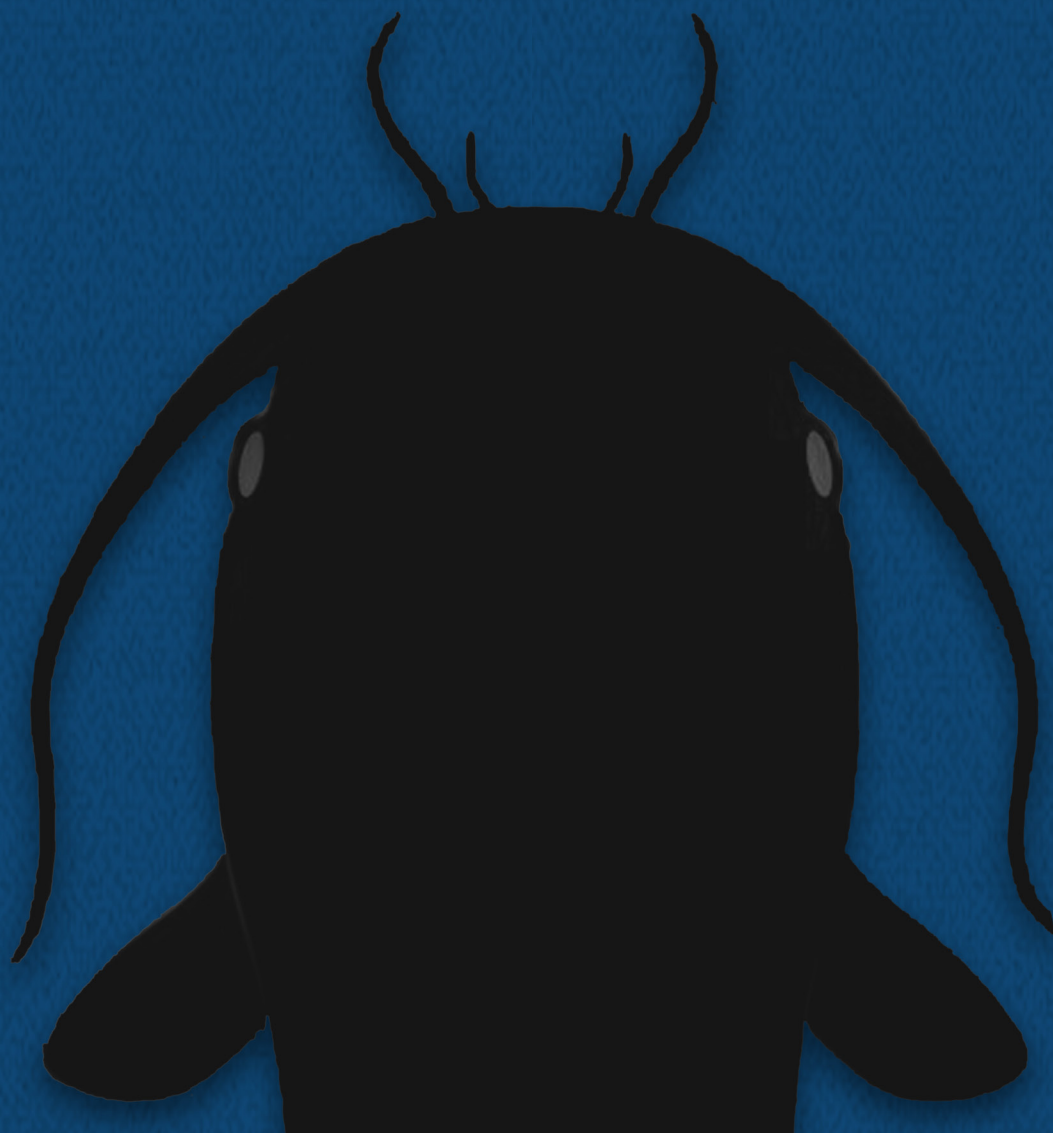


BIF Nigeria Market Analysis and Strategy

Aquaculture



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1. Executive Summary

As Nigeria moves towards attainment of self-sufficiency in fish production, aquaculture is seen and is increasingly being embraced, especially in light of the decline in captive fishing and its inability to meet the country's growing fish demand. Many empirical studies in Nigeria suggest the huge potential of aquaculture as a pathway toward economic growth, food security, environmental sustainability, and poverty reduction.



2. Introduction to the market

Aquaculture is the breeding, rearing, and farming of all types of fishes and seafood, in all types of water environmental enclosures outside their natural systems. Nigeria is the largest producer of farmed fish in Africa after Egypt¹. Among the major culture species farmed in Nigeria, which are catfish, tilapia, and carp, catfish farming is the single most-prominent aquaculture system, accounting for approximately 90% of the total aquaculture sector, worth nearly US \$2 billion in consumer spending². In 2012,

¹ Erik Hempel (2010): Value_Chain_Analysis in the Fisheries Sector in Africa www.fao.org/.../docs/Value_Chain_Analysis_Report_FINAL_hempel.do... 1

² Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45. Original figures from 2006. Current figure based on extrapolation on current production

of the 968,283 tons of fish produced domestically in Nigeria, farmed catfish represented 226,578 (23%) of local production³. Though captured artisan fisheries may represent the larger portion of domestic production, many research studies (Kleih et al, 2012; Odebiyi et al, Ataguba et al, 2013; Adedeji et al 2012) confirm that over time it has been erratic and has recorded a steep decline, perhaps due to adverse environmental factors, security concerns (piracy) and the depletion of natural fish resources amongst other factors⁴.

In contrast, farmed catfish in Nigeria, a relatively new but promising sector, has been on a strong rise due to intensive cultivation and application of modern best practices/technology increasing by almost tenfold from 21,372 metric tons in 2001 to 221,128 metric tons of fish in 2011⁵. Industry watchers suggest that Nigeria has further unutilized potential and opportunity to grow its fishery sector⁶.

The strength and dynamism of Nigerian aquaculture can be gauged by the sector's contribution of approximately US \$1 billion to the country's GDP. Conduciveness of the political economy, and openness to change through policy reform, is also favorable as the Federal Government of Nigeria (FGN), through the Ministry of Agriculture (MoA)'s Agricultural Transformation Agenda Program (ATAP) places fish on its priority

list with the aim of replacing imports with locally produced fish, accompanied with policy initiatives that severely discourage catfish imports.

All in all, farmed catfish looks promising, supported by high potentials of increased productivity, annual growth rate of over 30% in the aquaculture sector, growing source of incomes to farmers, the country's large consumer market given its population of approximately 170 million people, and competitive pricing in relation to meat/poultry which are more expensive and rising demand across the bottom to the top of the pyramid⁷. Catfish is also consumed across Nigeria, is resistant to harsh environmental conditions, commands a good price, and can be kept alive for days following harvest. BIF Nigeria has chosen to focus on the catfish market sector due to these beneficial and productive market characteristics. In terms of geographical focus, BIF's work in the farmed catfish market will cut across Nigeria covering the Northern and Southern regions. While no definitive and current statistics exist on the number of poor directly involved in this market, discussions with MoA officials and aquaculture experts suggest there is potential to reach and impact roughly 21,050 to 27,050 fish farms, 80% of which are small-scale producers within the aquaculture sector. In the initial phases of the program, activities will start

³ Akintola, Shehu (2014): Fisheries & Aquaculture: Options & Pathways to Providing More Fish in Nigeria. The Nation. Feb 14, 2014

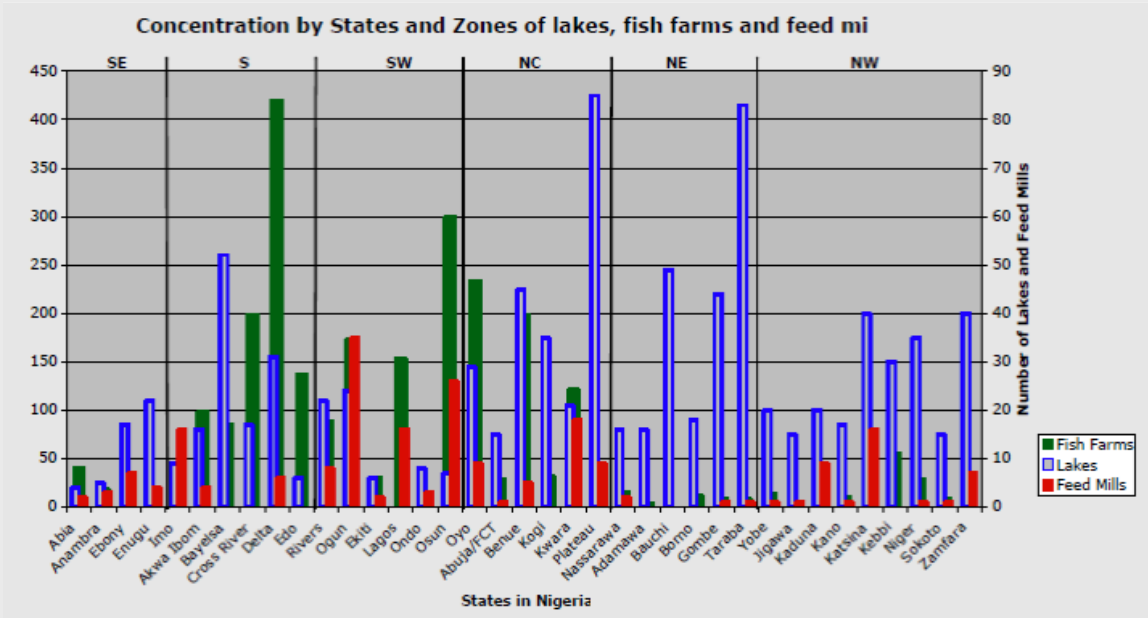
⁴Adedeji & Okocha (2011): Constraint to Aquaculture Development in Nigeria and Way Forward. Veterinary & Public Health Preventative Medicine. University of Ibadan. Journal of Applied Sciences Research.

⁵Pre-Anetekiah, Martins Agenuma (2013): Catfish Aquaculture Industry Assessment in Nigeria. African Union. Inter-African Bureau for Animal Resources. & <http://www.fao.org/docrep/003/5r9004e/R9004E06.htm#ch6.1>

⁶Teslim B and M.A.Y. Rahji (2010): Market Delineation Study of the Fish Market in Nigeria: An Application of Contegration Analysis; Journal of Agricultural Science Vol. 2, No. 3; September 2010 6158 ISSN 1916-9752 E-ISSN 1916-9760. <http://www.ccsenet.org/journal/index.php/jas/article/viewFile/7290/5650>

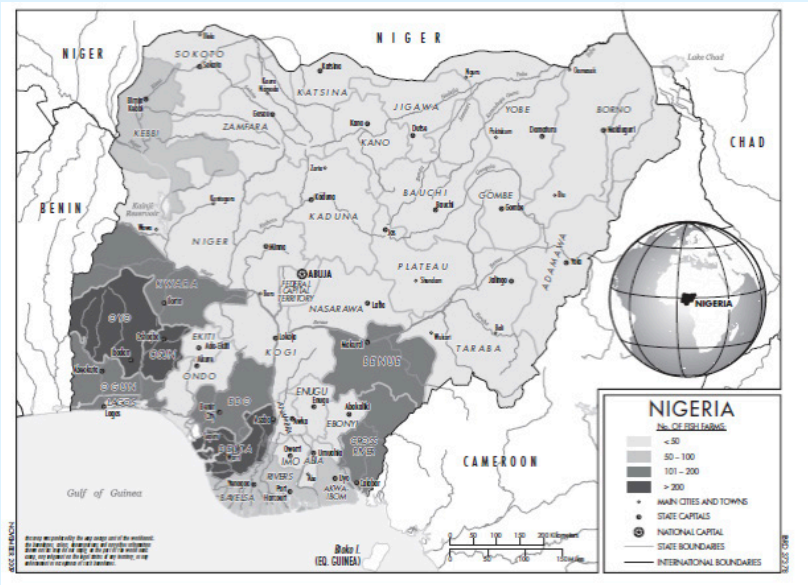
⁷Adewumi A. A.1* and Olaleye V. F (2011): Catfish culture in Nigeria: Progress, prospects and problems, African Journal of Agricultural Research Vol. 6(6), pp. 1281-1285, 18 March, 2011 <http://www.academicjournals.org/AJAR> DOI: 10.5897/AJAR09.361 ISSN 1991-637X ©2011 Academic Journals Review 2)

Figure 1: Distribution of fish farms, lakes and feed mills in Nigeria



Source: FAO Nigeria Fisheries Profile. March 2007.

Figure 2: Concentration of Aquaculture Production & Fish Farm Distribution in Nigeria



Source: FAO National Special Program for Food Security in 2009 World Bank Report on Nigeria Aquaculture Value-Chain

in the South, specifically Lagos, Ogun, Osun, Oyo and Kwara States - given the preponderance of fish farms and feed mills in these regions as displayed by the graph in Figure 1 and map in Figure 2.

While both diagrams clearly portray greater aquaculture activity in the South, our research identified that fish farming is also taking root in Northern Nigeria. As a result, BIF will be assessing entry points in Niger, Benue, Kano, Plateau, FCT-Nassarawa, and Kaduna where farm concentrations are known to exist.

2.1. Relevance to the poor

The importance of aquaculture farm-raised catfish to the poor can be viewed from three major perspectives: nutrition; employment; and poverty alleviation through income generation. Aquaculture and fish production provides the cheapest source of animal protein constituting about 40% of protein intake for many of the 120 million poor Nigerians who earn less than US\$1.25 a day⁸.

The phenomenal growth of the Nigerian fisheries sector—with aquaculture playing a dominant role over the last two decades - has provided livelihoods and household income security⁹. The poor are found across the entire value-chain from breeders/hatchers, cultivators/producers, processors, retailers, hospitality workers, to consumers, and often with many taking on a combination of these roles. Over time, the catfish industry has developed and garnered great size, importance, value, and

output providing approximately US\$850 million in revenues at the farm gate¹⁰.

Our programme of activity will be focused around production in the value chain. The distribution of the poor active in the aquaculture value-chain suggests there was only a limited business case for BIF to focus on processors because nearly all farm raised catfish consumed on the Nigerian market are sold live (85%), while the remainder is consumed smoked, sundried, or otherwise processed¹¹. These figures show that processing or value-addition takes place on a limited scale and as a result concentrating efforts on this aspect of the chain will bear limited impact. The consumption of smoked catfish is also largely location specific. The North Central and South Western regions (our focus geographic areas) consume mostly fresh fish, while consumption of smoked fish is found mostly in the core North, South-South, and South East Nigeria¹².

Likewise, the BIF focus on production of catfish reflects the fact that key constraints found in the aquaculture market, which are around the limited access to finance and high cost of fish inputs representing 65% of production costs, affect largely poor producers disproportionately¹³. There is also potential to increase the incomes of these target beneficiaries through the production, supply, and distribution of quality fingerlings, spur new investment and technology transfer in the local production of currently imported feed to reduce high input costs, and to deepen improve productivity and incomes through the provision of agronomy and business

⁸S. A. Adewuyi, B. B. Phillip, I. A. Ayinde and D. Akerele (2010): Analysis of Profitability of Fish Farming in Ogun State, Nigeria, www.unaab.edu.ng/.../2291-analysis-of-profitability-of-fish-farming-in-27/5/14 & FAO 2009.

⁹ Nigerian Ministry of Agriculture. Federal Department of Fisheries (FDF) 2011.

¹⁰ Pre-Anetekiah, Martins Agenuma (2013): Catfish Aquaculture Industry Assessment in Nigeria. African Union. Inter-African Bureau for Animal Resources.

¹¹Peter G.M. Van der Heijden (2012). Commodity Research Aquaculture Factsheet. Wageningen UR Centre for Development Innovation. & Velu et al (2009). Gender Analysis of Aquaculture Value-Chain in Northeast Vietnam & Nigeria. Discussion Paper 44. World Bank.

¹² From discussions with NIOMR during field research

¹³Odebiyi et al (2013). Value-Chain Analysis of Coastal Fisheries Development in Nigeria. Global Journal of Science Frontier Research Agriculture & Veterinary. Volume 13. Issue 11 Version 1.0.



management skills training to cultivators. Working to amalgamate fragmented producers into existing associations should serve to champion collective bargaining. Lastly, BIF will identify opportunities to create market linkages and expanded access to finance through the development of innovative financial products that will grow the enterprises of small-scale cultivators.

