NATIONAL AQUACULTURE DEVELOPMENT PLAN (NADP)

A Strategic Framework for Sustainable and Profitable Aquaculture Development in Nigeria

Edition One

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Abbreviations

AARC	-	Aquaculture Advisory and Research Committee
AIFP	-	Aquaculture and Inland Fisheries project
ANAF	-	Aquaculture Network for Africa
BOD	–	Biological Oxygen Demand
CCRF	-	Code of Conduct for Responsible Fisheries
FAO	-	Food and Agricultural Organisation
FDEMU	-	Fish Disease and Environmental Monitoring Unit
FDF	-	Federal Department of Fisheries
FISON	-	Fisheries Society of Nigeria
FMARD	-	Federal Ministry of Agriculture and Rural Development
GIS	-	Geographic Information System
HPA	-	High Potential Area
ICT	-	Information and Communication Technology
IFAD	-	International Fund for Agricultural Development
LGAs	-	Local Government Authorities
M, E & C	-	Monitoring, Evaluation and Control
M & E	-	Monitoring and Evaluation
MOU	-	Memorandum of Understanding
MSME	-	Micr0, Small and Medium Enterprise
NAFDAC	-	National Foods, Drugs Administration and Control
NADP	-	National Aquaculture Development Plan
NCRI	-	National Cereal Research Institute
NGO	-	Non-Governmental Organisation
NPFS	-	National Programme for Food Security
OSSAP- MDGs		Office of the Senior Special Assistant on MDGs
PHCN	-	Power Holding Company of Nigeria
PPP	-	Public-Private-Partnership
WRS	-	Water Re-circulatory System

Executive Summary

Aquaculture has been growing at about 25 – 33 % per year since 2003 in Nigeria. This is evident in the level of intensity of catfish farming activity, which currently account for approximately 25% of the 110,000 tons of catfish consumed in the country annually. At present, farmed catfish market surpasses US$27 million per year (Graham and Susana, 2006), from many of the farms across Nigeria. However, despite this remarkable growth, many fish farms continue to stop production due to non-profitability of the operations as a result of high cost of inputs especially feeds and poor market price of products.

The current Transformation Agenda of Nigeria's government in the context of the adopted policies of economic liberalisation along with divestment of public sector infrastructure and services in favour of private sector intervention necessitate the development of this strategic framework for aquaculture development in Nigeria. This is underpinned by a renewed emphasis on good governance as an essential part of the development of all sectors of the country's economy. These policies require that Government shift from playing the role of investor and corporate manager to that of facilitator and regulator, civil society being in charge of developing the economy.

It is in this framework that the National Aquaculture Development Plan was authored. The aim of the Plan is therefore to suggest ways of developing sustainable aquaculture that achieves overall objectives of sustainable and profitable aqua-businesses with a growth of small- and medium-scale enterprises (SMEs);

The Plan activities were therefore designed for the attainment of these objectives based on the '*PEST*' analysis, i.e. *Political, Economic, Social and Technological* considerations and grouped into six modules; *Knowledge, Capacity Development, Roll Out, Partnership, Aquaculture Development Fund and Research*.

The collective actions of these activities will result into outputs and the expected results of 25 % to 75 % increase in aquaculture production per annum, 25 % to 50% increase in consumption of aquaculture products per annum, 25 % increase in the value of aquaculture harvest, 100,000 new jobs created per annum and 25 % to 50% increase in the number of women and youth participating in aquaculture.

With this development, at the end of the 5-year period of the plan, it is expected that Nigeria's aquaculture subsector will results in significant contribution to GDP, significant contribution to food supply and food security, significant contribution to employment creation, positive impact on health and nutrition, aquaculture becomes a viable option for employment of youth, at least a third of the jobs along the entire aquaculture value chain held by women and optimal utilisation of the vast inland water resources in Nigeria.

1.0 INTRODUCTION

Over the years capture fisheries has been the source of the bulk global fish supply with the sector regularly producing between 90 and 95 million Metric tons (MT) per year. However fish production from the fisheries has been declining year after year. This is as a result of collapse of most capture fisheries in the world. Capture fisheries have reached their maximum sustainable and enhancing productivity will be an uphill task. However, aquaculture has shown some promising trend on the global scene. Aquaculture fish production now accounts for about 50% of total fish production amounting to about 80 million MT and it is estimated that another 40 m MT of aquatic food will be required by the year 2030 (FAO, 2006).

