

Review Article

Flood Insurance and Sustainable Aquaculture: The Case of Lapa-Gwari in Minna, Nigeria

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Abstract - Sustainable aquaculture may generally be defined as the aquaculture industry that can adapt to a planet with an ever increasing human population that uses non-renewable resources resiliently despite opposing external forces. The unemployment and Small Medium Enterprises (SMEs) push and the continuous demand for farmed fish pull have made many people venture into the aquaculture industry without sustainable fixed and running capital. This often leads to early liquidation of the business, most especially when disaster strikes. This study used a physical field survey and questionnaire to examine the flood disaster that affected over 150 fish farmers' ponds in Minna, Nigeria. The result of the descriptive analysis revealed that about USD730 368.85 (NGN278, 416,610) was lost to the disaster without any insurance coverage or any governmental intervention for sustainability. It is, therefore, recommended that operators of aquaculture should, as a national policy, have insurance.

Keywords - Aquaculture, Disaster loss, Flood insurance, Sustainability, and Vulnerability.

I. INTRODUCTION

Aquaculture, which began in China many decades ago, is now the fastest-growing animal food production sector in the world as it tends to fill the gap created by the decline in the supply of marine and freshwater fisheries [1]. The unemployment push and the Small Medium Enterprises (SMEs) drive have made the production and consumption of farmed fish lucrative. But the sustainability of the fish farm in this part of the world is a major challenge. When discussing food security issues. The use and interpretation of 'sustainable development' are highly subjective and sometimes incompatible among food-related disciplines, but FAO [2] defines it as:

"the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development conserves land, water, and plant and animal genetic resources is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable."

This definition, according to Canvas [3] and William [4], was said to address only the supply side of the problems faced by the fisheries sector at the end of the twentieth century. Floodplains are areas of solace for the poor in terms of livelihood and shelter, and when human-induced disasters occur, the victims wholly depend on government relief packages that have a political undertone and are ephemeral in nature. Developing Countries like Nigeria, Land Locked Countries and Small Island Developing States (SIDS) are often affected disproportionately by flood disasters [5]. In fact, the 2012 and 2018 floods in Nigeria, which is the largest on the recent record of losses, was about 0.1 % of the country GDP. Any risk-transfer approaches provide a form of flood insurance as the National Flood Insurance Programme (NFIP), which is a major government response to flooding as in Carolina, Mississippi, and Louisiana. This study, therefore, examined the flood disaster that affected over 150 fish farmers' ponds in Minna, Nigeria, in relation to their sustainability and flood disaster insurance in the country.

II. LITERATURE

A. Sustainable Aquaculture Development and the impacts of Climate Change

The need to cope with climate change impacts and environmental degradation has necessitated continuous innovative research in aquaculture to keep in line with the 2030 Agenda on Sustainable Development [6]. Technology has actually assisted in the diversification of aquaculture species which helps in providing a wide range of high-quality products with groupings such as Mariculture, polyculture systems, integrated farming systems, and intensive culture systems [7, 8, and 9]. In freshwater aquaculture, studies have revealed that fish pond farming is the most important method, with an estimated share of 60–70% of total freshwater aquaculture production [10]. There has been a remarkable improvement in water quality control within the aquaculture environment and disease prevention and control in cultured species [11,12]. Also, ecological aquaculture technologies have been continuously improved, perfected, and vigorously promoted [13, 14, 15, 16, and 17].

The global climate change threat also has its footprint on aquaculture activities as the atmospheric carbon dioxide



level has changed from 280 ppm at the beginning of the Industrial Revolution to 400 ppm presently, and to be about 430 ppm by 2030 [18]. The greenhouse effect is the bane of the climate change impacts that is responsible for the high rise records of scenarios like Ice Cap Snow, sea rise and ocean tide, precipitation anomalies, flooding and variable drought, heatwaves and others [19 and 20]. Aquaculture activities are highly vulnerable to drought and other climatic conditions because of their water supply dependency. This has necessitated the development of a Hazard Analysis and Critical Control Points (HACCP) system for large scale and pollution-free aquaculture and product certification [21 and 22]. Furthermore, innovations like digital fishery, archival fishery, and quality traceability systems are in operation in many parts of the world in response to climate and ecological challenges [23]. Global assessment of vulnerability provides a valuable indication of where aquaculture-related climate change effects may occur and where further research to provide stakeholders with the knowledge they need to develop their own strategies and innovations [24].