Our analysis would be incomplete without exploring, discussing and analyzing gender roles, which are clearly delineated within the aquaculture market-sector. Conventionally, men are involved mostly as producers while women are concentrated in typically in combined sales and processing roles¹⁴. The role of poor women makes them a major player in the aquaculture sector as they constitute the greater percentage of the raw catfish sellers and processors (55-80%) often controlling the cash income from the sale of fish for the benefit of entire households. Processing roles have expanded the creation of employment opportunities in many parts of the country enabling young women to stay in their communities with an added effect of strengthening the economic viability of isolated areas and enhancing the status of women

2.2. Opportunities for pro-poor growth

The aquaculture industry is being promoted by the Nigerian government with a view to increasing local production of fish and saving much of the foreign exchange

of approximately \$600 million spent on fish importation¹⁵. The industry currently contributes 2% of GDP¹⁶. Over the 5 years to 2016, the FGN through the MoA has estimated the post-growth value of the aquaculture value chain at 1 trillion naira¹⁷, with the hatchery industry worth N50 billion naira; the fish production industry worth N500 billion; the fish processing industry worth N900 billion and the feed mill industry worth N230 billion naira¹⁸

The demand for catfish continues to grow across household and industrial consumers as the aquaculture sector deepens and expands, increasing by almost tenfold in the 10 years to 2012. Table 1 shows the trend in production.

Nigerian demand for catfish has surged as incomes increased, and as consumers develop greater health awareness and a preference for protein derived from fish as a healthy alternative to red meat. Prior to 2001, catfish was not a popular part of the Nigerian diet, however since the expansion and development of the aquaculture sector, farmed catfish has been on the rise especially within the last decade featuring prominently in the diet of Nigerian families. It is also a delicacy made and eaten as 'pepper soup' by many including specific consumer segments in the hospitality industry. Aside from traditional demand from middle and upper class household consumers and hospitality sector commercial consumers, the reliance of the poor on catfish consumption as a cheap source of animal protein has also increased the demand for catfish causing it to grow

¹⁴ UNDP (2013) Roadmap for Nigerian Agribusiness Supply Development Programme http://www.ng.undp.org/content/dam/nigeria/docs/IclusiveGrwth/UNDP_NG_RoadmapNigerianAgribussmaer2013.pdf

¹⁵ This is an conservative figure based on a multiplicity of data sources that provide a range of \$600m to \$750m 16 S. A. Adewuyi, B. B.

¹⁶ Phillip, I. A. Ayinde and D. Akerele (2010): Analysis of Profitability of Fish Farming in Ogun State, Nigeria, www.unaab.edu.ng/.../2291-analysis-of-profitability-of-fishfarming-in-27/5/14 & FAO 2009.

¹⁷ Federal Government of Nigeria Ministry of Agriculture (2011): Agriculture Transformation Agenda.

¹⁸ Federal Government of Nigeria Ministry of Agriculture (2011): Agriculture Transformation Agenda. & News Agency of Nigeria (2013): Nigeria May Soon Ban Fish Importation—Minister. Premium Times. August 27, 2013.

Table 1: Estimated Catfish Production (metric tons) in Nigeria (2001-2012)

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<i>Clarias gariepinus</i>	19518	24530	24542	35160	45084	67662	68100	115000	137516	180482	199015	228508
<i>Clarias hybrid</i>	390	491	491	703	902	1353	1362	2300	9168	12032	13268	15234
<i>Heterobranchus</i> sp	1464	1840	1841	2637	3381	5075	5108	8625	6112	8021	8845	10156
Total	21372	26861	26874	38500	49367	74090	74570	125925	152796	200535	221128	253898

Source: African Union Report. Catfish Aquaculture Industry Assessment in Nigeria. December 2013

rapidly. Due to its hardiness, flavour, lack of a need for cold-chain services and its ease of production, fish farmers have seized on these incentives and have gravitated towards culturing catfish species hence its popularity over other farmed fishes. The explosion of farmed catfish over the past decade has led to a rise in associated employment.

Fish companies are mostly small and medium sized enterprises (SMEs) as large commercial firms are still very few. As at 2003, there were 2,642 fish farms in Nigeria as reported by FAO of which 100 were state owned. In 2009, the total number of fish farms was believed to have reached 5,000¹⁹.

Despite extensive research and enquiries to MoA in Abuja, NIOMR, FDF liaison office in Lagos, BIF has not been able to obtain conclusive information on the number of fish farms in Nigeria, which is a limitation of this study. The only data available to us, and upon which the FGN MoA bases its planning for the aquaculture sector, are outdated and grossly under-estimate the number of farms. To this end, a registration exercise to populate a database of fish

farmers nation-wide has commenced. Our independent research suggests the 5,000 figure to be very conservative. Based on field research and extrapolations based on current production trends, we estimate that there are at least 26,000 catfish farms in Nigeria.

Though most fish farms are small, the entire value-chain creates indirect jobs to other poor beneficiaries. A 2012 African Union report assessment carried out on the catfish industry indicates that over 253, 898 people are employed in the sector²⁰. Given Nigeria's growing population and large consumer market, the strong demand for fish will generate great market opportunities for the poor. Nigeria's Aquaculture Development Plan along with USAID-MARKETS II report that the overall aquaculture sector continues to burgeon, growing at 30% annually. With farmed catfish accounting for 90% of market share, extrapolated growth figures for the sub-sector are approximately 27% year on year per annum. Subsequently, a five year projection of supply and hence growth, highlighted in yellow, has been forecasted in Table 2.

¹⁹ Peter G.M. Van der Heijden (2012). Commodity Research Aquaculture Factsheet. Wageningen UR Centre for Development Innovation.

²⁰ Pre-Anetekiah, Martins Agenuma (2013): Catfish Aquaculture Industry Assessment in Nigeria. African Union. Inter-African Bureau for Animal Resources

Table 2: Domestic Supply & Demand of Catfish in Nigeria with 5-Year Growth Forecast 2013-2014

Year	1995	2001	2005	2007	2010	2012	2013	2014	2015	2016	2017
Demand	16,619	24,398	56,355	85,087	228,610	289,444	367,594	466,844	592,892	752,972	956,275
Supply	-	21,372	49,367	74,570	200,535	253,898	322,450	409,512	520,080	660,502	838,838

Actuals

Deduced / Forecaster

Source: Demand Figures from PIND Study. "Aquaculture Value Chain Analysis" Dec 2011.

Source: Supply Figures from Federal Department of Fisheries found in African Union Report. "Catfish Aquaculture Industry Assessment in Nigeria." Dec 2013.

Nothing from the literature review and field interviews conducted suggests any evidence of deterioration in demand. Instead, prices have remained attractive to fish producers and input prices have risen or kept pace. Even though demand may be indeterminate, five year forecast figures for 2012-2017 for demand at the very minimum were deduced on the basis that demand trends have at least kept up with supply trends given the 14% variance in both.

Given the larger picture, total supply for fish in 2014 is estimated at 2,113,750 metric tons, of which farmed catfish (409,512 metric tons output for year 2014) accounts for 19%²¹. According to the MoA's ATA, average total aggregate domestic fish supply per annum is approximately 700,000MT. With the supply data shown in the table above, if farmed catfish is producing on average of 335,512MT per annum, this represents approximately 47% of the country's internal fish supply making aquaculture catfish significantly important to the industry and consumers. Industry watchers believe there is room for higher production given the country's large population (about 170

million) and rising incomes²².

With continuing market confluence, social, political and technological factors, growth potential for the market are enormous. Having recognized the sizeable role catfish plays in the nation's internal supply along with the presence of un-utilized and un-optimized resources like fallow land and fresh water resources, the FGN through its National Aquaculture Development Plan has set out growth objectives for the aquaculture sector with expected results as follows:

- a) 25% - 75 % increase in aquaculture production per annum;
- b) 25% - 50% increase in consumption of aquaculture products per annum;
- c) 25% increase in the value of aquaculture harvest;
- d) 100,000 new jobs created per annum;
- e) 25% - 50% increase in the number of women and youth participating in aquaculture.

The ATA has also identified specific targets for fish production activities and

²¹GMSJNN Farms Limited, Establishment of a Commercial Catfish & Tilapia Farm at Kuchi Karu LGA Nassarawa State, Nigeria. 2011. <http://fishconsult.org/wp-content/uploads/2012/01/Establishment-of-a-commercial-catfish-and-tilapia-farm-in-Nigeria.pdf>

²²Adewumi A. A.1* and Olaleye V. F (2011): Catfish culture in Nigeria: Progress, prospects and problems, African Journal of Agricultural Research Vol. 6(6), pp. 1281-1285, 18 March, 2011 <http://www.academicjournals.org/AJAR> DOI: 10.5897/AJAR09.361 ISSN 1991-637X ©2011 Academic Journals Review 2)

aquaculture development for the 2011-2015 period. These include: the creation of 10,000 hatchery jobs; 500,000 fish production jobs; 3,700 fish processing jobs; and 2,500 feed mill jobs with a minimum wage of N18,000 naira monthly which translates into N9 billion naira in the hands of low-income Nigerian workers in the sector. Of the 100,000 jobs created annually, at least 20% are aimed at women²³ and youth through capacity-building, targeted business support and mentorship. Within the MOA a Youth and Gender Division under the Department of Extension has been established to carry out trainings in fish farming across the country²⁴.

In assessing the sector's competitiveness, collaboration amongst market players has been positive to a degree, bringing about current outcomes. The sector's early development was largely stimulated by growing public support, inflow of foreign capital, knowledge/technology transfer and expertise driven growth. In a report and fact sheet prepared by the Wageningen UR Centre for Development Innovation, Van der Heijden notes that "foreign companies have played an important role at the start of the aquaculture industry 10-15 years ago (2000) with technical advice, intensive modern production methods, mass production of quality fingerlings and supply of good quality fish feed."²⁵ Now that the sector is maturing and is less dependent on foreign support having passed its incubation and teething period, indigenous companies, and especially large-scale farms and a few stand-alone consulting firms, offer knowledge, training, related input services, and provide other services especially pond construction and cultivation information to

those interested in fish farming. Moreover, core-value chain actors (notably breeders/hatchers, producers and aggregators/wholesalers) are finding common ground, forging alliances through associations and cooperative arrangements.

Realizing the popularity of farmed catfish, a 'Fish for All' summit was convened in Abuja by the Nigerian government in 2005. Private individual fish farmers decided to form the Catfish Farmers Association of Nigeria in 2005 following the discussions and action points emanating from that summit. The association has 22 State chapters across Nigeria and a total of approximately 20,000 members constituting the diversity of all actors in the core value-chain. Despite its existence however, collaboration is still not clearly evident or embedded. Many fish farmers interviewed either were unaware of the organisation's existence or did not see the benefits of membership. Indeed, the President of the Lagos State Catfish Farmers Association (LASCFFN) indicated same and estimated the association's membership at 800 farmers, approximately 20% of active fish farmers in Lagos. The association reports that, on average, 12 new aquaculture practitioners and individuals become members every month, 50% of which are cultivators.

In all, we observed a weakness in governance, fragmentation and a lack of clear value propositions across the key associations which also include the Association of Fish Farmers and Aquaculture of Nigeria (AFFAN), Fish Society of Nigeria (FISON), and West Africa Aquaculture Productivity Initiative (WAPI). The growth trends and other anecdotal evidence do however

²³ Federal Government of Nigeria Ministry of Agriculture (2011) Agriculture Transformation Agenda.

²⁴ Adebayo, Abolaji (2014): Aquaculture Value-Chain: Federal Government Promises 500,000 jobs in 5 years. National Mirror.

²⁵ Peter G.M. Van der Heijden (2012). Commodity Research Aquaculture Factsheet. Wageningen UR Centre for Development Innovation.



indicate dynamism in the sector with growth trajectories continuing to be impressive.

Public interest and investment is growing with many state governments (like Lagos, Niger, Ogun, Ondo, Oyo) and the FGN investing heavily through policy and fiscal measures on special projects aimed at poverty reduction and employment generation. At the federal level, the MoA is reportedly promoting the commercialization of fish production under the Staple Crop Processing Zone (SCPZ).

Three of the 16 SCPZ (Lagos, Bayelsa, and Rivers) have fish and as anchor products. On the state level, there have also been notable individual examples such as Niger state which trained over 100 women in homestead catfish production, and a recent Ondo state initiative to admit 100,000 youths in its aquaculture project and plans for more ²⁶. Likewise, Oyo state in September 2014 spearheaded a \$60 million investment in catfish cultivation along with a high production capacity hatchery (25 million fingerlings per year) in partnership with Triton Aqua Africa Ltd, which is geared at generating at least 1,000 jobs for unemployed youth²⁷. Private sector

interest continues to grow, with a notable investment between an indigenous firm, Durante feed mill, and Nutreco-Skretting, a foreign investor, who have joined forces to innovate and adopt a new business model through the establishment of a feed production factory plant in Ibadan, aimed at producing starter feed (Artemia) which hitherto has been exclusively imported. This joint venture is expected to be finalized in October 2014, and will manufacture feed for Nigeria's local market and the regional West Africa market.

The bottlenecks for local production have included information asymmetries, lack of know-how in nutritional formulation and limited access to specialized technology. In summary, policy-makers, investors, and market players alike believe that in spite of these constraints further development of the industry will continue to attract new entrants and increase local production of fish with possible creation of thousands of jobs²⁸.

²⁶The Fish Site (2014): Nigeria Engages 100,000 Youths in Aquaculture. May 21, 2014. <http://www.thefishsite.com/fishnews/23226/nigeria-engages-100000-youths-in-aquaculture>

²⁷ Ibid

²⁸ S. A. Adewuyi, B. B. Phillip, I. A. Ayinde and D. Akerele (2010): Analysis of Profitability of Fish Farming in Ogun State, Nigeria, www.unaab.edu.ng/.../2291-analysis-of-profitability-of-fish-farming-in-27/5/14



3. BIF research methodology

The research approach adopted for this market strategy commenced with secondary research through literature reviews that provided quantitative and qualitative information on the sector. The literature reviews involved analysis of documents from various sources such as online journals, internet sites, online news articles, official government documents and publications. Following that stage, primary research was also conducted to validate initial findings, fill literature gaps, obtain up-to-date information, and deepen our contextual understanding of the sector. The fieldwork component of the study was conducted using qualitative research techniques particularly telephone and face-to-face interviews with key resource persons and stakeholders in both the public and private sectors.

4.

Market Structure and Performance



4.1 Overview of the Market System

The aquaculture market-system for farm-raised catfish is captured in the mapping in Figure 3: Map of the aquaculture market system. It consists of seven critical supporting functions which include: water resources, power services, transport services, information services, aggregation services, financial services, and extension services. The core-value chain comprises of eight key actors namely input suppliers, hatcheries, small-scale producers, integrated producers, processors, wholesalers / retailers, and industrial / household consumers.

WWThe market is supported and governed by four key formal rules, standards and regulations including the Agricultural Transformation Agenda (ATA) Aquaculture Strategy, 1978 Land Use Act, Specialized Growth Enhancement Scheme for the Aquaculture Value Chain (GES-AVC). In addition, there are informal norms pertaining to land tenure practices and gender division of labour. These elements

of the market system are analyzed in this section of the strategy, with discussion on how these functions currently operate and are structured, and the roles performed by players and their capacity and the degree to which they are able to execute their roles successfully highlighting areas of under-performance.