Aquaculture has been growing at about 25 – 33 % per year since 2003 in Nigeria. This is evident in the level of intensity of catfish farming activity, which currently account for approximately 25% of the 110,000 tons of catfish consumed in the country annually. At present, farmed catfish market surpasses US$27 million per year (Graham and Susana, 2006), from many of the farms across Nigeria as shown in Figure 1. However, despite this remarkable growth, many fish farms continue to stop production due to non-profitability of the operations as a result of high cost of inputs especially feeds and poor market price of products.

To sustain this comparable rapid growth of aquaculture at a profitable rate, the need for a strategic approach in development is critical if the reported potential is to be realised. Strategic guidelines for the integration of the sub-sector into the new political and economic environment will have to clearly outline.

The current Transformation Agenda of Nigeria's government in the context of the adopted policies of economic liberalisation along with divestment of public sector infrastructure and services in favour of private sector intervention necessitate the development of this strategic framework for aquaculture development in Nigeria. This is underpinned by a renewed emphasis on good governance as an essential part of the development of all sectors of the country's economy. These policies require that Government shift from playing the role of investor and corporate manager to that of facilitator and regulator, civil society being in charge of developing the economy.

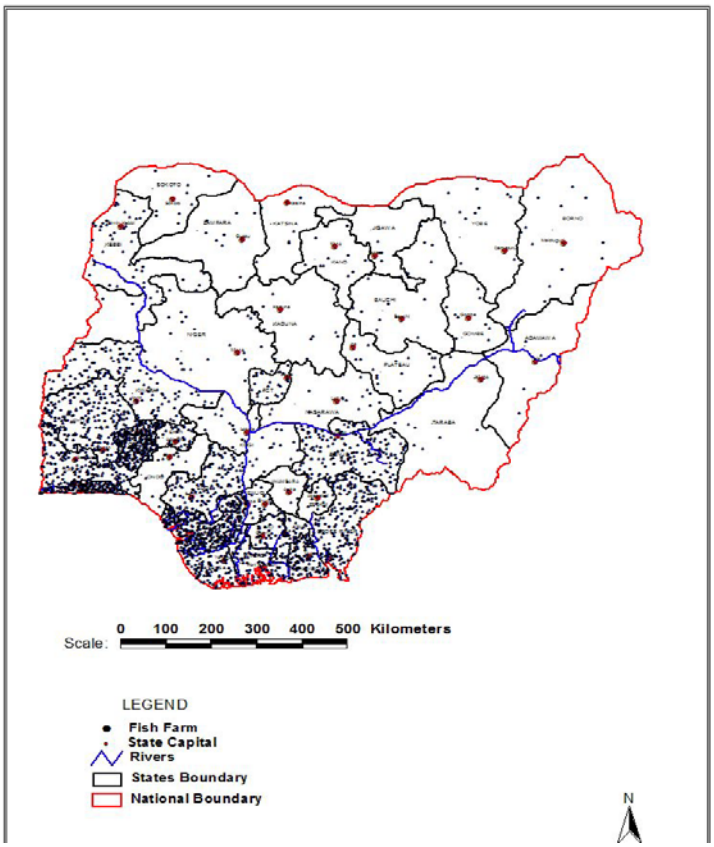


Figure 1: Distribution of Fish Farms in Nigeria*(Abdullah, et al. 2010)*

2.0 AQUACULTURE DEVELOPMENT OBJECTIVES

Currently, Nigeria meets only 30 per cent of domestic demand for fish, with aquaculture contributing less than 30% of the domestic production. Recent trends indicate that, like elsewhere; most natural fisheries have reached or exceeded maximum sustainable yields. Fish imports to satisfy local demand require hard currency, which is often lacking or scarce. Additional fish supply should therefore come from aquaculture for sustainable economic growth. Estimates indicate that aquaculture production can increase by over thirty fold, covering close to 90 % of the local demand. This will result in improve food security and sustain economic growth. By providing opportunities for import substitution and export of fish and other aquatic products, aquaculture development can also improve the country's balance of trade. Likewise, the generation of employment along the value chain; on-farm and in service industries such as processing, marketing and inputs supplies, can provide employment opportunities and increase income and reduce poverty (Figure 2). In addition, increasing the efficiency of water use and adding value to agricultural by-products used as nutrient inputs can reduce pressure on natural resources and the environment