B. Natural Disasters and National Flood Insurance Programme

Globally, more than 200 million people are affected by disasters such as droughts, floods, cyclones, earthquakes, landslides and other natural phenomena yearly. Among the developed countries, recent large-scale floods that occurred in the U.S (2005, 2008, 2012), the UK (2014), Germany (2002; 2013), France (2010), Austria (2002, 2013), and Australia (2000, 2011), have triggered historical levels of losses. These, however, ignited fairly intense national debates about who should pay for the economic consequences of flood catastrophes and the appropriate roles of the public and the private sectors. They also challenged flood insurability built on risk-based premium principles and how one addresses issues of affordability of flood insurance [25, 26, 27, and 28].

The origin of the National Flood Insurance Programme (NFIP) can be traced back to the Congress of the United States established the National Flood Insurance Act of 1968 [29]. The programme enables property owners in floodplain (flood-prone) areas to purchase insurance protection, administered by the government, against losses from flooding and as of August 2017, the programme had insured about 5 million homes but was owing to an accumulated debt of about \$25 billion to the U.S. government as of December 2019 having been overwhelmed by the Hurricane Katrina and Hurricane Sandy disaster [30 and 31]. Market failure is generally seen as the cause of the absence of private-sector who sees catastrophe insurance as bad business due to nonexistent losses in some years but to astronomical losses in other years [32].

In developing countries as well, floods have been very devastating, including severe floods in China (2010), Nigeria (2012, 2018, 2020), Morocco (2013; 2014), Pakistan (2010), Philippines (2012, 2013), and Thailand (2010). In these countries where insurance markets are

much less developed, there is also a growing national discussion about what flood insurance solutions tailored to local needs could look like. Atreya [33], based on the various existing flood insurance approaches in several countries, categorize the sales of residential floods insurance into i) Public versus Private Roles, ii) Voluntary versus Mandatory, iii) Bundled versus Single policy: iv) Risk-based versus Subsidized: v) Economic Incentives: and vi) Federal Disaster Relief interventions.

III. AQUACULTURE DEVELOPMENT IN NIGERIA

In Nigeria, aquaculture development has been driven by a series of socio-economic forces of recession and the need to improve community nutrition and create employment. According to FAO [24], Sub-Sahara African countries produce about 615,749 tonnes, and Nigeria is the highest with a production output of over 291,323 tonnes per annum; this is closely followed by Uganda and Ghana with an output of about 103,737 and 76,630 tonnes, respectively. About five other countries: Zambia, Madagascar, Togo, Kenya and Sudan, produce more than 1,000 tonnes each. FAO statistics further showed that Nigeria imports about 2.1 million metric tonnes per year of fish, while the annual domestic fish supply in Nigeria stands at about 800,000 tonnes. This is not unconnected with the teemed population of about 200 million people.

The total domestic production (TDP), artisanal fishery production (AFP) and aquaculture (AQU) per annum were about 42%, 37% and 5%, respectively of the total estimated demand (ESD). The fisheries sector accounts for about 2% of national GDP, 40% of the animal protein intake and a substantial proportion of employment generation, especially in the rural areas; the sector is a principal source of livelihood for over three million people in Nigeria [34 and 35]...In an effort to boost the fish sector, the WorldFish-Nigeria partnered with a wide range of stakeholders—state agencies, civil society, communities and the private sector—to conduct a scoping study and value chain analysis to better understand the fish agri-food system. This strategy aligns with the WorldFish [36] strategy and has as its overall goal to improve food security, nutrition, employment, income and empowerment of women and youths in Nigeria, as illustrated in Figure 1.