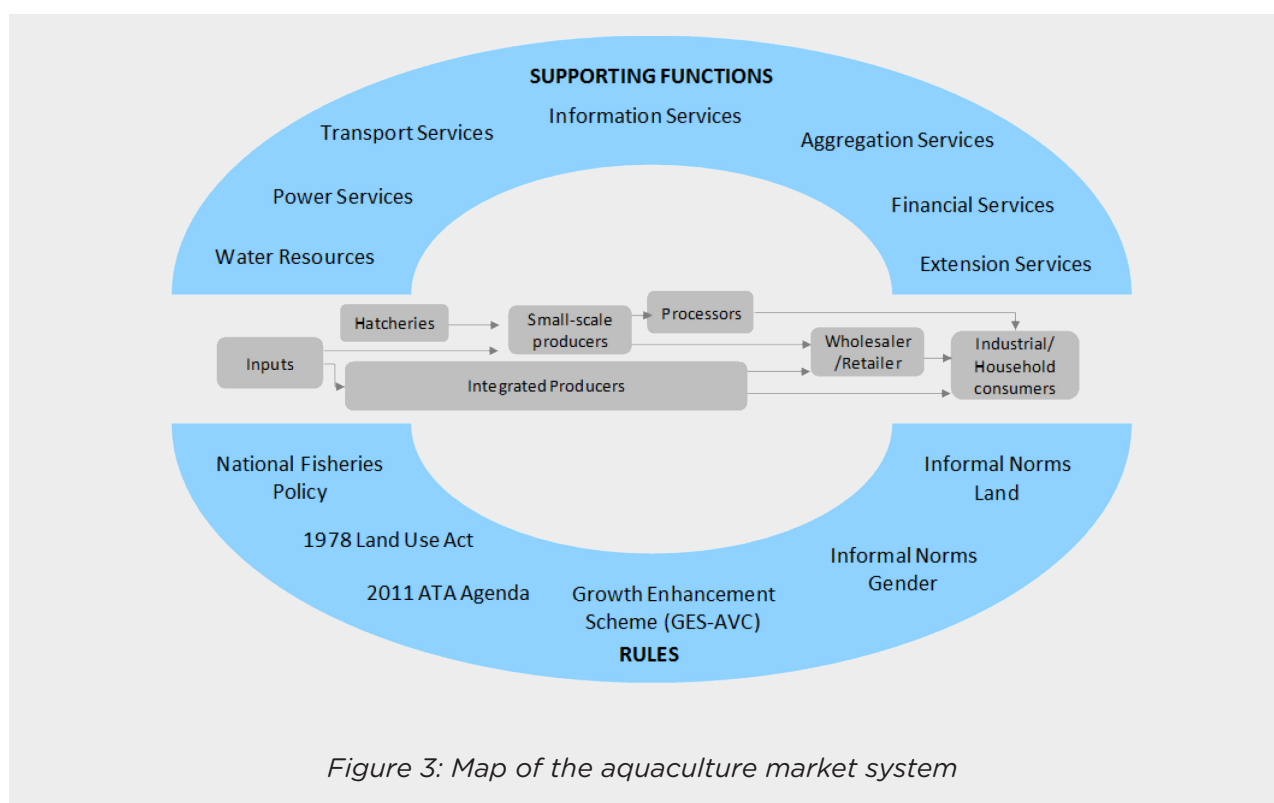


Figure 3: Map of the aquaculture market system

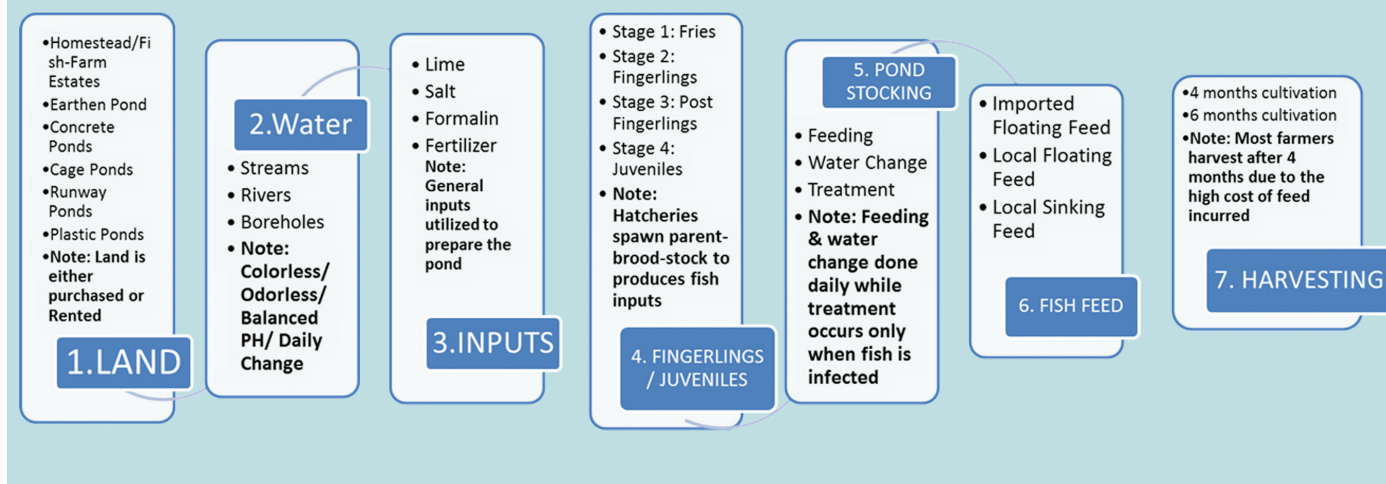
4.2. Core market performance

The analysis of the farm raised catfish market system begins with the core value chain depicted below in Figure 4: Steps in fish farming cultivation which shows the seven core market functions and respective players and how they interact.

4.2.1 Core market function

The backdrop and overview of vital steps in catfish cultivation is presented in Figure 4: Steps in fish farming cultivation below. This will aid the following discussion and analysis of the incentives and performance of key actors in the core-value chain.

Figure 4: Steps in fish farming cultivation



4.2.1.1 Input Supply

Aquaculture is heavily dependent on key inputs that are necessary for fish cultivation and production. The relevant actors in this space include providers for general inputs, hatcheries that provide fingerlings/juveniles, and feed mills that provide fish feed.

Input supply providers: play a critical function in the aquaculture market. They are responsible for supplying supplementary inputs such as preventative and therapeutic treatments for fish diseases, lime, and fertilizers, which are the first-stage inputs utilized in fish farming during the pond preparation process before fishes are stocked. Treatments for fish disease are mostly purchased from pharmacies, while lime is purchased from agro-allied chemical shops, and fertilizers from a variety of agro-dealers and sellers at open markets.

Amongst the first stage inputs, fertilizer, which is relevant only for earthen ponds, is very important and necessary to enhance pond bio-culture productivity. Fertilizer helps to enrich water with nutrients for plankton production on which fish feed resulting in improved fish size and higher production volumes. Two distinct types of fertilizers can be used. First is inorganic chemical fertilizer such as NPK 15-15, phosphoric acid, and urea, used in reservoirs and ponds dissolved in water. Average cost for the fertilizer is N2,000 per 100/kg with two bags usually required at the start of the cultivation in a typically sized 200m² (30ft x 60ft) pond. Organic fertilizer is the second type of fertilizer used, such as poultry manure, or dung from cattle and other farm animals, heaped at the corners of the pond. Catfish tend to thrive in bright green water pools which indicate that the pond is rich in organic nutrients. However, exces-

sive amounts of nutrients lead to depletion of dissolved oxygen in pond water, resulting in extensive fish mortality.

Lime is another first-stage input that goes hand in hand with fertilization in earthen ponds. For fertilizer to be effective when used, it is critical to apply lime to condition the soil because liming activates fertilizers and controls acidic soils which may harm the fish²⁹. Lime typically costs N250 per kg in a typical homestead-sized pond 12.5kg is used.

Treatments used in aquaculture include formalin, a parasiticide, and salt, used to treat common bacterial and fungal infections suffered by fish, especially on their gills, skin, and fins. This reduces fish mortality rates, infestation, pests, and the menace of predators.

Given the constant need and demand for these supplementary inputs there are clear incentives for the wide range of input supplier actors in the aquaculture sector to provide these products on a regular basis. There has been no indication from studies or interviews with farmers indicating that price or scarcity of these products are matters of concern. In fact many of them state the supplementary inputs are very cheap, affordable to buy, and quantities required and utilized are often minimal.

The performance of private-sector based input suppliers has been adequate as regarding stable pricing and supply. The extent to which this has been a factor in the performance of fish farmers is undetermined. However, in spite of the availability of these inputs, expertise in application and identification of the appropriate inputs ap-

pears to remain an issue. Farmers appear have focused exclusively on external parasites. Internal infections, which are also a critical mortality factor, are hardly considered and there is no indication that farmers are aware of how to detect and treat such cases.

Hatcheries: are actors in the “second-stage” inputs supply function in the aquaculture market. There are independent small hatcheries and medium scale hatcheries. Their typical role lies in identifying, producing, and maintaining healthy quality fish parent brood stocks that can be utilized for fish seed production and breeding fries, which are grown into fingerlings, post-fingerlings, and ultimately juveniles. Many of the small to medium hatcheries produce between 20,000 to 60,000 fingerlings per year, while the large scale high-tech commercial farms with integrated hatchery functions can produce 3 to 4 million per year³⁰. Examples of large-scale well established hatcheries include Durante, Zartech, Obasanjo Farms, Cannan Land Farms, Songhai Farms, and CHI Ajanla Farms Ltd.

Hatchers of all sizes (small, medium, and large) have a clear-cut incentive to provide fingerlings and juvenile supplies to fish farmers, because without their products cultivation cannot take place. The rising demand for fingerlings continues to sustain their business operations allowing them to generate revenues. The government’s recent policy of de-incentivizing the importation of catfish through high tariffs is a significant macro-economic driver which gives them an added incentive to breed for local catfish cultivators.

²⁹FAO and Federal Government of Nigeria (2005): Fish Pond Construction & Management: A Field Guide & Extension Manual. National Special Program for Food Security.

³⁰ FAO Nigeria Aquaculture Profile. March 2007.

The vast majority of small-scale fish-farmers patronize small-scale sized hatcheries for fingerlings via referrals and established networks. Their capacity to perform the input supply function is greatly hampered by poor productivity and poor quality brood-stock for breeding, sub-standard facilities and poor water distribution systems affecting the quality, quantity, and rate of their fingerlings and juveniles production output. Furthermore, they are constrained by limited knowledge, training, techniques, and technology in identifying the right female/male fish brood-stock, performing proper breeding, broodstock management, and adopting appropriate processes for artificial insemination. The end result has an adverse effect on the wider market and value chain as they are unable to provide

adequate quantities of good quality fingerlings.

Feed mills: also play a critical input supply function in the aquaculture market. FAO reports that as at 2007, there were 215 feed mills present across Nigeria. Many of them are concentrated in the southern part of the country, in line with the growth trends and location of fish farms. Ideal Feed produced in FCT and Vita Feed produced in Jos, Plateau, is an exception. The most active South West zone has some of the big and well-known local feed producers including Durante, CHI Ajanla Farms Ltd, Zartech, Fishline, Top Feed, Feed-Masters, Obasanjo Farms, and Capsfeed. Table 3: Location of feed mills shows the geographical distribution of these facilities³¹.

Geopolitical Zone	North Central	36	Number of Feed Mills
South East			32
South South			18
South West			91
North Central			36
North East			3
North West			35

Table 3: Location of feed mills

There are basically two types of feed available to fish farmers:

- Type 1 starter feed, typically based on Artemia. This is an imported extruded floating feed high in protein used during

the first two months of cultivation;

- Type 2 feed, used during the latter months of cultivation months 3-6, which takes three forms, locally produced floating feed, locally produced sinking feed, and home-made feed.

³¹ Ibid

For feed mills the incentive to provide fish feed appears not to be strong because few produce fish feed as a core business³² which is hard to understand in view of the rising supply and consumption trends. For many of the mills including those interviewed, fish feed accounts for only about 10% of their total business activities. The 91 mills in the SW zone are engaged in animal feed production mainly for the poultry and cattle industry and many are unable or unwilling to extend their production lines to cater to the growing aquaculture sector. The eight well-established local fish feed manufacturers mentioned above use raw material ingredients (soya, maize, fish meal, and mola-feed) obtained locally and sell their feed at the retail price of N160-180/kg, usually in 20kg bags costing about N3,600/bag³³. In 2007, the combined total feed produced in Nigeria was estimated at 25,000 - 30,000 tons/year³⁴. Seven years later, the President of the Catfish Farmers Association of Nigeria (CFFN) stated during an interview that feed produced locally had increased to approximately 100,000 tons per annum given 2013 figures, a trend which suggests that feed production is barely keeping pace with the growth of the catfish market, even if the demand still outstrips supply, as shown in the paragraph below.

The capacity of local fish feed mills to perform the input supply function is limited on quantity and quality grounds. The demand for feed is three times the locally produced tonnage per annum on average. The industry adopts a 1:1 fish

feed to fish tonnage conversion tonnage ratio, and with the estimated production in 2013 at approximately 322,450 tons of catfish local production at 100,000 tons still falls far short. Secondly, irrespective of the fact that there are a few stand-out firms like Durante and VitaFeed, the fish feed produced by most mills still does not meet ideal standards; they are largely unsatisfactory in quality and texture for fish farming. Thus as much as 85% of the feed utilized by large commercial farms is imported, mostly from Denmark, Norway and Iceland (made available at a retail price of N300 to N350 (\$1.80 - \$2.10)/kg usually in 15kg bags, whilst the remaining 15% is from local sources^{35 36}.

Most small-scale fish farmers cannot afford imported feed for the total cultivation cycle, so after the first two months they rely on a combination of locally-produced floating/sinking feed and home-made self-formulated feeds as a lower cost-alternative³⁷. Inability to pay for high quality protein rich feed causes the small-scale fish farmers to be heavily disadvantaged as they have much lower yield volumes, higher average production costs per kilo and lower productivity yields. In all, fish-feed production involves heavy investment in of capital, machinery and power supply to deliver the intricate formulations and complex technology required for manufacturing and pelletization. This makes it a less attractive venture for existing and prospective market-players.

³² Ibid.

³³ Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45

³⁴ FAO Nigeria Aquaculture Profile. March 2007.

³⁵ Akintola, Shehu (2014): Fisheries & Aquaculture: Options & Pathway to Providing More Fish in Nigeria. The Nation. Online Article. Feb 14, 2014. <http://thenationonlineng.net/new/fisheries-and-aquaculture-options-and-pathway-to-providing-more-fish-in-nigeria/>

³⁶ Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45

³⁷ Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45

4.2.1.2. Production cultivation channels and harvesting

Catfish farming operations may be classified by production capacity, production system utilized, output, and income.

Channel producer 1 - small-scale fish farmers: representing 80% of producers³⁸ mainly buy fingerlings or juveniles and grow them until ready for sale. They have no brood stock and do not grow their own fingerlings. Most of them have a single or few ponds (typically 5 or less) sometimes within their residential premises or rented from other land-owners. Earthen ponds are more common amongst this category of farmers. Output is usually about 100kgs (0.1 tons) per month, with an overwhelmingly usage of the green water earthen pond system³⁹.

Small-scale fish farmers produce for local markets, selling to individual retailers and aggregators. It is a means for livelihood, employment and income generation. However, many of them remain poor in comparison to other actors within the value-chain due to input supply market constraints such as high cost of feed, improper pond cultivation practices, and usage of poor quality fingerlings, resulting in their low output productivity. BIF interventions have the potential to unlock some of these constraints leading to increased incomes, food security, and socio-economic stability.

Channel producer 2 - Medium-scale fish farmers: have fairly large farms, controlling anywhere between 6 to 20 ponds, and produce mainly to sell to consumers through wholesalers. These cultivators use a combination of earthen, concrete, and

foldable/collapsible ponds. Some farms are integrated with their own hatcheries and have parent brooding stock and facilities for artificial insemination and may employ up to 2 workers on average. The output of these farms is 5 – 10 tons per month with about 5,000 – 20,000 fish in stock.

Channel producer 3 - Large-scale fish farmers: are typically established by private individuals with large-scale financial investments operating 20 ponds and over. They tend to supply to marketers and wholesalers, and directly supply to industrial consumers like restaurants, hotels, fish shops/bars, fastfood chains, and other enterprises in the hospitality industry. Almost all are integrated farms with their own hatcheries and have parent brooding stock and facilities for artificial insemination. Unlike small-scale and medium fish farms, large-scale farms are more sophisticated mostly deploying water recirculation technology systems which is capital intensive. Output is above 10 tons per month.

Large scale farmers also employ a lot more people than the smaller operations and earn more revenue per year, ranging from N96-192 million naira⁴⁰.

All fish farmer cultivators described above are primarily responsible for harvesting. Harvesting, also known as cropping, is undertaken when the fish stock or part of it has attained market size. Market size of fish is usually determined by consumer acceptability and preference. With proper feeding and management, most fish species reach market size within 6 to 9

³⁸ Ibid

³⁹ Ibid

⁴⁰ Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45

months of stocking. Almost all small and medium-scale fish farmers harvest their fish completely and prefer to sell to wholesalers and aggregators. The reason for this preference is because wholesalers and retailers informally known as “mammies” are easily accessible and come directly to the farm gate to purchase. Furthermore, mammies buy any available fish and always in bulk, unlike industrial consumers (i.e. restaurants, hotels, fish shops/bars, and fast food shops) who buy a small portion of total fish harvested, with the farmer expected to deliver the fish at the various industrial sites. On farmer interview by BIF stated that this amount was 50kg. The cost of transportation to industrial users, along with payment terms, which are usually 30 days after invoicing, holds up the working capital and affects the cash flow of small-scale farmers who are typically poor.

4.2.1.3. Wholesaler/retailer

Wholesalers are private individual traders who buy fresh fish at the farm gate in large quantities and resell to retailers such as market women, fish processors, and retail outlets and other smaller distributors. Their major incentive is driven by profit-making through volume sales. They buy at farmgate prices and then re-sell to retailers who cannot readily access the farmers either as a result of information asymmetries or distance enabling them to accrue wide profit margins. Individual retailers sell catfish products to individual household and other small-scale consumers earning a profit margin of N25-75/kg. From all indications, wholesalers who are the main links between

farmers and retailers are able to carry out their functions properly as they are primarily responsible for the transportation and distribution of fish throughout Nigeria. The wholesalers provide a valuable service in terms of price discovery and arbitrage⁴¹. Perhaps the only downside brought about these actors, who are organized into small networks, is that they have a very strong influence on the wholesale and retail price of fish skewed in their favour and interest. There are a number of business membership organizations (BMOs) for participants in this market sector; prominent amongst them is the Women Sellers Association⁴².