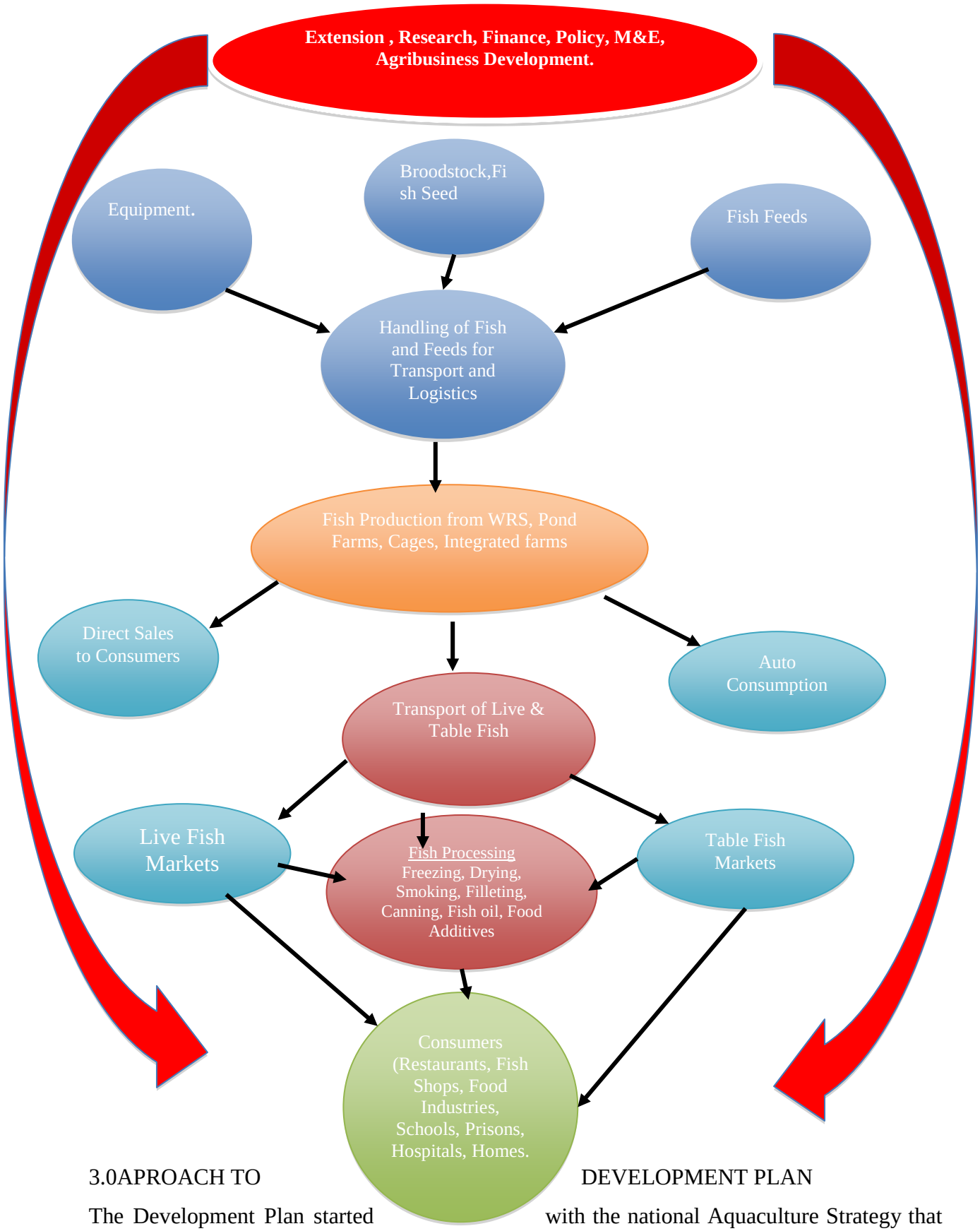
Within this context, the objectives of the aquaculture sub-sector in Nigeria are therefore to:

a. Boost production to meet local demand and assist in balancing trade in aquatic products
b. Create employment opportunities through aquaculture practices.
c. Improve efficiency of natural resource management.