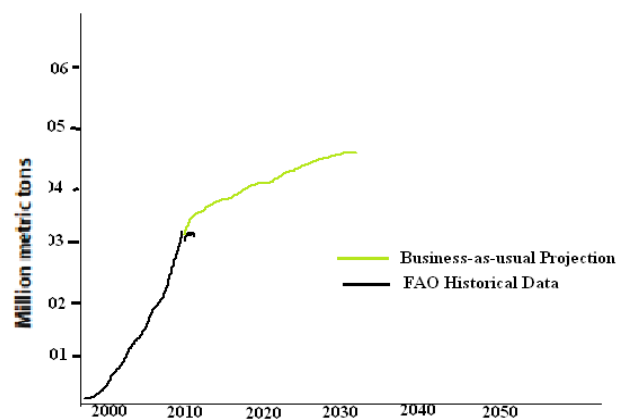


Fig. 1 Projection of aquaculture production in Nigeria. Source: (WorldFishIMPACT fish model, 2018)

The major species cultured in Nigeria include tilapias, catfish and carp; however, the African catfish (*Clarias gariepinus*) is the most farmed [37]. In spite of the great potential of fish farming in Nigeria, Nigeria is still unable to bridge the gap in the shortfall in total domestic fish demand. According to Foreign Agricultural Service • U.S. Embassy & Consulate in Nigeria\FAS OAA [38], Nigeria is a potential market for approximately 2.5 MMT of Atlantic mackerel, horse mackerel, herring, and croaker fishes valued at \$3 billion. In fact, Ubawuiké [39] opine that the plans by the Federal Government to ban fish importation will save the country over \$1billion US dollars.

IV. MATERIALS AND METHODS

A. Study Area

Minna, the present administrative capital of Niger state, derived its initial growth following the opening of the Kano-to-Baro railway in 1911 and the extension of the Lagos-to-Jebba line in 1915 to a junction in Minna, which became a major collecting point for agricultural products. Geographically, the town lies between latitude 9° 38' - 9° 45' N and longitude 6° 33' - 6° 39' East and is about 135 km away from Abuja, the Federal Capital Territory (FCT). The actual study location is in Lapa-Gwarii village in the peripheral area of Minna, as shown in Figure. 2.

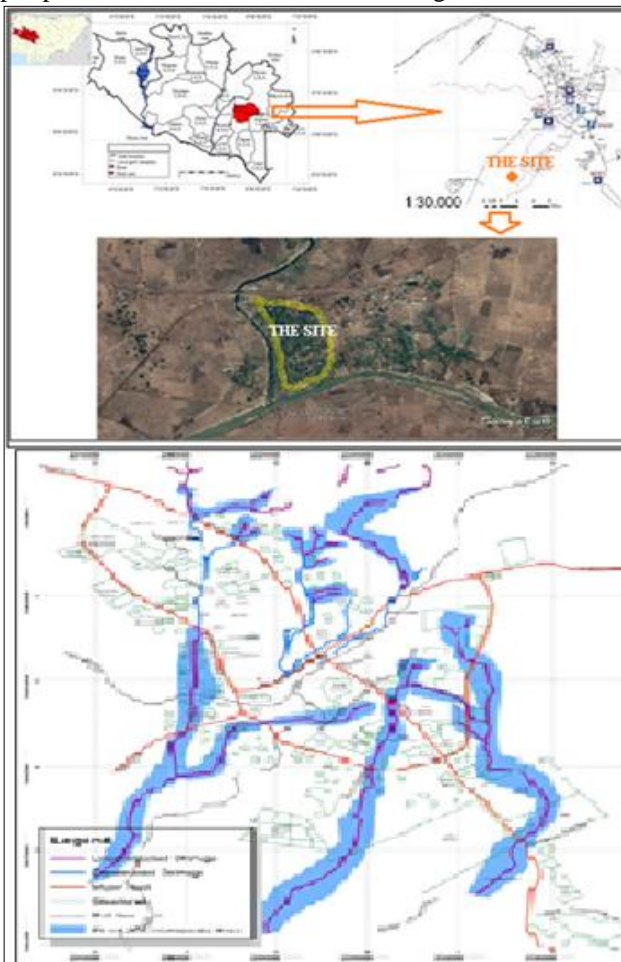


Fig. 2 Geographical location and floodable areas of the study

Source: Google extract.