4.2.1.4. Processors

Small-scale processors: women constitute the greater percentage (55-80%) of catfish processors concentrated along the post-harvest segment of the value-chain working as fish processors buying fresh fish directly from the producers at the farm gate⁴³. Processing involves filleting, gutting, scaling and deboning of fish which end up as either smoked or dried. Other processed outputs include catfish paste, catfish cake, canned catfish chunks, and catfish oil; though such outputs are miniscule in comparison to smoking/dried fish which is more prevalent and widespread. The benefit of processing is that smoked fish is a means of preservation causing the fish to last longer and makes it more suitable for transportation across greater distances⁴⁴. Some consumers prefer it because it adds a unique flavor and aroma when used to prepare traditional foods.

⁴¹ Velu Athdhe et al (2009): Gender Analysis of Aquaculture Value-Chain in Northeast Vietnam and Nigeria. Agriculture & Rural Development Discussion Paper 44. World Bank.

⁴² Velu Athdhe et al (2009): Gender Analysis of Aquaculture Value-Chain in Northeast Vietnam and Nigeria. Agriculture & Rural Development Discussion Paper 44. World Bank.

⁴³ Ibid

⁴⁴ Alagoa, Yela et al (2011): Aquaculture Value-Chain Analysis: The Niger Delta. Foundation for Partnership Initiatives in the Niger Delta. www.pindfoundation.org/wp-content/plugins/.../download.php?id=45

Smoking techniques are still largely traditional using mud bricks and barrels for burning wood. This results in low productivity, poor environmental outcomes and unhealthy working conditions. The issue is further exacerbated during rainy season when there is a wood shortage⁴⁵. Even with the advent and introduction of improved charcoal kilns (used by medium/large-scale processors), few small-scale processors use them as the high cost of purchase makes them unaffordable. However, the major concern noted by these actors is that the kilns do not generate much smoke that is linked to the flavor and aroma generally associated with smoked fish in Nigeria.

Commercial integrated farmers: form the smaller segment of processors involved in filleting and smoking catfish for export. After years of failing to sell smoked catfish internationally due to quality issues such as pollutant adulteration levels and improper packaging and labeling, a few producers have successfully engaged in international trade with the introduction of improved production techniques using smoking kilns which allowed them to meet internationally acceptable standards and certification requirements from the United States Food & Drug Administration⁴⁶.

Just like their bigger commercial counterparts, women fish processors are engaged in processing to earn the extra monetary value that can be realized because there is a premium placed on smoked fish. The fish processors who smoke fish usually are not very selective of fish quality or size at the farm gates. In fact many use harvested fish runts, which are

undersized adult fish unsuitable for sale.

These runts are cheap (approximately N250 per kilo) compared to the price of typical table-ready fresh catfish, sold at the farm gate for about N470-550/kg. As a result of this, processors are able to make more money per kilo their other counterparts, who specialize in fresh fish sales. Smoked fish can fetch as much as N800 per kilo as opposed to fresh, which sell at the top end market for about N600 to N700. Smoked catfish is sold across the country but is most popular in the South-South and South Eastern states where there is significant consumption of smoked fish.

Municipal authorities tend to designate specific markets for fish to cater for special requirements in terms of handling and processing and improve product quality⁴⁷.

4.2.1.5. Consumption

Wholesalers, fish farmers, and fish processors: are all key players within the marketing chain for fresh/processed catfish to consumers. There are three marketing channels from which domestic consumers access.

- Channel 1 is the largest channel and features all three actors. Centralized channels mostly comprise middle men that have greater capacity, through access to transport vehicles, to get produce to consumers more readily, especially to industrial consumers who need consistent and timely delivery of supply. Individual retailers sell the products mostly to household consumers.

⁴⁵ Velu Athdhe et al (2009): Gender Analysis of Aquaculture Value-Chain in Northeast Vietnam and Nigeria. Agriculture & Rural Development Discussion Paper 44. World Bank.

⁴⁶ Oluyinka, Alawode (2014): CADP Fish Farmers Export Smoke Fish to U.S. Markets

⁴⁷ FAO (2007): Nigeria Fishery Profile

- Channel 2 involves direct purchase of small quantities of catfish by individual community and neighborhood consumers from fish farms for household consumption. As decentralized channels, fish farmers (Channel 2 actors) are limited in their supply capacity as they can only reach consumers in close proximity to their locations.
- Channel 3 involves direct sourcing by industrial consumer restaurants, hotels, fish shops/ bars, and fast food shops purchasing catfish directly from fish farms at base prices. In this instance, fish farmers know their customer needs in advance of cropping. Industrial consumers based solely in the hospitality sector are driven by demand from their customers and the need to expand their menu options. Individual household consumers are driven by access to diversified and cheaper sources of protein in comparison to red meat or chicken which catfish provides, and the perceived health benefits emanating from its consumption. International consumers are serviced by commercial processors who export smoked fish. Integrated large-scale farmers such as Tee Ess Farms process fillet and whole-smoked fish packaged using barcodes to enhance competitiveness and protection mostly for Africans in

the diaspora in US and the EU. However, export consumption is still negligible with exports approximately 60 tons of smoked catfish per annum. International demand for smoked fish is expected ⁴⁸ to rise with increased transcontinental migration and growing appreciation for African flavours and food.

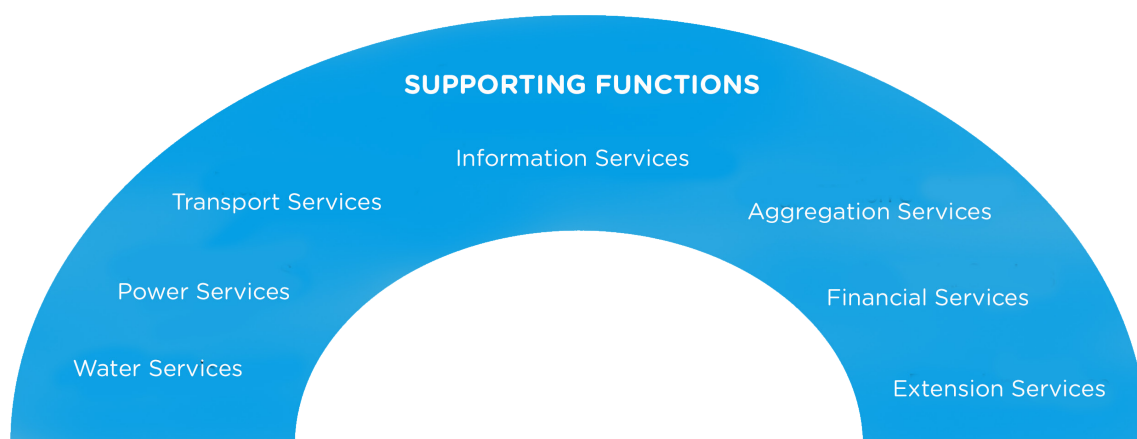
4.3. Supporting functions

There are seven key supporting functions in the aquaculture market system for farm-raised catfish as illustrated in Figure 5: Supporting functions. Each function is described underneath, analyzing the key players, incentives, and interactions with the core market.

Please also refer to the BIF Nigeria Political Economy Analysis for further information on general constraints that impact on the aquaculture market, especially in regard to issues covered in section 4.3.7

4.3.1 Water Services

Adequate and consistent water supply services are vital for small-scale fish farmers if their enterprises are to be sustainable and lucrative. UNDP notes that small-scale



⁴⁸ Small-Starter Think Tank (2013): Dried and Smoked Fish Exports—How to Serve the Demand for Africans Living Abroad. Feb 23, 2013.



operators mostly depend on small fresh water ponds. In some fish farming estates, boreholes are sometimes made available to farmers, while in other estates, water services are not provided and each farmer is responsible for sinking their own borehole to service their ponds. Other independent small-scale farmers rely on wells, streams, rivers, public water sources and rain water⁴⁹. In many cases, farmers whose land is located in swamps simply excavate earthen ponds. Unlike the South, states in North Central Nigeria rather tougher challenges in accessing water given the low water table structure of the region, leading to higher costs for water access. For many states in this region, which is typically dry, irrigation is the solution. The government has invested heavily in developing a network of irrigation channels in Northern Nigeria, but for many poor farmers accessing this water is still a challenge as the associated irrigation service provision is significantly underdeveloped.

4.3.2. Power services

Fish farmers rely on power supply for daily water pumping especially for those using wells and boreholes as their main water supply sources. This includes some farmers with earthen ponds, but especially those with concrete ponds, mobile, and collapsible ponds. The erstwhile nationalised power company, Power Holding Company of Nigeria, has had the monopoly of power provision in Nigeria, and following years of poor and erratic service provision, is undergoing fundamental changes to its structure that will see most of its functions reside within the private sector. Poor power supply is a

constant constraint to productivity across the Nigerian business landscape, and fish farmers, as with every other business, have been equally impacted by the lack of affordable, constant supplies. In mitigating the impact of the power shortfall, farmers have become dependent on alternatives, mainly fuel-powered generators, without which many fish farmers will not be able to run and operate their farms.

4.3.3. Transportation services

Conveyance of fresh catfish is done mostly by wholesalers who attend at the farm gate to buy fish. Unlike wholesalers, fish farmer producers do not have the incentives to take their fish to market for several reasons, though they could fetch approximately N50-100 more per kg in sales. Firstly, many assert that they confront a high risk when they do not find ready buyers at the market to purchase harvested fish. Retailers are also more likely drive a hard bargain for cropped fish on the basis that the farmer would prefer not to lose their fish, which suffer sometimes fatal stress when re-introduced into the pond. The farmer is then left to concede to protect against losses that can occur, leading most to a preference for sales to wholesalers at the farm gate.

Retail sales of a crop of fish can take time to complete; farmers noted that transporting and marketing their fish directly requires spending extended periods away from the farm. Aggregators, on the other hand, are driven by clear incentives to make catfish widely available to consumers. After harvest wholesalers utilize private medium commercial vehicles or trucks/

⁴⁹Hundeyin-Agoro, Christopher (2011): Socio-Economic Analysis of Small-Scale Fish Farming Enterprise in Lagos State Fish Farm Estate Ikorodu, Nigeria. Department of Aquaculture & Fisheries Management. University of Agriculture, Abeokuta, Ogun State.

vans as their major transport modes. The live fish are usually packed in plastic basins or in 50 litre plastic kegs filled with water, some ice, little salt, and some palm oil to stop water from foaming in transit before placing on the floor of the trucks/vans during transportation to major regional markets in cities such as Lagos, Abuja, Port-Harcourt and Kano. Transportation is not a significant issue for most wholesalers though areas with poor road infrastructure and transportation networks connecting to outside communities may face adverse conditions and costs of attracting wholesalers/traders to get fish to consumer markets⁵⁰.

4.3.4. Information services

Information services providers include cooperatives and farmer associations, indigenous companies such as large-scale farms, and very few stand-alone aquaculture consulting firms. With the exception of cooperative associations, the other two actors provide a variety of services in the form of consultancy, especially in relation to pond construction, setting up of farms and hatcheries, nutritional formulations for on-farm feed making, as well as general knowledge and information on the business of fish farming and management to new and existing fish farmers.

Government programmes established for the purpose of supporting farmers across product lines have enjoyed only limited success. Their core role in the provision of agricultural extension services also remains largely unmet in the farmed fish sector. There are however some examples of state

governments, as in Lagos State, with proactive approaches to the creation of improved links and support for fish farm operators. Cooperatives and associations have not been as successful as they could because only a small proportion of fish farmers are enrolled as members. Existing members get some information on where to source quality input such as fingerlings/juveniles, affordable yet effective locally produced feed at discounted rates, etc. The lack of effective value propositions in the activities of these associations has been a constraint to their growth and influence.

Typically, information on prices, market intelligence, conditions and demand drivers, is gathered from practicing fish farmer colleagues through established personal but informal channels, and at periodic meetings and gatherings held by associations. However only active members benefit from the latter. Structured channels for disseminating credible and consistent information simply do not exist.

4.3.5. Self-help aggregation services

Cooperatives and Associations are at the forefront of self-help aggregation services in the sector, offering an assortment of value-based services to their members by helping them to derive benefits that are not available to them when acting alone. For example, a few Associations have used collective bargaining to obtain preferential terms with quality local feed mill producers such as VitaFeed and Durante thereby reducing costs incurred by farmers. Growth in membership should translate to greater leverage in collectively bargaining with

⁵⁰ Odebiyi et al (2013): Value-Chain Analysis for Coastal Fisheries Development in Nigeria.



feed producers. Other Associations are examining how they can provide better access to market and minimum price guarantees for farmers by serving as a collection point and first buyer of all catfish produce, serving effectively as an off-taker who then sells on to the various consumer channels.

The incentives to provide services through self-help aggregation are obvious as cooperatives/ associations realize they can provide beneficial services to their members, such as lowering costs through collective bargaining, and capturing some of the lucrative profits to be made through the aggregator/middle-man function, all contributing to the growth of their organizations, influence, and financial strength. Despite the clear potential offered by such initiatives, Cooperatives and Associations still have not been able to provide services in other fundamental areas such as water management and power supply, largely because of the geographically dispersed nature of many fish farmers.

One key constraint to the growth and development of these organisations is the lack of effective governance and the lack of any professional management skills. This causes most of these organisations to fragment and lose focus over time. Our research has identified this as a potential area for BIF support.

4.3.6. Financial services

Credit and working capital is critical to the sector for several reasons; it energizes

other factors of production like land, labour, inputs, and equipment. Almost all small/ medium fish-farmers source their own finance from savings, family borrowing and from engaging in other economic activities. For an assortment of reasons there is little interest from commercial banks. Agricultural lending schemes introduced and promoted by the government, such as Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) have not had the desired impact. As with the larger commercial banks, micro-finance banks are perceived to be more SME and low-income earner friendly, studies indicate that issues still abound from both the user and supplier side. The lack of a developed market in effective agricultural insurance services is another interlinked constraint.

4.3.7. Extension services

Like any other enterprise fish farming requires enormous amounts of planning, and a grasp of key knowledge and skills before venturing into the business. Effective, accurate, and appropriate cultivation practices and technologies for the aquaculture sector are not as widespread as is necessary. For small-scale producer farmers, training knowledge transfer in agronomy is usually done through government led extension services. These services are under the purview of the State Agricultural Development Programs (ADP) - parastatals under the various State Ministry of Agriculture. As such the provision of extension agents for small-scale farmers across the fish producing regions of the nation are made by these entities. Special training arrangements are also offered

by the State MoA. For example, in Lagos, the Ministry of Agriculture & Cooperatives Department of Fisheries offers training for a fee on various aspects of hatchery operations. Research Centers also play a role in extension service provisioning to farmers/hatchers. For example, National Institute of Freshwater Fisheries (NIFF), African Regional Aquaculture Center (ARAC), and Nigerian Institute of Oceanography & Marine Research (NIOMR) offer short-term entrepreneurial training to farmers on fish farm management, fish feed formulation and production, and fish processing and value-addition. NIMOR also offers a 5 day training to hatchers at a cost of N30-N40,000. Main extension methods and modes for knowledge transfer employed include extension manuals, exhibitions, field trips visit to farmers, and famer excursions to facilities owned by research centers.

Though seeming to possess higher capacities than traditional extension workers (through their facilities that allow for observation, hands on/practical training and experiments), Government extension services within the aquaculture market do not cater extensively to the low-income strata of fish farmers. For the past 27 years of its existence ARAC has only managed to train 4,000 practicing and prospective farmers nationwide. A large portion of ARAC's trainings is in the form of academic knowledge transfer geared towards literate individuals who want to pursue post-graduate diploma or Masters degrees in aquaculture.

The private-sector having noticed loopholes in public extension services and faced with high demand for training from

aquaculturists have taken advantage of this incentive with an effort to fill the gap created in the market, but have done so only to a slight degree. Large integrated aquaculture enterprises such as Durante Fisheries Industries and CHI Ajanla Farms; a few feedmills; and independent stand-alone aquaculture consultancies such as Strategic Time Fish Farming, ChrisAyo Nigeria Resources Ltd., Jovana Farms, Fishmaster Ltd., Kingsway Agro Services, Animal Care Services Konsults Ltd, and Aquanton Konsults provide agronomy training for hatchers and fish farmers through a variety of means, such as seminars, workshops, practical demonstrations, manuals, videos, and online resources for a fee as and when needed upon enquiries. Unlike their counterparts, the few feed mills engaged in agronomy training do so once or twice a month. They are also the only actors that do not charge fees for extension services they provide because they see it as a way to attract hatchers/farmers to buy their feed products and keep their customers loyal. They also see it as an opportunity to grow the sector because it has an indirect benefit which their company will reap in the long-term because better informed breeders/cultivators means higher feed sales.