The aim of this Development Plan is therefore to suggest ways of developing sustainable aquaculture that achieves the above-stated objectives. These overall objectives are accompanied by several specific objectives that will establish and maintain:

a. Sustainable and profitable aqua-businesses with a growth of small- and medium-scale enterprises (SMEs);
b. Reliable supplies of quality and affordable production inputs;
c. Functional producer groups;
d. Improved information flow and outreach; and,
e. Acceptance of aquaculture as a credit-worthy enterprise.

Figure 2: Aquaculture Value Chain Structure



3.0APROACH TO DEVELOPMENT PLAN

The Development Plan started with the national Aquaculture Strategy that led to setting up of National Aquaculture Task Force. The Task Force reviewed the strategy

and develop a plan of action for the strategy. A consultancy was then commissioned to develop the National Development Plan. This started with and elaboration over a period of 20 working days. In collaboration with experts and policy makers from the Federal Department of Fisheries and National Programmes for Food Security of the Federal Ministry of Agriculture and Rural Development, the consultant developed the first draft of the plan. Further consultation with fish farmers and other relevant Stakeholders in the industry and the FAO Representation in Nigeria and the draft was discussed and adopted in a national stakeholders meeting held on 28th September, 2011 and 4th October, 2011. Aquaculture Advisory Committee was then constituted and inaugurated on 14th November, 2011 during which the document was validated by the committee. Final validation came in a stakeholders' workshop on the 22nd November, 2011 and a follow-up actions was undertaken to define the Strategic Framework for the plan. This was then consolidated in a meeting with key officers of the project, FAO technical backstopping and the consultant. The meeting ended up with the development of a roll out document; Farming Fish for the Future: Concept for Growth in the National Programme. The document presents start-up activities for the plan in five modules: Knowledge, Capacity Development, Rollout, Partnerships and Aquaculture Development Fund. It is envisage that funding these actions will be accommodated through the UTF.

4.0 DEFINITION OF THE DEVELOPMENT PLAN

For the purposes of this Plan, producers have been divided into two categories: commercial and non-commercial. Commercial producers can be small medium or large-scale, and are active participants in the market. They purchase inputs (including capital and labour) and

engage in off-farm sales of the fish produced. For these individuals, aquaculture is a principal economic activity[1]. Non-commercial producers may also purchase inputs, mainly seed and feed, but rely chiefly on family labour and on-farm sales of the produce. An additional feature of non-commercial aquaculture is that, it is one of the varieties of enterprises comprising the farming system; it is undertaken to diversify production, improve resource use and reduce risks of such events as crop or market failure.

4.1*Identification of high potential aquaculture zones*

In most countries, the biophysical[2] and socio-economic[3] potential for aquaculture is not uniform, with some zones having greater intrinsic capacity for aquaculture growth than the others. A first step in determining where resources to develop aquaculture could be efficaciously used is the identification of those areas with highest potential. This screening should be supplemented with a comparison of existing aquaculture activities, including the concentration of existing producers and the presence of government and other infrastructure (Aguilar and Nath, 1998).

Zones based on biophysical and socio-economic potential may well be subdivided into areas that correspond to input supply/delivery. For example, to the extent that private seed supply comes from specialised private hatcheries, these hatcheries will operate within areas circumscribed by the economic ability to deliver seed to producers.

4.2 Appropriate *framework for Aquaculture Outreach*

Some level of technical information dissemination is generally considered as necessary to support the aquaculture sub-sector. This is achieved through public-sector-supported outreach. Drawing upon a wide range of published experiences, a general approach to supporting the development of aquaculture can be suggested. This is based on the premises that:

a. Some long-term technical assistance for producers is necessary;

b. Generalist/unified extension services often lack the specific technical expertise to assist aquaculture producers; and,

[1]In addition to these characteristics, commercial aquaculture can be defined as the farming of aquatic organisms, including fish, molluscs and crustaceans and aquatic plants with the goal of maximizing profits. Thus, the distinction between commercial and non-commercial aquaculture operations relies primarily on the existence or absence of a business orientation and on how factors of production such as labour will be paid.

[2] Biophysical criteria include water quantity and quality, ambient temperature, soil quality and water holding capacity, etc.