In terms of rainfall and flooding activities in the area, the mean monthly rainfall discharge pattern from the Nigeria Metrological Agency shows that Minna and its environment experience about 933mm of rainfall per annum, with about half of that occurring between the months of July and August every year, see Figure 3. The general flood plain dwellers confirm this annually as experienced by many settlements along major rivers like Niger-Benue and Kaduna in the country. This was corroborated by the work of Olugunlorisa and Tersoo [40]. Flood episodes are not a new thing in many urban centres in Nigeria, including Minna in Niger State. For instance, the state government occasionally advised people in the urban areas against building on flood plains and indiscriminate dumping of refuse in drainages, culverts and other waterways as a proactive measure to curb the flood menace, and that they are particularly worried about the perennial flooding and the fatality that comes with it. The government also often embarked on early flood warning public enlightenment campaigns to ensure that the riverine communities are adequately informed to prepare for and prevent eventual consequences of the flood [41, 42, 43].

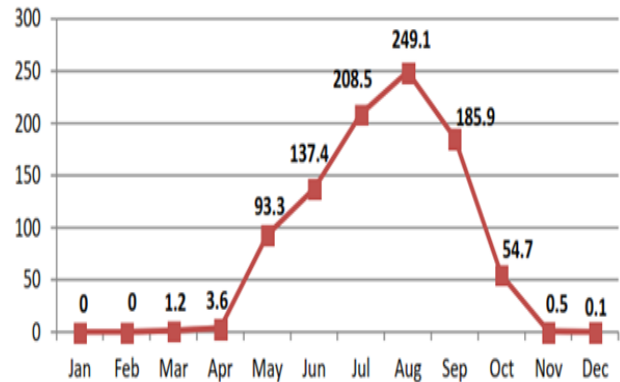


Fig. 3 Rainfall pattern in the study area (mm)

B. Description of the fish farm

The fish farm in this study area is made up of rectangular dugout ponds, each measuring about 6 by 3 meters wide. Their walling are reinforced with layering sandbags each, and this allows groundwater seepage without siltation from backfilling of the pond. An average fish farmer has three to four ponds within their jurisdiction based on their capital. Most of them operate on lease holding bases, while others have tenure rights over the land. Small farmhouses are built by individual pond owners as stores for farm tools since they are actually urban dwellers that engage in SMEs as a primary or secondary income source. The inhabitants of the village supply the labour force while also benefiting from the ground rents. In terms of fish-holding per pond, the population density depends on the expertise of the pond owner and the levels of farm extension services received. Also, the water demand for their operation actually comes from the adjoining river that has a very long and wide catchment area within and around Minna, the administrative capital of Niger State. This river empties into River Chanchaga in the southeast, about 3km away from Lapa-Gwarii village that host the fish farmlands. In the year (2020), the river had a major bank overflow of

about 500m of its course due to the heavy inflow from its various tributaries. The flood was beyond expectation; hence the resultant colossal loss to the aquaculture industry depends on its water supply. See Figure 4 for the spatial location of the fish farm.



Fig. 4 Spatial location of the Lapa-Gwari fish ponds and the flood scene.

Source: Field survey (2020).