However, during an interview with feed workers at the mills, it was discovered that some of the mills (such as Capsfeed) have stopped offering training due to management decision; enquiries to find out why or speak with management proved abortive. Likewise, Feedmasters though it trains does so infrequently.

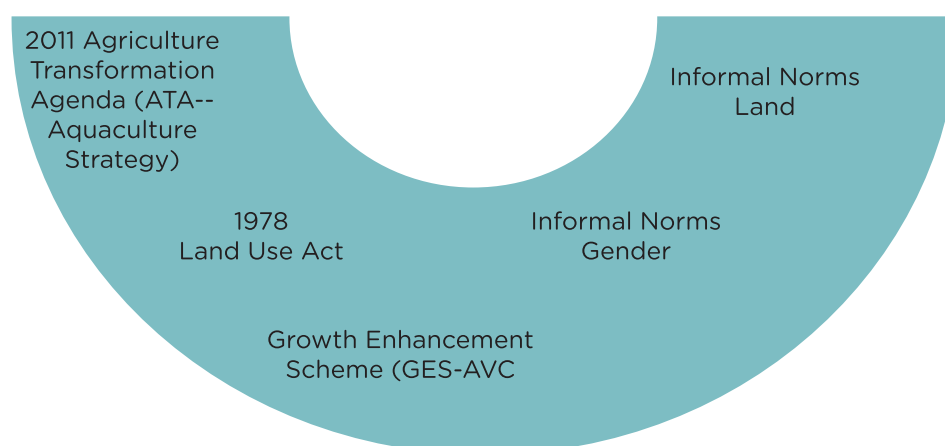
4.4. Rules

Figure 6: Rules shows the rules, standards, and sector-specific regulations that frame the aquaculture market. Each is described below in the following sections.

Please also refer to the BIF Nigeria Political Economy Analysis for further information on general constraints that impact on the aquaculture market, especially in regard to issues covered in section 4.4.1, 4.4.3 and 4.4.4

4.4.1. Agriculture transformation agenda (ATA) aquaculture strategy

FGN-MoA along with its state counterparts are the premier actors in the ATA. In it they have made fish a priority agricultural commodity for production since it constitutes 41% of total animal protein intake by the average Nigerian. Aquaculture is therefore seen as a major investment outlet to help the MoA reach its goal of creating an enabling environment for increased and sustainable production of over 1 million



Nigeria has no specific legislation on aquaculture at a federal level⁵¹. From an institutional point of view, the authority responsible for the management of fisheries and for the preparation of policies and programs for the development of fisheries is the Federal Department of Fisheries (FDF) of the Federal Ministry of Agriculture and Natural Resources, which provides technical support to State Departments of Fisheries (SDF). Likewise, the latter provide support to Local Government Authorities (LGA) on fisheries matters.

metric tons of farmed table fish. The goal creates a clear incentive for the FGN-MoA to promote the development of the aquaculture sector because the country currently spends on average N97,000 million naira on annual fish imports holding the position of the world second largest importer of fish⁵². Undeniably, this has a debilitating effect on Nigeria's domestic aquaculture sector and wider economy because the country is importing what it can produce in abundance. The FGN MoA realizes that import dependency hurts Nigeria's farmers and displaces local production creating rising unemployment.

⁵¹ FAO: Nigeria Aquaculture Legislation Overview. Fisheries & Aquaculture Department.

⁵² Anudu, Odinaka (2014): Reducing Nigeria's N125 Billion Fish Import Bill. Business Day Newspaper. September 17, 2014

Most pressing of all, import dependency is deemed as fiscally and economically unsustainable placing continuous pressure on the naira which fuels domestic inflation. Lastly, if exports are banned or production in other exporting economies is jeopardized due to any external/ internal shocks, this could threaten Nigeria's food security. With this in mind, promoting selfsufficiency in fish production became a major goal of the MoA.

With the hopes of turning the country from a net importer of fish to a net exporter,

the ATA target to produce over 1million tons of farmed table size fish per annum is projected to generate 500,000 jobs within 5 years (essentially 100,000 jobs per year). The ATA seeks to achieve this through the creation of an enabling environment for increased and sustainable production. Specific strategies and performance status over the past 4 years from 2011 till date (indicating progress and developments) aimed at achieving the above-mentioned objective are as follows:

S/N	Aquaculture Strategy	ATA Performance Status
1	Reduce importation of eliminated aquaculture products and inputs by 25% annually	There have been a recent measures introduced by GoN to severely limit the importation of farmed fresh water fish (catfish and tilapia species) due to the high investment of small, medium, and large private-Sector players in its production Nigeria.
2	Double the hectares (previously 60,000 ha) under production to 120,000 Note: Current yield: 2.55t/ hectare Note: Targeted yield: 18 tons/ha	Present water surface area under fish production is unknown. Presently the nation produces an average of 2.55t/ha. However, the MoA notes that to meet projected demand aquaculture production must reach 18tons/ha as the country average, which would include the establishment of water recirculatory systems (WRS) and other systems that can produce as much as 40t/ha
3	Enable small-scale fish farmers to be part of the value-chain	13 hatchery production centers have been established since the ATA launch in 2011. 72 farmers (2 trainees per state) were trained on hatchery development to achieve the 1.25 billion fingerlings required to produce the targeted domestic supply of 1 million tons of fish per year. 62 fish farmers benefited from the Fish Farm Estate Development Program. 3,000 fish farmers took part in the Lagos database registration. However, it is unknown how many have been registered in other states. One-stop shop initiatives fish markets (including breeding, cultivation, and marketing of fish) have been established in Yauri (Kebbi State), Erinwe (Ogun State) and Atabong (Cross River State), while 2 more in Lokoja (Kogi State) and Onitsha (Anambra) are under development.

S/N	Aquaculture Strategy	ATA Performance Status
4	Encourage clusters of farmers to produce fish that would service processing & packaging plants	Between June to Oct 2012, farmers have been encouraged to form clusters in each state. A fish farm estate was developed in Erinwe, Ijebu, Ogun State through a private initiative that produces 1,500 tons/year. Comparison of the yield productivity of this estate with the national average of 2.55/ha (to decipher if it is significantly more productive and efficient) isn't possible as of now because the total hectares of the estate is unknown. However from discussions with NIOMR officials, the estate is doing well. In 2011, two largescale fish processing plants were established in Kwara & Borno States. Likewise, Six cottage processing centres were established in Borno, Kebbi, Lagos, Delta, Imo, and FCT under a PPP arrangement. Finally 3 SCPZ for fish processing have been established in Lagos, Bayelsa, and Rivers states.
5	Establish maintain quality standards along the value-chain backed up by appropriate regulation for the purpose of fish farm certification	Currently the West African Agriculture Productivity Program (WAAPP) is certifying brood-stock banks/hatchers. FDF has trained 40 facilitators to disseminate training models for the certification of fish farms. 2 facilitators were trained per state. It is unclear when actual certification will commence.
6	To generate foreign exchange through exports of aquaculture products.	A total of 3,967 metric tons of fish and related products were exported to the EU and US in 2012 representing a total value of \$45,090,640. Of this, the exact value contributed by smoked catfish is unknown, however research indicates the country exports 5 tons of catfish per month, a total of 60 tons per year - this is mostly done by a few large commercial fish farmers who have met international certification/processing standards.
7	Improve fish food safety and traceability standard (developing a national standard)	Still ongoing. International standards - known as Good Agricultural Practices (GAP) -are being adopted by FGN with specific farms (mostly large-scale for now) being GAP certified. NAFDAC & SON are also formulating standards which are underway.

Whilst some progress has been made towards meeting each objective, developments and uptake (based on government initiatives) still remain very minimal given the four-year timeframe within which the strategy has been implemented. Despite little government support, the dynamic growth and deepening of the catfish market over the past fifteen years is largely based on the activities of the private-sector, capitalizing and riding on a wave of increased local sourcing through the limitation of imports of farmed catfish.

4.4.3. 1978 Land Use Act

Though it is unknown what obtains in other states, in Lagos, agricultural land is not made available or accessible directly to private individuals (with the exception of homestead cultivators) for aquaculture purposes in a bid to deter undesirable outcomes of the drilling of multiple boreholes across the state because of its environmental impact. Firstly, it weakens the soil, the foundations of other adjacent lands, and (though albeit not a major issue in Nigeria) increases the risk of earthquakes. As a result, government land that is eventually sold and set aside for aquaculture is usually bundled up in parcels (located in outskirts/remote areas) and is purchased from the Agricultural Land Holding Authority (ALHA) before selling to private farmer users. Secondly, there is limited land available that can be sold due to population pushes and pressures. The process of urbanization has had a negative overall effect on fish production in the

State in terms of accessibility to land by investors and farmers (smallscale) who plan to expand. Lagos is growing on daily basis. In a study of perceptions and practices of aquaculture within Lagos, over 80 percent of respondents agreed that extensive system using dug out earthen ponds cannot be practiced any longer within the cities because of the industrialization process. According to the farmers, the ever-increasing number of people migrating to the cities is putting pressure on the land⁵³.

These variables, especially land tenure systems put serious limitations on the amount of land that is available for aquaculture. Beyond Lagos, Adeogun reports it is particularly true for and proves a major constraint for the eastern part of Nigeria⁵⁴. Since the FGN MoA wants to double the total water surface area under fish production from 60,000 ha to 120,000 ha, it is unclear what steps or key initiatives are being implemented to streamline access to land for fish farmers over the nation.

4.4.4. Special Growth Employment Scheme for Aquaculture Value-Chain (GES/AVC)

The GES has commenced database registration of fish farmers all over the nation as a means to enhancing reach and distribution of fish feeds and fish fingerlings/ juveniles. 840 registered farmers were given free fish fingerlings and 5 bags of subsidized fish feed in 10 states including the Federal Capital Territory (FCT Abuja)⁵⁵. In the period to July 2014, 8,400 fish farmers have benefitted from the GES/AVC scheme. The inputs distributed

⁵³ Adeogun, O.A et al (2007): Urban Aquaculture: Producer Perceptions and Practices in Lagos State, Nigeria. Middle East Journal of Scientific Research. Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria. Department of Agricultural Economics, Faculty of Agriculture, Obafemi Awolowo University, Ile Ife, Nigeria.

⁵⁴ Adeogun, O.A et al (2007): Urban Aquaculture: Producer Perceptions and Practices in Lagos State, Nigeria. Middle East Journal of Scientific Research. Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria. Department of Agricultural Economics, Faculty of Agriculture, Obafemi Awolowo University, Ile Ife, Nigeria.

⁵⁵ Abolaji Adebayo (2014): Aquaculture Value-Chain: Federal Government Promises 500,000 jobs in 5 Years. National Mirror Newspaper. July 4, 2014.

seem inadequate in the light of the typical production costs of an average small-scale fish farmer. In a given cultivation cycle of four months, a small-scale farmer stocks on average 1,500 juveniles (costing N37,500/\$235) and requires approximately N400,000 (\$2,500) in fish feed.

There appears to be no consistency in the provision of these inputs supplied to fish farmers as intended. In Lagos State a number of fish farmers interviewed had not benefitted from the initiative.

This is most likely due to a combination of reasons. Some farmers were unaware of the FGN or State MoA database registration exercise. Corruption is another potential factor. It is not unusual for officials in responsibility roles to distribute the inputs amongst themselves rather than to the fish farmers it was intended for. While a good development in principle, the introduction of the GES/AVC scheme seems to be fraught with implementation issues.

4.4.5. Informal norms - land ownership and costs

Access to and ownership of land affects utilization ability, food production, self-sufficiency, and overall well-being of the farmers. Most small-scale fish farmers cultivate within their residential premises. The land upon which they live (mostly rural or semi-urban) is usually from traditional inheritance or family/communally owned. Where necessary, farmers engage in land leases and purchases from private individuals. A significant portion of small-

scale farmers interviewed actually rent the land upon which they cultivate farmed fish. On average, small scale farmers cultivate on 1 plot of land which can fit 2 ponds (30 ft x 60 ft) with earthen and concrete ponds. Costs incurred by small-scale farmers in relation to land acquisition for cultivation are explained and differentiated in Table 5: Costs of different types of ponds.

Table 5: Costs of different types of ponds

Type of pond	Land acquisition costs	Pond construction costs
Earthen Pond: This involves digging up the soil (usually clay) to create a pond	1 plot of land can fit 2 ponds 1 plot cost N500,000 in Ikorodu, Lagos to own 1 Plot costs N100,000 in Akure Note: For earthen cultivation, ponds are rented not land due to the permanent nature of the dug-out. In Akure rental rates for 2 ponds on 1 plot goes for (N10,000) per month (totaling N120,000) per year. In Ikorodu, Lagos, rental rates for 2 ponds on 1 plot goes for N17,000 per month totaling (N200,000/year). Figures are based on field interviews with fish-farmers.	The ponds are hand dug using locally fabricated equipment called a digger. The equipment cuts the muddy soil into rectangular shaped “blocks”, which are used to build retention walls/dykes around the pond. Labour Digger Costs: N30,000 Laying of Pipes & Nets: N10,000 Sub-Total: N40,000 Total Ikorodu: N240,000 (including land rental cost) Total Akure: N160,000 (including land renting cost)
Concrete Pond: Cement blocks are used to construct the pond above the ground level.	1 plot of land can fit 2 ponds 1 plot costs N500,000 in Ikorodu, Lagos to own. 1 plot costs N100,000.00	Surveys - N5,000 Site Clearing labour - N2,000 Excavation of reservoir/pond - N10,000 Channel Construction-N16,200 Carpenter & Bricklayer labour - N3,500 Planks/wire net/ monks - N3,000 Labour dressing/grassing pond - N3,000 Sub-Total: N42,900 Total Ikorodu, Lagos: N542,900 (including land purchase) Total Akure: N142,900 (including land purchase)
Plastic Ponds & Fiber Pond: These are fiber glass tanks. The advantage of this pond is that it can be moved	Land space would still need to be purchased or rented to house and place the movable ponds. Cost of renting in Lagos approximately N200,000 per plot Cost of renting in Akure approximately N120,000 per plot	No pond construction costs involved. Purchase of plastic pond-N30,000 Grand Total Ikorodu, Lagos: N230,000 Grand Total Akure: N150,000

Source: Field Interview August 2014 & “Financial Analysis of Small-Scale Fish Farming Enterprises to Alleviate Poverty in Homestead.” Aiyedun, 2005



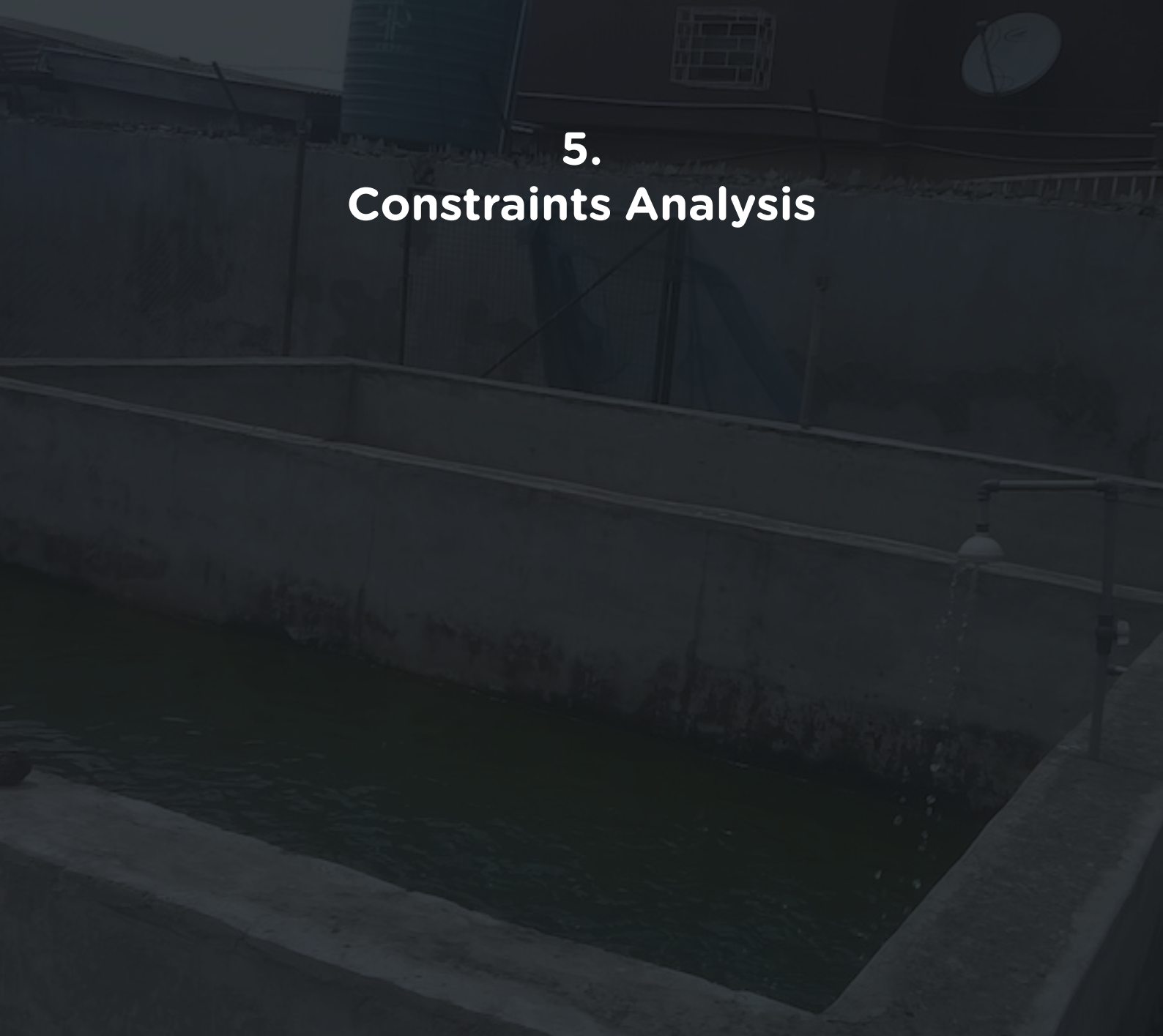
Farms are almost always registered in rural communities in the name of men (to represent households), and customary male-dominated patterns of control over land remain a constraint for women farmers in Nigeria. All in all, more male fish farmers own their land in comparison to their female counterparts who tend to rent.