[3] Socio-economic criteria to evaluate include cultural aspects, availability of inputs (fingerlings, feeds, fertilizers) access to markets, range of partners, production technologies, etc.

c. Extension services dedicated to aquaculture assistance could be limited in scope due to corresponding limitations in human and financial resources.

In this light, high quality technical support[4] needs to be carefully assembled and targeted. This can best be achieved by "mobile-mixed-teams" providing punctual, periodic support to a relatively large geographic area. These teams, each composed of at least one specialist from a Research Institute, one from Federal Department of Fisheries and one from State Fisheries Department should work exclusively in high priority zones and give priority to assisting effective producer groups in partnership with Non-Governmental Organizations (NGOs) and other outreach agencies as feasible. These should be complemented by a series of private seed producers, and/or service providers, who should also provide technical support to farmers. Thus, the mode of operation of these mobile teams should be one that brings research and extension together and into direct contact with farmers.

5.0 THE AQUACULTURE DEVELOPMENT PROCESS

Aquaculture sub-sector is multi-faceted with the national programme involving a wide variety of actors and institutions (Table 1). Accordingly, it is appropriate that an advisory committee that reflects this diversity and ensures that all stakeholder groups have a voice in the process

[4]That is, well trained and well-equipped

oversee the process. The process should also closely involve all producer groups, evaluating *in situ* the needs for one or more national aquaculture associations.

5.1 *Policy and Institutional Implications*

The implementation of the elements in the preceding section will require a thorough review of current policies, regulations, legislation and institutional arrangements to determine what adjustments must be made to accommodate the new approach to aquaculture development and achieve the national objective. This will be an interactive process that is best undertaken in a step-by-step manner: i.e., strategy, plan, pilot activities, policy, legal and institutional adjustments, strategy up-dating, revised plan.

The adoption of the new strategic approach cannot be done "in theory" but must be done in practice. Effective and sustainable adoption will require clear private-sector-driven demonstrations of profitable aquaculture businesses; these most efficiently accomplished by initially concentrating resources on well-chosen and high-potential pilot sites. Methods so tested at private sector pilot sites can then be expanded nationally. During this process, including the interpretation of the results of field implementation as they affect policy, legal and institutional arrangements, it will be expeditious to have an oversight group in the form of an Advisory Committee, with revised membership and Terms of Reference as necessary.

5.2 *Key Issues for Consideration*

The way forward for the development of the aquaculture development plan is interlinked with several national-level multi-sectoral key issues and considerations. Within this context of a justified change receiving strong political support, the overarching considerations that need to be addressed as the sub-sector is redefined include:

a. The need for a good environment for investment that will allow easy access to government support, regulation of imported fish, etc.;
b. The ability of current resource levels in terms of financial and human capital to meet the needs of the redefined sub-sector;
c. The ways and means of delivering necessary extension and outreach;
d. The methods for ensuring the availability of quality inputs of seeds and feeds;
e. The need to implement the roles and responsibilities of the public and private sectors as outlined in national strategy;
f. The need to address the ecological and environmental concerns facing expanded aquaculture development;

g. The mechanisms to address value added products development, marketing and quality control of aquaculture products; and,
h. The need for an effective monitoring, evaluation and control programme.

These issues need to be further viewed in the broader context as it relates to the whole economy and related relevant policy, legal, institutional and strategic instruments regarding:

a. Water
b. Lands
c. Environment
d. Agriculture
e. Trade and Industries
f. Marketing Logistics
g. Investment Policy

For the successful implementation of this plan, the final plan product must be endorsed by stakeholders and supported by Government; these issues will require attention. This document therefore has attempted to address the issues with the understanding that inter-relationships with government and civil society will require additional fine-tuning for effective synergy.

5.3 *Time Frame*

The Nigeria's Aquaculture Development Plan (NADP) will run for a period of 5 years (Table 3). Long and medium term objectives would be realised following the logical framework of inputs, activities, outputs, outcomes and impact where medium and long-term objectives are set.