C. Data Collection and Analysis

The direct field survey carried out in November 2020 was of two types (socio-economic and geospatial surveys). The geospatial survey guides the flood disaster areas validation and identifies other inundated areas using Binoculars and a Digital Camera. For the purpose of assessing the people's perception of flood hazards in relation to aquaculture activities and socio-economic characteristics of the people, one hundred and twenty (120) pre-coded close-ended questionnaires were administered, the operation office of the National Emergency Management Agency (NEMA) and Niger State Emergency Management Agency (NISEMA) in Minna was contacted to ascertain their levels of involvement and possible relief and financial aid, (see Figure 5 for the secondary data collection), Focus group discussions as inclusive planning approach and possible implementation of the flood insurance programme were carried out. Qualitative

analysis was used to present the impacts of the flood on fish farm activities and the village as a whole.



Fig. 5 Field data collection at the fish farm site.

Source: Field survey (2020).

V. RESULTS

A. The Impact of Flood in Lapa-Gwari fish village

The effects of floods are always debilitating, though their intensity and scope vary depending on terrain, the intensity of human activities, the quantum of water and the level of preparedness by the stakeholders. Flooding, especially River flooding, are among the most devastating natural disasters in the world, claiming more lives and causing more property damage than any other natural phenomenon. The flood that devastated Lapa-Gwari originated from the northern villages outside Minna that received heavy rainfall overnight. The two major rivers that traversed the town have their catchment from the north-western suburb areas, and they merge before getting to the fish village. Many properties along its paths were destroyed, and many people were rendered homeless, but this is outside the scope of this study.

In the study area (Lapa-Gwari), a total of 151 famers were enumerated as victims of the flooding activities in the study. Each pond housed about 3,000 fishes (especially *Clariasgariepinus*) that are in their various level of growth, while some were matured for sales distribution at the time of the flood. Based on the interview survey, the major source of capital was through revolving loans and some from family contributions or retirement funds. The items lost to the disaster include Fish, Water pump generating set, Water hoses, Farm sheds, Feeds and Aquaculture tools.

The analysis of the questionnaire administered revealed that 90% of the fish farmers were male while the remaining ones were female. In terms of educational qualification, about 64% of the respondents had tertiary education, 30% attained secondary education, 4% had primary, and only 2% of them had no formal education. The result of the questionnaire also revealed that 67% of the fish farmers are of Niger State origin, while the remaining 33% are from other states of the country.

Using the Liker scale opinion survey, only 10% of the respondent strongly agreed that their ponds are too close to the riverbank, and 47% of them fully agreed that the flood is associated with climate change. While 32% of them strongly believed that the flood is mystical, about 12% strongly agreed that it is man-made. Concerning the need for an aquaculture insurance programme, while 53% agreed for the need, the remaining 47% fairly agreed, and this is because about 86.7% agreed that most fish farmers are ignorant of insurance coverage. It then means that there is a serious need for advocacy and enlightenment. On the issue of compensation from the government, 3.7% fairly agreed that compensation is a right, 6.3% just agreed, while about 65.2% of the respondents strongly agreed that it is a right of the beneficiaries to be compensated by the government during disaster concurrencies, (Figure 6). This is not unexpected based on their levels of private business insurance and the present operation of democratic government in the country (Vote compensation and politicizing of issues).