4.4.6. Informal norms - gender roles and division of labour

Historically men have been farmers and women focused on processing because culturally women have domestic roles. In the South, most small-scale processors are women who use traditional methods of smoking; they also undertake retailer roles. Women are less likely to be directly involved in hatcheries but are more visible in the post-nursery farming stages. Men on the other hand, are found mostly in the cultivating, packaging, hauling, logistics, and transporting channels of the value chain. A sample of 53 fish farmers in the Lagos Aquaculture Producer Perception and Practices Study indicated that 89% of producers were male while 16% were female 56. Similar trends were found in the Niger Delta fish farming regions.

In contrast to the South the norms in Northern Nigeria are characterized by a distinct difference in terms of the role of women along the value-chain owing to cultural and religious beliefs. As such, Northern women are usually at home cultivating the pond, while men undertake processing, transporting, and retailing activities.

Finally, the role of the youth (mostly unemployed graduates) in the sector illustrates a norm that is deepening. It appears that many young people are getting involved and are gravitating towards hatching nurseries with its lower capital outlay requirements and the shorter product cycle. Anecdotal evidence suggests that this preference is also driven the ability of these youths to understand the technicalities of hatchery operations better and faster as they are more enlightened and literate than their older counterparts.



5. Constraints Analysis

5.1. Main constraints

Critical to the continued success of Nigeria's aquaculture sector is a well-functioning and efficient market for farm raised catfish. To this end, the bottlenecks, inefficiencies, asymmetries, and constraints that result in market under-performance must be addressed for small-scale fish farmers to maximize returns from their enterprises. The section above covered key constraints and performance issues found across the core market functions, which are in-turn linked to the following symptoms summarized below as areas of market underperformance.

1. Untrained farmers use low quality fingerlings/juvenile inputs which results in low productivity;
2. Farmers employ poor cultivation practices in relation to feed, pond, and water management which results in low productivity;
3. Farmers employ poor water quality management which affects their productivity;
4. Farmers experience high feed costs which increases their cost of production and reduces their profitability;
5. Small-scale farmers do not have economies of scale in infrastructure and inputs which leads to high production costs. In the following section each of these constraints is analysed, and the root causes of each are outlined.

Constraint 1: Untrained farmers use low quality fingerlings/juvenile inputs which results in low productivity.

Poor quality fingerlings/juveniles affect fish farmers adversely, reducing productivity and overall cost. Many large-scale hatcheries known for quality production are unable to satisfy mass market demand as well as meet their own needs for fingerlings/juveniles. Small-scale/medium -scale hatchers step in to fill in the supply shortages, but are generally unable to produce quality fingerlings/juveniles. What they do produce is genetically compromised owing to improper identification and in-breeding of parent-brood-stock, and spawning methods/procedures that jeopardize the health of fingerlings/ juveniles. With low rates of production and low output of good quality fingerlings, the productivity of the dependent small-holder farmers is affected

with many experiencing low yields, high incidents of runs, and mortality rates, thereby limiting their ability to maximize their incomes.

Root cause 1.1 - limited access to capital for hatcheries: the persistence of low yields due to insufficient supply of good quality fish inputs can be traced to a significant factor, the sub-standard facilities that characterize many small-scale hatcheries. A standard hatchery should use a flowthrough or re-circulatory water system, however this needs uninterrupted power that pumps and supplies water at a consistent temperature for fries, fingerlings, and juveniles. In the absence of constant affordable grid-based power supply, the cost of fuel to operate round the clock generators is problematic for their profitability. For those that cannot afford fuel, they utilize manual “water-change” method, which is not desirable due to the inconsistency in water temperature, a serious factor that leads to the mortality of newly spawned fries and the creation of fingerlings/juveniles runs. A second key indicator of a sub-standard facility is inadequate space. Hatcheries need adequate space to spawn, to house nursery ponds for new fries, to house segregate fingerlings/juveniles by growth rate, and to house and genetically separate brood-stock they cultivate. All of this cannot be achieved without adequate expanse of land and small-scale hatchers find the terms of capital from mainstream commercial and micro-finance banking systems unaffordable. Small-scale hatchers have noted that access to capital would afford access to enough land to house a standard hatchery with all the relevant requirements.

Root cause 1.2 - limited linkages to technical expertise and training available to hatcheries: the proliferation of poor quality fingerlings/juveniles in the market is also as a result of inadequate technical knowledge possessed by hatcheries. A dominant proportion of hatchers in Nigeria are the small-scale hatchery operations that comprise about 80% of the catfish aquaculture sector, and which face severe knowledge constraints and technical skills in identifying adequate brood-stock to be utilized for spawning and breeding good quality fingerlings. In some instances young, immature fish are utilized for parent brood-stock and spawning, a gross departure from standard best practices.

The female fish brood-stock, which is responsible for producing eggs, is utilized too frequently without alternating resulting in compromised eggs. Other technical knowledge constraints that contribute to poor quality fish inputs and improper cultivation include lack of know-how in relation to proper water quality and temperature management.

Root cause 1.3 - limited information and extension services provisioning to farmers: many farmers rely on informal networks to identify input suppliers resulting in multiple trial and error approaches in locating a hatcher who produces good quality fingerlings/juvenile specimen. Many small-scale farmers are unable to identify what makes good-quality fingerlings/juveniles and how to distinguish them from bad ones because they lack knowledge and formal/systematic reliable information channels on “what” but particularly “where” to source. Unqualified suppliers

therefore supply poor quality fingerlings to unsuspecting farmers, especially inexperienced farmers/new entrants in the aquaculture sector. The resultant effects are a high proportion of runts during harvest period amounting to a significant loss for poor small-scale fish farmers.

Constraint 2: Farmers deploy poor cultivation practices in relation to feed regimens and content which results in low productivity.

Many Nigerian fish farmers employ poor cultivation practices, which manifest, for instance, through the lack of adherence to a proper feed regimen (such as use of cheap/poor quality on-farm/homemade self-formulated feed), poor pond management, and truncation of standard cultivation periods as seen with farmers who harvest after 4 instead of 6 to 9 months as recommended. The cumulative effect of these, reduces their productivity yields and ability to make most of incomes they could derive.

Root cause 2.1 - limited information and extension service provisioning to farmers: the underlying cause of improper cultivation practices is because farmers do not have credible, reliable information channels and rely on informal sources, which are mostly ad hoc knowledge passed down by other farmer colleagues, to obtain information on how to cultivate farmed catfish. This can lead to devastating outcomes. When fish are not fed adequately, irregularly or with poor components lacking balanced nutrition, this adversely affects their health, growth, and ultimate size. Similarly, when the pond is not managed properly through frequent sorting

of fish, a practice whereby small size fishes growing at a slower rates are separated into other ponds to feed separately and to stop cannibalization by bigger fish, then high mortality rates and runts also manifest. All this may be traced, historically, to the root cause of limited information and extension service provisioning to farmers due to ineffective service delivery by State Agricultural Development Programs (ADP) the responsible public agent provider. One of the major reasons for limited services is the inadequate ratio of agents to farmers. Nigeria has adopted the FAO standard ratio of 1 extension agent to 1000 farmers (1:1000). Field visits to the Lagos State Agriculture Development Program and other research revealed that most States, including Lagos, have an agent to farmer ratio that is nearer 1:30,000, with the farmers covered involved in a wide variety of different crops and livestock. Lagos currently has 83 agents when it should have a minimum of 128 according to state officials. Beyond shortages of agents, existing agents are also poorly trained and are unable to reach or visit farmers due to lack of transportation because ADP are underfunded and operate below capacity, having to face competing demands for funds from other MoA initiatives and programs. In any given year the state Commissioner of Agriculture determines unilaterally what programs get adequate funding, the amount, and timeliness of which such funding are granted.

Constraint 3: Farmers employ poor water quality management which affects their productivity.

Critical to fish farming productivity, and especially in concrete ponds, is the availability and supply of water and proper water quality management. To this end, many farmers provide their own water supply individually through the sinking of boreholes. All small-scale farmers utilize the “water-change” mechanism for their ponds, which involves daily pumping of water from boreholes and channeling through inlet and outlet pipes. For a variety of reasons, including a lack of knowledge and the power deficit, daily water changes are not always adhered to, resulting in an adverse impact on the health, growth, and harvest weight of fish crops. This results in losses or in severely truncated profits.

Root cause 3.1 - farmers do not have economies of scale in infrastructure: the underlying cause that prevents small-scale farmers from following proper water management is the high cost of power.

To pump water on a daily basis for their ponds, farmers need consistent power supply. However, due to the country's erratic supply from the national grid, farmers utilize their individual generators and purchase fuel for their power needs. As a result of this and owing to the fact that catfish farmer cultivators are geographically dispersed in homesteads or on lands that are not strategically designated for that purpose, they do not realize economies of scale in infrastructure such as power supply. Likewise, farmers who are contiguously located in fish farm estates fare no better as they too provide their own power supply

individually leading to higher cost of production.

Constraint 4: Farmers experience high feed costs which increases their cost of production and reduces their profitability.

Fish feed accounts for approximately 60-70% of total cost of production incurred in any given catfish cultivation cycle. Farmers often use both types of feed - type 1 starter feed and type 2 ongoing feed - during the cultivation period in order for the fish to thrive. The actual costs for a typical small-scale farmer are high compared to their incomes, leaving little margin for error. Faced with this high cost of production, the profitability of fish farmers is hampered.

Root cause 4.1 - Limited Access to Capital, Linkages, & Strategic Partners for Investing in Type 1 Starter Feed.

The underlying cause of high feed costs faced by farmers is due to total lack of production of type 1 starter feed (high quality, rich in protein Artemia) in Nigeria. The production vacuum is as a result of limited access to technology and know-how. Yet, almost all farmers raising table size fish utilize type 1 starter feed for the first two months of cultivation when fingerlings/juveniles are still young, fragile, and are in their critical early formative stages. As such all type 1 feed used by both farmers and hatchers is imported because local feed mills have not been able to master the nutritional component and the cold extrusion technology required for this specialty feed type. The cost of the product and import duties, are factored into the sale price to farmers.

Furthermore, capital constraints and the high cost of lending in Nigerian discourage feed mills from making critical investments needed for type 1 starter feed, i.e.: knowledge acquisition on appropriate. Given the specialized nature of type 1 feed production, much of the knowledge and know-how still resides outside Nigeria, with supplies sourced from Netherlands, Israel, Denmark, and the U.S.A.

The perceived high risk /high cost of engaging in fixed asset investment in Nigeria, deters outsiders. The growth in demand appears not to have created sufficient incentives thus far to localize production in Nigeria, for the local market.

4.2 Root Cause: Farmers Perceive Locally Produced Feed as Inferior and Produce Self- Formulated Feed

Unlike type 1 starter feed, type 2 ongoing feed used during months 2 to 6 can be , and is locally produced in Nigeria. Apart from a few quality-oriented millers, local type 2 fish feed is not produced to international standards (lesser protein content), nor in sufficient quantities as most feed mills engage in fish feed as a non-core business. Many local mills interviewed confirmed that fish feed production accounts for only about 10% of their output, with a greater focus on cattle, poultry feed. This is because fish feed is too costly to produce being that it must be pelletized unlike other livestock feed comes as a mash. Many local feed mills utilize sub-standard machinery which does not pelletize properly, and in most cases sun-dry the inputs instead of using machine air dryers which guarantee quality. The outputs justify the farmers'

perception of these products as being inferior to imports, with the perception widely applied to all Nigerian feed. To guard against this quality deficit, small-scale farmers pursue what they consider to be suitable alternatives and engage in self-formulated /homemade feed production. The prevalent practice by the farmers worsens the incentives of local feed mills to invest in quality improvements.

4.3 Root Cause: limited access to capital, linkages and strategic partners for improving and expanding type 2 starter feed production: type 2 feed production demands sufficient power supply to operate pellet machines for long periods of time, and high levels of working capital to maintain supplies of raw materials such as soya, maize and molafeed, which are seasonal and are therefore subject to price fluctuations. Because other livestock feed are easier in nutrient formulation, cheaper to produce, involve less complex technology and less investment, fish feed production, with its relative high cost, is seen as a challenging market to potential investors. Without the growth of effective competition with new entrants and additional feed mills, or enhancement of the capacity of existing local feed mills through greater access to finance, linkages, and strategic partners that can provide technology, and know-how, the improvement of access to quality type 2 feed remains a daunting challenge.

Constraint 5: Small-scale farmers lack economies of scale in infrastructure & inputs which leads to high production costs.

Lack of economies of scale in infrastructure and input supplies contribute heavily to high production costs incurred by farmers. As already analysed above, the cost of feed is the biggest input supply issue farmers face. The second is the issue of infrastructure (mainly power supply) for daily water pumping needs to service fish ponds. Farmers have high operating expenses, which reduces their profitability.

Root cause 5.1 - farmers do not understand the benefits of collective action: farmers face high production costs because many producers are still fragmented and operate independently with approximately 80-90% of cultivators not part of any producer Associations resulting in limited collective action on the part of farmers. This is largely because many independent fish farmers are uninformed of cost-savings that Associations can offer. Even so, there is limited evidence that Associations manage to maintain an attractive value proposition to attract new members and maintain existing ones. Governance, accountability and professionalism are lacking in the management and operations of many Co-operatives and Associations. The potential for collective action, beneficial for effective input price bargaining and for advocacy is significant, yet largely unrealized. Currently, very few Associations have partnerships with quality feed mills or purchase feed in bulk allowing for a reduction in cost. We have also seen examples in the Niger Delta, of the co-operative approach used

to manage the risk of over-supply in the market through controlled harvests from member ponds.

5.2. Summary of constraints and root causes

We have analysed these constraints in

order to identify the root causes of each constraint and to then design interventions that can remove these root causes and thereby address the constraint. Our analysis of the root causes, and proposed interventions, are presented in Table 7.

Table 6: Root cause of the constraints and proposed interventions

S/N	Constraints	Underlying causes	Related core, supporting and enabling functions	Root causes	Intervention
1	Untrained farmers use low quality fingerlings/ juvenile inputs which results in low productivity	Insufficient supply of quality fingerlings	Extension Services Hatchery Services Financial Services Aggregation Services	• High cost of feed • Limited access to capital for hatcheries • Limited linkages to technical expertise and training available to hatcheries	Intervention 1: Work with mediumlarge hatcheries to develop an outgrower scheme providing embedded know-how, inputs and finance to small-scale hatchers e.g Tropical Fish Services is ready to enter into contract farming arrangements with three smallscale hatchers
		Farmers rely on informal / untrained networks to identify input suppliers	Extension Services Information Services	Limited information and extension service provisioning to farmers	Intervention 1: Work with medium large hatcheries to develop an outgrower scheme providing embedded know-how, inputs and finance to smallholders.
		Farmers are unable to recognize and identify good quality fingerlings/ juveniles	Extension Services Information Services	Limited information and extension service provisioning to farmers	Intervention 2: Work with Farmer associations to devise a certification system incorporating a certification mark that identifies small hatcheries that meet minimum acceptable standards of production eg LASCAFFN, CAFN, FISON, and WAPI are prospective associations.