5.4Medium-Term Development Objectives

The development objectives of the sector in the next five years are to:

a. Increase profitability of aquaculture businesses;
b. Increase cultured fish production;
c. Strengthen aquaculture business inputs (seed, feed, capital) and output markets;
d. Address environmental concerns;
e. Rely on tested production systems
f. Improve support to producer organisation
g. Improve extension service delivery and information exchange
h. Make research responsive to industry needs and

i. Establish mechanism for monitoring, evaluation and control

5.5Long-Term Development Objective

The long-term goal is the realization of aquaculture potentials to contribute significantly to economic development of Nigeria through employment creation, food security improvement, and income generation.

5.6 Activities

Activities designed for the attainment of the long term objectives were based on the '***PEST***' analysis, i.e. ***Political, Economic, Social and Technological*** considerations and grouped into six modules; ***Knowledge, Capacity Development, Roll Out, Partnership, Aquaculture Development Fund and Research***. The collective actions of these activities will result into outputs and the expected result.

5.7Outputs

The following outputs are expected during the year one period of the NADP:

a. 25 % to 75 % increase in aquaculture production per annum
b. 25 % to 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[5], and
e. 25 % to 50% increase in the number of women and youth participating in aquaculture

5.8 Results

Investments in economically, socially and environmentally sound aquaculture businesses must increase for the sub-sector to begin to realize its potential. To stimulate investments, Government will assume a new role of a facilitator and monitor of the development and expansion of aquaculture business. Government will improve policy and regulatory environment, facilitate secure and equitable access to land water, credit and services while promoting access to quality input and output markets. Fish farmers will improve their business and managerial skills, quality and add value on their products in order to increase output, penetrate lucrative markets and take advantage of improved policy and regulatory environment.

The following results are therefore expected from the 5thyear period of the NADP:

[5]Aquaculture and Inland Fisheries Project (2004) estimated that for every 1 million tons of fish produced, 100,000 jobs will be created per annum.

i. Significant contribution of aquaculture to GDP,
ii. Significant contribution to food supply and food security,
iii. Significant contribution to employment creation,
iv. Positive impact on health and nutrition,
v. Aquaculture becomes a viable option for employment of youth,
vi. At least a third of the jobs along the entire aquaculture value chain held by women
vii. Optimal utilisation of the vast inland water resources[6]

5.9Risks

The following risks may have adverse effect on successful implementation of the NADP:

i. Inadequate funding may hinder projects completion
ii. Non-adherence to basic aquaculture requirements
iii. Hyper enthusiasm will lead people to undertake activities without proper technical advice
iv. Fragmentation of the national program due to lack of collaboration amongst key players/actors
v. Marketing and distribution of inferior products
vi. Inadequate human resources to provide technical back-up
vii. Disease outbreaks, parasites
viii. Market volatility
ix. Constraints on land and water use (climate change)
x. Trans-boundary conflicts
xi. Political interference
xii. Water use conflicts and
xiii. Un-harmonized regulations of various sectors (water, fisheries, environment, etc.)

5.10*Monitoring &Evaluation*

Monitoring and Evaluation is key to successful implementation of the Plan. Federal Fisheries Department will have the responsibility of preparing an M&E report to the advisory board for onward transmission to the national Planning Commission.

[6]Aquaculture and Inland Fisheries Project (2004) estimated 14 million hectares of inland water surface area in Nigeria.

5.11 *Partnerships*

Nigeria's constitution defines agriculture as a concurrent item where the three tiers of government; Federal, States and Local Governments (LGAs) have the responsibility. Aquaculture as a subsector of agriculture therefore falls under this. However, substantial national budgetary allocation goes to the Federal government, therefore should take up substantial responsibility in terms of investment. State and LGAs can contribute especially in land allocation and other appropriate support to farmers residing in their area. Some of the areas are highlighted in Table 1.

6.0 MODULES

6.1 Module 1 (M-1): Knowledge

i. Develop comprehensive aquaculture legislation
ii. Identify and document best management practices
iii. Define current production systems in terms of viable investment packages
iv. Improved statistics collection and collation