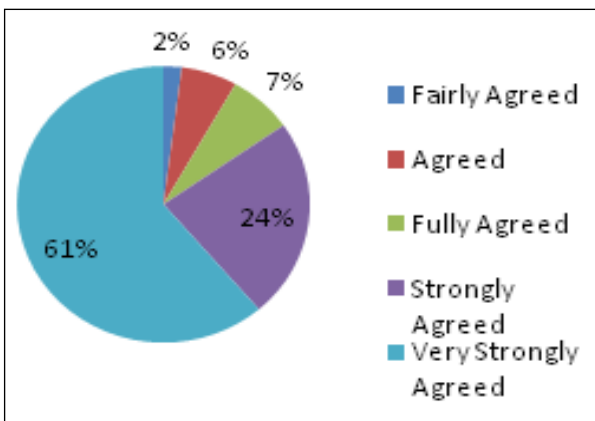


Fig. 6 Opinions on rights to government compensation for flood disaster

The study further revealed that the fingerlings were sourced mostly from places like Ibadan and Lagos in the southwest of the country, and each one cost about NGN35 (₦35) depending on the existing relationship, species, and sizes. Niger State has no Hatchery Centre; hence all fingerlings are sourced from distant states of the country. A mature catfish (*Clarias gariepinus*) is sold at the rate of NGN800 (₦800) per/kilo, depending on the bargaining power of the parties. The computed cost of the disaster is about USD730 368.85 (NGN278, 416,610) without any insurance coverage or governmental intervention; this does not cover the personal and hired paid labour.

B. External Relief Assistance

Disaster occurrences usually attract both governmental and humanitarian relief assistants depending on the level of physical damage and loss incurred and the dissemination of the information at the local, national and international levels. In this episode, the Director-General of Niger State Emergency Management Agency (NSEMA), Alh. Ahmed Ibrahim Inga reported the case in some of the dailies (Daily Trust, Vanguard, and Sun) of 17 Jul 2020 that Fish worth over a hundred million nairas has been washed away by flood at Lapa-Gwari in Bosso Local Government Area of Niger State. The same was also reported by the Secretary to the State Government(SSG), Alhaji Ahmed Matane, who maintained that the flood, which occurred after many hours of rainfall in the area, destroyed over 500 fish ponds, feeds, equipment, several farmlands and houses, (see figure 4 for the flood scene) They, however, forwarded the same to the appropriate offices in Abuja (the federal capital) for intervention. As at the time of this study (a year after the flood hazard), it was observed that no government agency had responded to their submission through their association. The study, however, revealed that while some left the business entirely, about 61.3% of the respondents strongly agreed that the fish farmers re-established without external aids, as indicated in Figure 7.

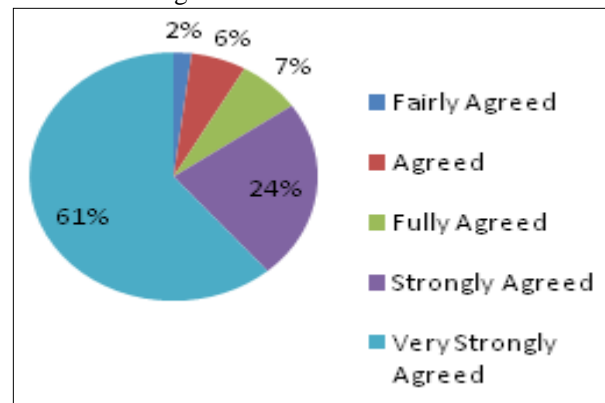


Fig. 7 Opinions on rebuilding of business without external aids.

It was, however, observed that some faith-based organizations reached out to some of their affected members with token financial assistance. This is supposed to be a complement of the government relief assistance and insurance indemnification where it exists, but this is a mirage in this case.

C. Needs for National Insurance Scheme Coverage for Flood Victims

Aquaculture, like any other business venture, is very lucrative where there is an efficient managerial skill, the right technology application, and a suitable enabling environment. Marine and freshwater aquaculture practices in countries like China are contributing immensely to the Gross Domestic Product (GDP) through the local supply and exportation of aquaculture products, as revealed in the works of Xuepeng [44]. In fact, Mikpon [45], in their own

study, also found out that even crabs have remarkable socio-economic importance in Southern Benin, Africa. Technology has also advanced their scope of operation to include polyculture, mariculture and even digital aquaculture, as discussed in the works of Filke [46]. But in Nigeria, especially Minna environments, traditional freshwater fishing on rivers Muya, Kaduna, and Shiroro, still dominate the market supply.

When discussing the impact of a natural disaster like food in Nigeria, Niger State is prominent in Federal Government's flood disaster relief distributions due to the major rivers like Niger and Kaduna that traverse the state and their extensive flood plain areas. An urban flash flood is also pronounced in Minna, the state capital, despite the artificial Julius Berger drainage channels within the built-up areas of the town. These drainages that have their tributaries outside Minna merge to form the stream that passes through this fish farm area, which is the bane of the 2020 flood disaster.