S/N	Constraints	Underlying causes	Related core, supporting and enabling functions	Root causes	Intervention
2	Farmers employ poor cultivation practices in relation to feed, pond, and water management which results in low productivity	Farmers rely on informal sources of information about cultivation	Extension Services Information Services Self-Help Aggregation	Limited information and extension service provisioning to farmer	Intervention 1: Work with medium large hatcheries to develop an outgrower scheme providing embedded know-how, inputs and finance to smallholders. Intervention 3: Work with farmer associations to define/strengthen governance, membership services offering and outreach. This should include provision of basic extension service eg LASCAFFN, CAFN, FISON, and WAPI are prospective associations to work with to provide on-farm practical demonstrations, videos, manuals, and content for radio programs for fish farmers.
3	Farmers experience high feed costs which increases their cost of production and reduces their profitability	Lack of locally produced type 1 starter high quality protein rich feed for farmers & hatcheries in early cultivation	Feed Services Financial Services Aggregation Services	- Limited access to capital for investing in type 1 starter feed - Lack of access to linkages and strategic partners for feed production	Intervention 4: Strengthen the design and optimization of insect breeding systems as substitutes for Type 1 & Type 2 Fish Feed for small-scale fish farmers eg Insectbreeding businesses have been established in Ohio, USA (Enviro- Flight), Mali (Institut de Economie Rurale supported by PROteINSECT) and Ghana (Fish for Africa supported by PROteINSECT) are all focused on rearing black-soldier flies and maggots/ house fly larvae for fish farms as cost-

S/N	Constraints	Underlying causes	Related core, supporting and enabling functions	Root causes	Intervention
3					effective alternatives to conventional feed. However, further research needed to identify key actors and players in Nigeria that can adopt the model. Note: Further research needed to identify key actors and players in Nigeria that can adopt the model
		Local feed mills are not producing sufficient quantity and quality of type 2 ongoing feed	Feed Services Financial Services Aggregation Services	• Farmers perceive locally produced feed as inferior and engage in and utilize self-formulated on farm / home-made feed • Limited access to capital for expanding the improvement of type 2 ongoing feed • Lack of access to linkages and strategic partners for type 2 feed production expansion	Intervention 3: Work with farmer associations to define/strengthen governance, membership services offering and outreach. This should include provision of basic extension services, Intervention 4: Strengthen the design and optimization of insect breeding systems as substitutes for Type 1 & Type 2 Fish Feed for small-scale fish farmers.

S/N	Constraints	Underlying causes	Related core, supporting and enabling functions	Root causes	Intervention
4	Small-scale farmers do not have economies of scale in infrastructure & inputs which leads to high production costs	Limited collective action on the part of farmers	Aggregation Services Self-Help Aggregation	- Farmers do not fully understand benefits of collective action - Farmers do not know how to come together effectively	Intervention 5: Work with a fish products entrepreneur to implement an integrated clusterfarming model that will provide a community of fish farmers with shared infrastructure, services and access to market eg Debirith Nigeria Limited has secured land to establish a Fish Farm Estate.



6. Market Strategy

6.1. Market strategy statement

The BIF vision for Nigeria's farm-raised catfish market is to increase local production and supply output to meet the country's domestic demand for catfish, and improve farmer incomes. This will be achieved by improving productivity yields of small-scale farmers through improved cultivation practices and by enhancing the capacity of their input suppliers (hatchers and feed mills) to produce better quality input products (fingerlings/ juvenile and feed) at competitive prices without jeopardizing quality

There are prospects for small-scale fish farmers to achieve higher incomes through opportunities created by existing national policy on import substitution of fresh-water fish currently promoted, and implemented by the FGN MoA towards the nation's goal of self-sufficiency in fish production. The recent imposition of import restrictions on all fresh-water farmed fish creates opportunities that can be capitalized upon by private-sector investment in farm raised catfish production, which can raise the output efficiency of current small-holder producers while simultaneously absorbing additional new entrants. Currently producing on average 250,000-300,000 metric tons compared to a goal of producing 900,000 metric tons annually, the supply gap that small-scale farmers can fill is sizeable, creating attractive incentives to realize lucrative income gains, subject to the maintenance of demand growth in parallel.

Also on the horizon is the establishment of dedicated fish marketing terminals in Lagos, Ondo, Kwara, and Kogi states which are sure to widen market access for farmers leading to enhanced terms of trade. Increased yields emanating from adoption of better cultivation practices and higher quality inputs can also be channeled into processing channels and specific initiatives currently underway to spur deeper investment in the sector. These include Staple Crop Processing Zones (SCPZ's) for large-scale fish processing plants focused on catfish and its by-products (fish cakes, fish crumbs, smoked, filleted fish, and canned catfish chunks) for internal and export consumption which would also expand income opportunities for small-scale farmers.

6.2. Opening portfolio of interventions

BIF has a fundamental objective of enabling small-scale fish farmers to capture benefits of improved performance in the aquaculture market. The strategy employed to realize these benefits will focus initially on addressing constraining factors in the market where opportunities exist for scale and quick wins. To this end, five interventions are proposed but four are initially presented below in the opening portfolio given ease of implementation. These proposed interventions are designed to achieve change at enterprise and wider market sector level ensuring long-term systemic changes are catalysed.

Intervention 1: Work with medium-large hatcheries to develop out-grower schemes providing embedded know-how and input finance to small-scale hatchers.

Market underperformance: insufficient supply and production of quality fish fingerlings/juveniles is an ongoing problem because a sizeable proportion (80%) of hatchers in Nigeria are small-scale hatchery operations, who face severe knowledge constraints and technical skills in identifying and cultivating adequate brood-stock to be utilized for spawning and breeding good quality fingerlings and juveniles. Hatchery functions within the aquaculture value-chain operate significantly below standard expectations. Approximately 50% of hatcheries are suggested to be quacks comprising mostly of individuals trying to earn a living but who lack the professional skills, adequate capital and facilities to produce quality fish inputs.

Vision of change: the vision of change at the service level is to improve supporting functions in relation to extension, financial, and aggregation services related to the input supply core function of hatchery services. This will be delivered by increasing the availability, effectiveness, and reach of embedded services to hatchers in order to increase their technical knowledge, know-how, and capacity in implementing best practice and procedures needed to sustainably produce quality fingerlings/juveniles. Key elements of technological innovations in hatchery operations and management will include brood-stock identification, spawning and breeding, disease control, reduction in mortality rates of fries, and water quality and temperature management. As a whole, this will create a wider market change that improves access and allows small-scale fish-farmers to both consistently source and utilize quality fish fingerlings/juveniles leading to increased productivity.

Intervention overview: the model for this intervention is the creation of hatcher out-grower schemes. The model involves two main actors: large/medium sized, professionally run, commercial hatchers, and small sized underperforming hatchers. This model involves creating increased market share for large/medium-scale hatcheries as an incentive to expand and develop additional capacity in the production of quality fingerlings by taking on and incorporating small hatchers under their umbrella through an out-growers scheme or business franchise. Large/medium hatcheries will form partnerships with small ones, aimed at providing embedded services, supplying quality

brood-stock and/or fries for fish seed production, agronomy training, and feed on credit terms. The contracting farming alliance will ensure sufficient production and supply of quality fingerlings for wider fish farmer market end-users. Once breeding is completed, small hatchers then supply juveniles to large/medium hatchers as the off-takers, and the revenue is shared based on an agreed split that incorporates monetization of input credits and embedded services provided.

This model can be carried out with multiple small-scale hatchers, subject to the capacity of the dominant party. One potential entry point is with Tropical Fish Services, a large-scale integrated hatchery in FCT-Nassarawa region who appears keen to enter contract farming arrangements with three sets of small-hatchers who will breed from fries to juveniles.

BIF will aim to access small hatchers through specialized hatchery associations or integrated producer fish farmer associations in target states of BIF's focus. Equally, there may be opportunities to engage with other large hatchers such as Durante Fisheries, CHI Ajanla Farms, Obasanjo Farms, Cannan Land Farms, Songhai Farms, Abanum, and Zartech that possess the capacity to execute this out-grower schemes.

Activities for this intervention will include:

- Develop detailed and comprehensive case studies of successful hatchery out-grower's scheme within or outside Nigeria;
- Identify potential large and small-scale hatchers and effective Co-operatives

and Associations who may be interested in entering into an out-grower scheme in each target state;

- Create awareness of improved knowledge and best practice techniques and innovations in hatchery operations and management;
- Large/medium hatchers meet with independent small hatchers or those in hatchery or integrated
- producer Associations, facilitated by BIF, to carry out needs assessment of small hatchers;
- Large/medium hatchers develop a package of embedded services and proposals to small hatchers;
- BIF provides TA to help develop a business case to support this model;
- Adoption of the model through implementation of a pilot with BIF to provide seed fund or smart subsidy where deemed suitable;
- Data collection of baseline and post-pilot analysis;
- Dissemination of findings to partners to support further adaptation and expansion of the model;
- Process improvement review
- Wider publication of findings geared towards scaling-up and a wide spread market response.

Intervention 2: Work with Fish Farmer Associations to device a certification system incorporating a certification mark that identifies small hatcheries that meet minimum acceptable standards of production.

Market underperformance: fish farmers lack knowledge and information on how

to recognize and identify good quality fish fingerlings/juveniles. Many are not trained and are unaware of what features and characteristics to look for to determine the difference between healthy juveniles and those that are runts, in an industry where more than 50% of small hatchers are unqualified providers. Their inability to vet the quality of fingerlings/juvenile inputs before pond stocking compounds the problem of low productivity.

Vision for change: the vision of change at the service level is to improve information services as well as standards and regulation by enhancing quality of fingerlings/juveniles being produced in the wider industry. The wider market change will lead to the standardization and regulation of small-scale hatcheries. This will allow farmers to determine in a systematic manner, hatchers that are credible and to differentiate when sourcing inputs for fish cultivation, leading to reduction in trial and error sourcing for farmers and reduced loss of revenue.

Intervention overview: implementing a certification scheme for fingerlings/juveniles would involve two main actors: producer Associations; and small-hatchers. This model involves awarding kitemarks to small hatchers who meet grading and certification standards in production. Enforcement is via collective action. Fingerling production methods are verified, and produce is aggregated and sold through the Association on a platform which regulates and enforces standards. Participation incentives for small hatchers would come from discriminatory patronage in their favor. Incentives for the Association

will include increased trust and relevance through its value addition to members.

Potential entry points include working with small-scale hatchers that are members of the following bodies: Catfish Farmers Association of Nigeria (CAFAN); Lagos State Catfish & Agro-Allied Farmers Association of Nigeria (LASCAFAN); Fish Society of Nigeria (FSN), and Association of Fish Farmers and Aquaculturists in Nigeria (AFAN).

Activities for this intervention will include:

- Identification of all fish farmer and aquaculture-related associations in target States;
- Development of a selection criteria for the associations to work with, such as governance structures, size, coverage, etc.;
- Invitation of applications and short-listing of farmer Associations that buy into the value proposition;
- Due diligence and organizational diagnostic and assessments of corporate governance, systems, structures, carried out for all shortlisted participating farmer Associations;
- Farmer Association carries out needs assessment of existing and prospective hatcher members;
- Farmers Association develops detailed business plan, with BIF support, around operation of a certification scheme for hatcher members;
- BIF assist farmer Association to implement recommendations emerging from diagnostics related to organization strengthening and development before certification pilot commences;
- Data collection of baseline and post-pilot analysis.

Intervention 3: Work with farmer Associations to define/strengthen governance, membership services offering, and outreach. This should include provision of basic extension services.

Market underperformance: many untrained fish farmers, which is a vast majority of small-scale farmer, rely on informal sources of information about cultivation practices leading to poor feed, pond, and water management that hampers their productivity and poses a series of challenges to farmers.

Ordinarily the public sector extension services system has the responsibility and mandate to educate farmers on the correct steps and procedures to take for each of these critical dimensions of cultivation. However, many farmers report that such services, typically undertaken during field visits from extension agents, is not being provided. In relation to feed, farmers face high costs of production on their farms largely due to the cost of this input, which alone accounts for approximately 60-70% of total production costs. As fish feed is very expensive due to its high protein and nutrient content, farmers utilize a significant portion of home-made feed during the latter parts of the cultivation cycle (months 3, & 4), or one of the type 2 feed variations. Their on-farm derived formulas are inappropriate as they vary widely and are poor in nutrient content leading to adverse effects on the growth and size of fish, which impacts upon the ultimate productivity of the farmer.

Vision of change: the vision of change at the service level is to improve supporting functions in relation to extension services,

feed services and self-help aggregation services by utilizing fish farmer Associations as key catalysts and platforms for meeting a wide-range of membership needs. For extension services, the goal is to fill the gap created by ineffective and limited public-sector provisioning of services. This will be achieved through the provision of robust and comprehensive training/tutorial on fish farming best practices to farmers. Specifically, common issues and problems faced by cultivators related to the technical aspects of water quality management, pond management, averting the use of fingerling runts during purchase through proper and pro-active identification, as well as best use of feed and appropriate feeding routines. The wider market change created is that farmers will be able to access quality, affordable, and uniform extension services that disseminates best practices at a frequent and constant pace, which leads to higher productivity and overall reduction in waste and losses. For feed services, associations will be able to leverage on their numbers using collective bargaining to buy feed at discounted prices from mills, which allows individual farmers to benefit with an overall positive impact of decreased overhead production costs.

The provision of value-added services found in intervention 2 (certification of hatchers and their products by associations leading to standardized sourcing) and this intervention creates complimentary synergies for the farmers and further strengthens wider systemic change.

Intervention overview: for strengthening membership services and offering and

outreach to farmers the model involves three main actors: fish-farmers; existing producer Associations; and feed mills.

The intervention is two-fold. First it involves building knowledge, training, and technical expertise capacity of associations via a “train the trainer” model where a facilitator procured by BIF delivers master classes training key association members as trainers to meet the need of their in Associations across target states. Training would thus be cascaded down to members at their periodic meetings or at specific designated times moving forward. As part of the second component of the intervention, Associations will enter into partnerships with quality-led local feed mills importing and distributing type 1 feed and producing type 2 feed for regular sourcing.

Potential entry points include working with the following Associations: Catfish Farmers Association of Nigeria (CAFAN); Lagos State Catfish & Agro-Allied Farmers Association of Nigeria (LASCAFAN); Fish Society of Nigeria (FSN); and Association of Fish Farmers and Aquaculturists in Nigeria (AFAN). Durante, Vita-Feed, and Zartech feed mills also provide entry points as partners for BIF.

Activities for this intervention will include:

- Identification of all fish farmer and aquaculture related Associations in target states;
- Short-listing of farmer’s Associations that seek to buy into the value proposition;
- Invitation of applications and short-listing of farmer Associations who buy into the value proposition;
- Support Associations to carry out needs assessment of existing and prospective

members in relation to key membership service offerings desired by farmers and develop a detailed business plan around initial service offerings such as extension services and bulk feed purchase initiatives;

- Master trainers from all partner Associations identified and trained collectively to ensure uniformity in knowledge dissemination and adopted practices amongst farmers;
- Pilot training of farmers with BIF providing support where deemed necessary and then support to roll out and ensure adoption, adaptation and a wider market response.

Intervention 5: Work with a fish products entrepreneur to implement an integrated cluster-farming model that will provide a community of fish farmers with shared infrastructure, services and access to market.

Market underperformance: there is limited collective action on the part of small-scale farmers in terms of infrastructure and inputs, which leads to high production costs. Presently the fragmentation and geographical dispersion of small-scale fish farmers makes it arduous to reduce their overhead costs for existing ponds being cultivated and for those that want to expand and intensify their cultivation through additional ponds.

Vision of change: the vision of change at the service level is to improve supporting functions in relation to aggregation services for feed inputs, water services, and power services. This includes the provisioning of contiguous land facilities that would enable the creation of economies of scale through

shared water, reservoirs, smoking kiln, storage, and power supply facilities that reduces the per unit cost of production and output. Also contributing to the reduction in costs are feed inputs purchased at discounted rates through bulk-buying and extension services provided internally by the producer Associations. Taken together, the resultant wider market effect is significant costs savings realized by farmers making aqua-enterprises more efficient and profitable ventures.

Intervention overview: the model for this intervention involves two key actors: producer Associations; and a private agro-business entrepreneur coming together in an alliance for the development of a fish-farm estate. This model would work especially for small-scale farmers who lack space or are capital constrained to expand their cultivation ponds to new areas. With some components of key aggregated services provided by the investor (land, water, power, storage, smoking kilns) and others provided by Associations (feed and agronomy training), the agro-investor will be an off-taker of outputs from the fish estate which can be channeled into a privately operated fish market/terminal in close proximity to the estate to service local and wider demand, especially as the processed goods will have a longer shelf life than fresh fish products. Shared infrastructural services provided by agroinvestor is monetized and deducted from the farmer's income during harvest.

The linkages between intervention 3 (strengthening the governance and membership offerings/ services of producer associations) and this intervention create synergies that mutually strengthen both interventions and should bring about

more rapid and long-lasting systemic transformation. Potential entry points include working with Debirith Nigeria Ltd who has secured land to establish a fish farm estate in Ekiti state. Any of the Associations mentioned in intervention 3 could also feature as key partners.

Activities for this intervention will include:

- Identification and selection of fish farmer's and aquaculture related Associations in target States;
- Farmers Association undertake membership drive to strengthen

positioning, revenue base, and relevance in industry

- Farmers Association develops detailed business plan in collaboration with the investor;
- Data-collection of baseline and post-pilot data and BIF supports roll out and adoption, adaptation and a wider market response.

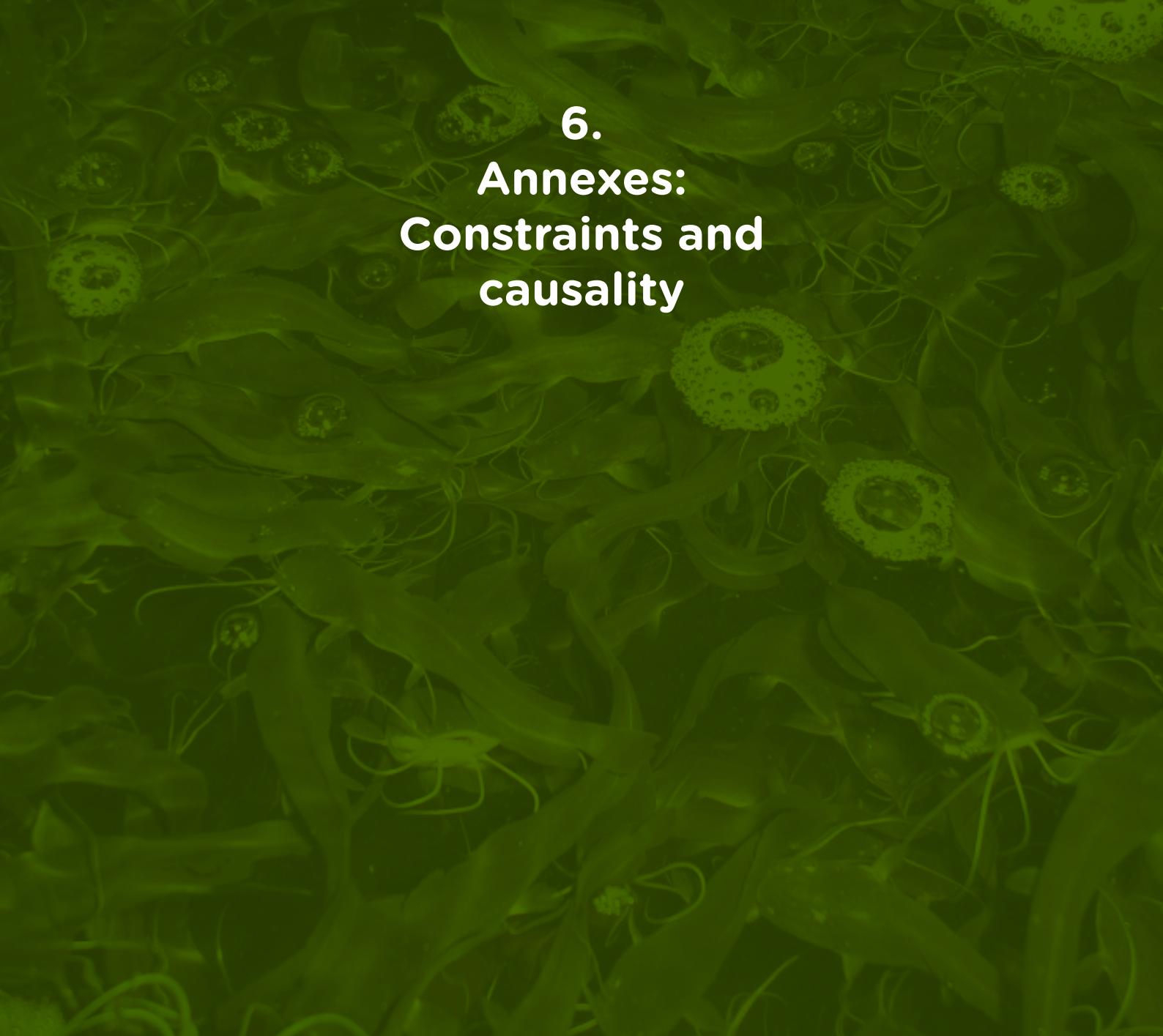
6.3. Risks

Table 7: Risks

Intervention	Risk Theme	Risk	Likelihood	Impact	Inherent Risk	Mitigation Action
Intervention 1	Operational	Not enough suitable medium/large hatchery partners willingly to participate in pilot phase	2	4	6	BIF will use current committed partner as a liaison to identify other mediumlarge hatchers likely to be more receptive
Intervention 1	Operational	Despite business case, hatchers may not take part in out-grower's scheme	1	4	5	BIF may utilize smart subsidies to get pilots running
Intervention 1	Operational	Small hatchers may try to circumvent the outgrowers scheme by defrauding large hatchery off-takers	2	3	5	Regular monitoring by hatchery-offtakers with deterrent or punitive compliance mechanisms built into scheme

Intervention	Risk Theme	Risk	Likelihood	Impact	Inherent Risk	Mitigation Action
Intervention 2	Market	Fish-farmers may not perceive or trust certification mark as an adequate or effective means to guarantee quality	1	3	4	Supplant this private-sector initiative with industry backing from govt regulatory agencies—SON , NAFDAQ, & FGN MoA
Intervention 2	Reputational	Certification marks may be forged or obtained illicitly if leaders of Cooperatives or Associations	1	2	3	Incorporate an independent inspector external to the Executive of the Associations to assess compliance before certification/ kite-marks are given
Intervention 3	Operational	Extension service agronomy training may not reach all farmers especially as membership grows exponentially with membership drive that is part of this intervention	2	2	4	Ensure there are enough master trainers in each given associations who train on a rotation basis

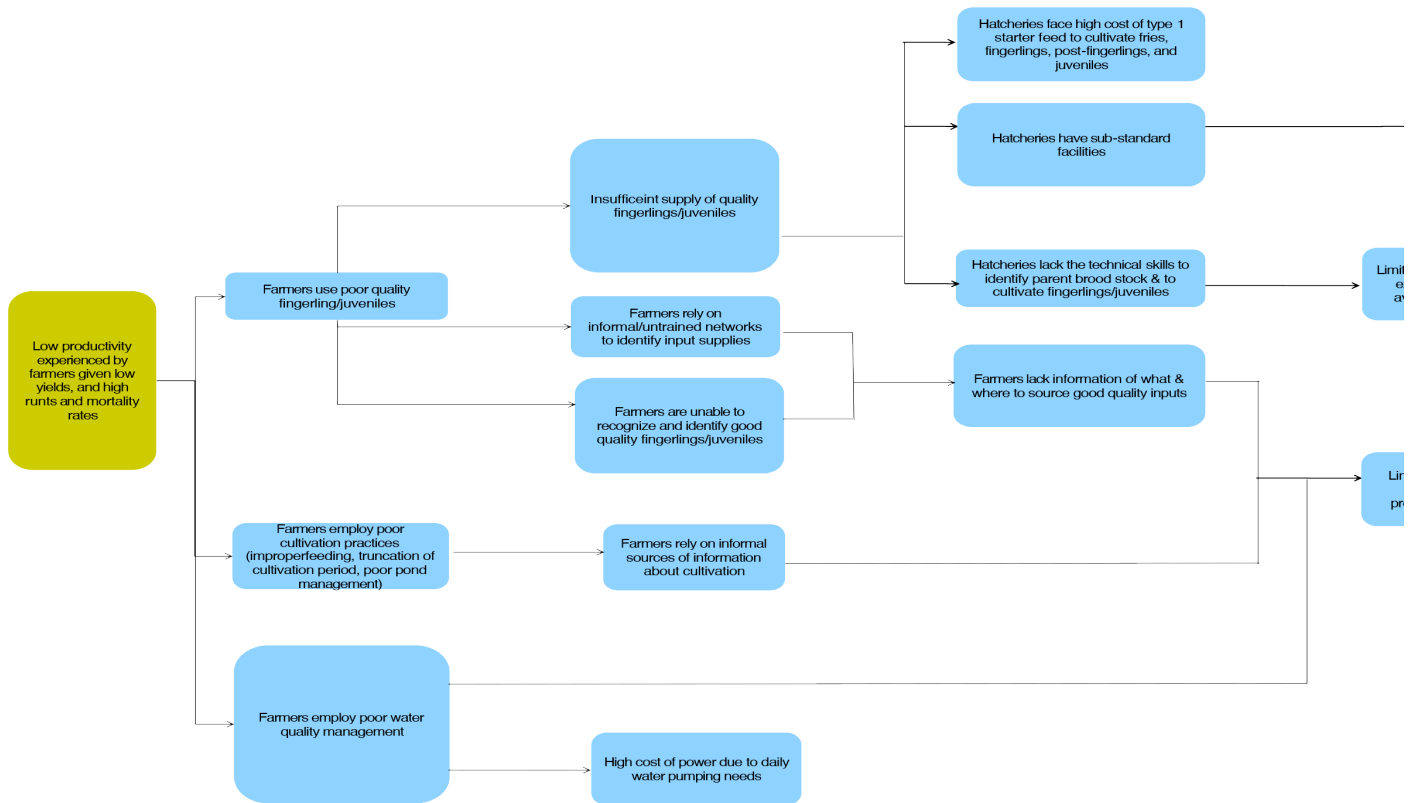
Intervention	Risk Theme	Risk	Likelihood	Impact	Inherent Risk	Mitigation Action
Intervention 4	Operational	Inability of insect breeders to meet quantity supply needs of fish farmers	4	1	5	BIF will seek to adopt various models when designing the intervention— promoting insect as part constituent make-up of fish feed component
Intervention 5	Financial	Fish farmers may not be able to afford the cost of land purchase or rent in the private estate	4	3	7	BIF will design a an costing model to assess/manipulate key variables to determine levels at which there is profitability for both farmer association and investor



6. Annexes: Constraints and causality

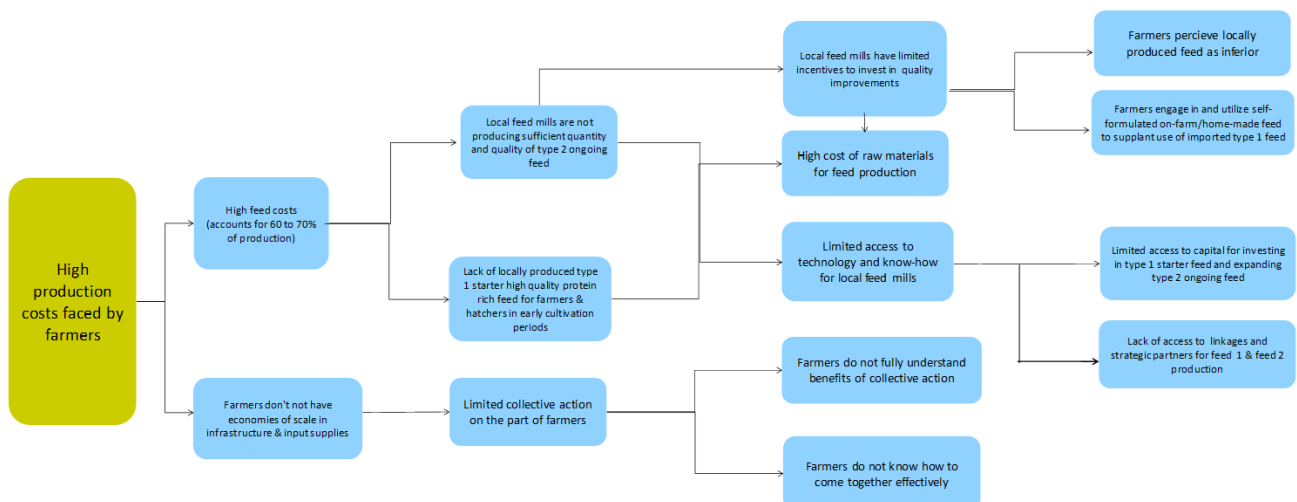
Annex 1: Depicts the first three symptomatic constraints:

1. Untrained farmers use low quality fingerlings/juvenile inputs which results in low productivity.
2. Farmers employ poor cultivation practices in relation to feed, and pond management which results in low productivity.

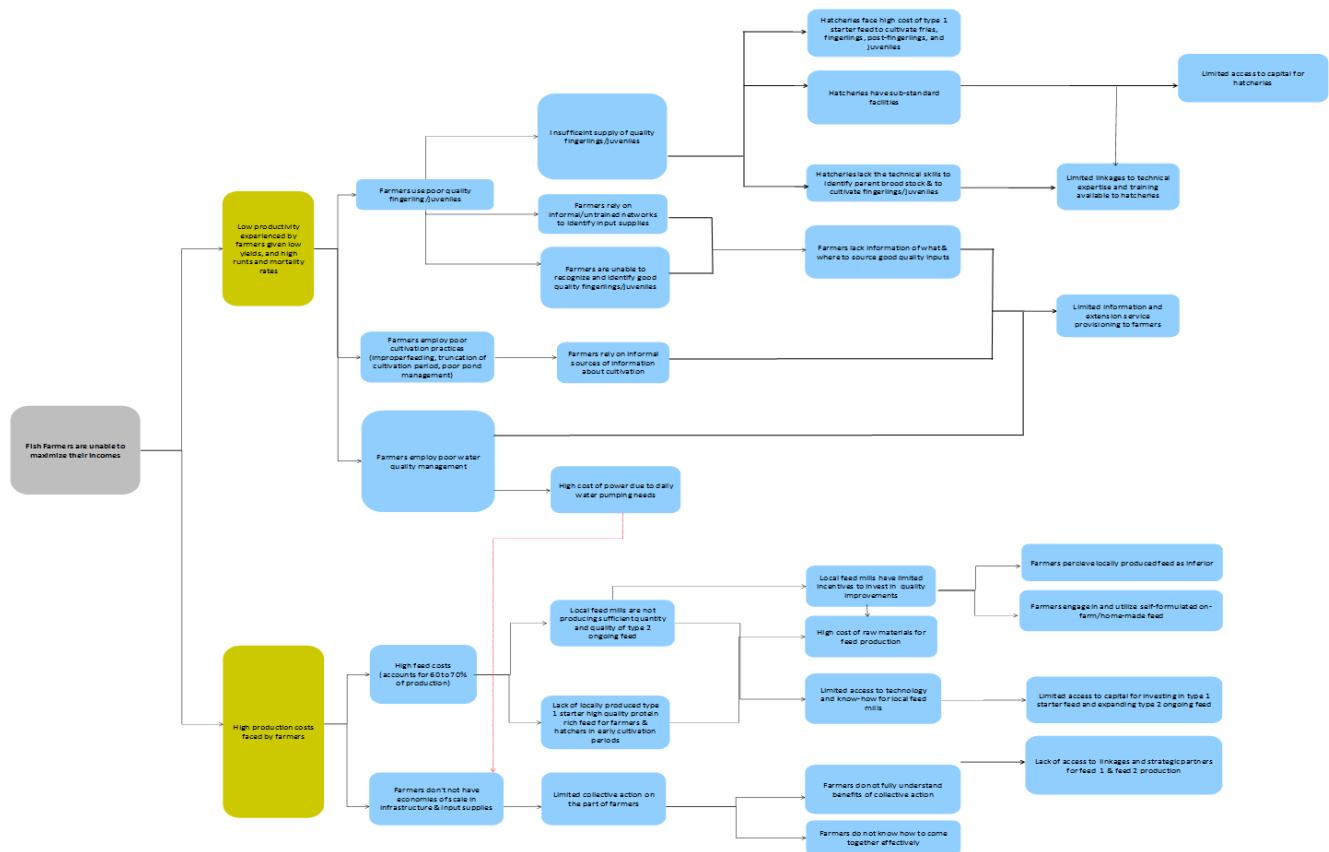


Annex 2: Depicts the last two symptomatic constraints

1. Farmers experience high feed costs which increases their cost of production and reduces their profitability
2. Small-scale farmers do not have economies of scale in infrastructure & inputs which leads to high production costs



Annex 3: Depicts the full constraints map in totality



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