Vietnam, for instance, is rated fifth of the countries with the highest exposure to river flood risks worldwide [47, 48, and 49], and this natural imposes aggravated poverty on the victims because of low capacity in most cases, as revealed in the works of Dube et al. [50]. In both marine and freshwater aquaculture, flood disaster is one of the most devastating occurrences that require flood insurance coverage, but in most developing countries like Nigeria, the active insurance companies only focus on residential property coverage. According to Saeed [51], teamwork at all levels is the best approach in flood disaster management, even with government intervention. Risk pooling is one of the ways a team responds to the flood disaster, but as observed by Atreya, flood insurance is still a subject of debate among scholars and governmental agencies about the operational principles on the level of public and private managerial involvement. The experience of the U.S as the initiator of the National Flood Insurance Programme (NFIP) in terms of the viability and sustainability of the programme is absurd and less attractive to other nations of the world as applied to building properties. None involvement of the private sector to create competition is the bane of the programme's failure, as reported by Michel-Kerjan. Aquaculture is a business enterprise like any other industry that requires insurance coverage. If shippers can have marine insurance coverage, then fish farmers should have one form of an insurance policy or the other, especially in developing countries like Nigeria with unstable economies. Government interventions are often seen as 'national cake' that need not be accounted for, hence the need for the private insurers as the key players in the National Flood Insurance Programme

In countries like Nigeria, where the public interest is secondary, as also observed in Indian rural development [52], and disaster relief packages are politicized, national flood insurance policy operation is still like a mirage. The country is still importing more than half of its fish protein food demand despite the huge available marine and

freshwater potentials. In fact, the country is lagging behind in self-sufficiency in the food security crusade of Sustaining Development Goals (SDGs) agenda.

Lessons for Sustainable Aquaculture and Food Security in Sub-Sahara Africa

- i. That freshwater aquaculture in Africa and Nigeria, in particular, is yet to meet the existing local demand, hence the continuous legal and illegal importation of the shortfalls.
- ii. Aquaculture activities in the region are still comparatively lagging behind in terms of technological adoption, whereas countries like China and the USA have gone digital in polyculture and mariculture.
- iii. A natural disaster like flooding is still a major challenge where there is no functional flood insurance policy in the region to secure scarce capital investment.
- iv. The hostile land tenure system and ill-informed local aquaculturist is still the bane of the industry development in the region, as revealed in the Nigeria case, and
- v. That economic recession and unemployment push are the bases of engagement in the industry as against occupational attractiveness and incentives. Investors only invest in it as a secondary source of livelihood in most cases.

The following are therefore recommended:

- i. The government in all developing countries (especially Nigeria) should, as a matter of urgency, enhance the formation of a functionality flood insurance policy in their country, putting into consideration the teething problems identified in other countries.
- ii. In view of the need to diversify the national economy, the government should create an enabling environment for the advancement of the industry while still controlling the environmental effects.
- iii. Scholarships for advanced training in aquaculture should be pursued vigorously to reduce the poor technological innovation in the country and extension services to the rural communities,
- iv. Drastic effort should be made to harness the abundant marine aquaculture potential along the coastal continental shelf of the regions

VI. CONCLUSION

Posterity is usually the central focus in sustainability, but the continued existence of the present means of production for the present needs is also crucial even with the aid of technological advancements. Investment security is a sensitive issue in national development and therefore requires a formidable insurance system for responsible

resource utilization as in aquaculture, with the use of technologies not detrimental to natural resources, ecosystems and human communities. Coastal marine aquaculture is still facing major challenges from oil exploration pollution as in Nigerian coastal regions. The freshwater fish culture, therefore, should be fully developed and financially sustainable if the dream for self-sufficiency in food security will not be a continuous mirage.

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