v. Update the existing fish farmers', feed producers, input suppliers, marketers' inventory
vi. Develop the data collection tools especially the use of mobile phone technology
vii. Establish other ICT hubs
viii. Develop ICT tools accessible to farmers (mobile phone technology)
ix. Collate and report data
x. Establish and maintain database
xi. Set up Geographic Information System (GIS) Laboratory
xii. Collate relevant data and information for GIS analysis
xiii. Identify high potential areas (HPAs) and conservation areas and develop GIS maps for clusters (NPFS, AIFP models) and accompanying outreach program
xiv. Produce Maps showing suitable areas for aquaculture on biophysical and socio-economic models
xv. Establish a Fish Disease and Environmental Monitoring Unit (FDEMU) in FDF in collaboration with Agriculture Quarantine Services, Federal Ministry of environment.
xvi. Create awareness on the impact of aquaculture on the environment
xvii. Disseminate information to end-users.
xviii. Develop the necessary tools for the M, E & C
xix. Conduct M, E & C as a policy and management tool
xx. Set up guidelines for responsible aquaculture practices
xxi. Enforce application of best aquaculture practices.

6.2 Module 2 (M-2): Capacity Development

i. Recruit members of producer organisations through FISON
ii. Establish farmer-to-farmer exchange program coordinated by Fisheries Society of Nigeria (FISON)
iii. Develop extension packages for countrywide use
iv. Establish standards for provision of outreach services
v. Recruit, train and facilitate extension and change agents
vi. Train farmers on aquaculture best practices
vii. Engage and coordinate relevant stakeholders to provide basic extension services
viii. Establish farmer extension clusters
ix. Identify areas where women and youth respectively have comparative advantage
x. Increased participation of women and youth by allocating specific percentage slots for their participation

xi. Design flexible women friendly programs
xii. Train the youth in skilled farm labour
xiii. Introduce aquaculture in schools and other youth training institutions
xiv. Develop new aquaculture products
xv. Identify the various aquaculture value chain Stages (Pond-to-Plate)
xvi. Identify stakeholders at each stage of the value chain
xvii. Determine specific needs of the stakeholders at each stage of the value chain
xviii. Identify appropriate technologies that will meet the needs of every stage
xix. Conduct specialised training for each stage of the value chain
xx. Encourage specialisation along the value chain to increase efficiency
xxi. Support development of cottage industries and private companies along the aquaculture value chain.
xxii. Examine mechanisms to cost sharing capacity building programs
xxiii. Enhance self-sufficiency in non-commercial aquaculturists
xxiv. Train aquafarmers in business skills
xxv. Support aquaculture farmers to develop business plans
xxvi. Support the farmed ornamental fish industry and other non-conventional aquaculture systems (Cage culture, rice-cum-fish, algae culture, etc.).
xxvii. Establish distribution networks including cluster level hatcheries
xxviii. Train hatchery operators
xxix. Package aquaculture business information into brochures, etc.
xxx. Identify the steps necessary for establishing aquaculture business
xxxi. Establish a pricing system for value added products
xxxii. Conduct campaign on the use of ICT within the network
xxxiii. Disseminate and sensitize to the stakeholders the best practices
xxxiv. Conduct refresher courses for major stakeholders
xxxv. Build capacity on M, E & C

6.3 Module 3 (M-3): Rollout

i. Establish Aquaculture Development Plan Coordination Office
ii. Constitute and inaugurate the National Aquaculture Advisory and Committee
iii. Conduct bi-annual meetings of the advisory boards
iv. Develop and establish regulatory structures (Proposed Fisheries Commission)
v. Put in place necessary tools to implement the legislations and regulations (e.g. quarantine, fish diseases and environmental monitoring units)

vi. Expanded aquaculture resource base
vii. Identify and promote new aquaculture systems
viii. Assess, develop, and promote mariculture
ix. Promote multiple use of aquatic resources e.g. dams, rivers, lagoons, estuaries, other non-traditional areas in the country
x. Develop and support farm shrimp production
xi. Develop Brood stock bank, Experimental Station in agro-ecological zones.
xii. Establish two Integrated Fish Production Facilities
xiii. Incorporate Fish into School Feeding Programme[7]
xiv. Engage with fast food chains to incorporate cultured fish into their menu
xv. Develop efficient logistic for the distribution of inputs
xvi. Establish a one-stop shop for investors
xvii. Develop and promote aquaculture parks
xviii. Regulate the importation of fish in favour of local production
xix. Reinforce feed quality monitoring unit
xx. Facilitate feed distribution networks
xxi. Conduct Sea Food Show and Reward best practicing farmer

6.4 Module 4 (M-4): Partnerships

i. Explore local and international market potentials
ii. Promote environmentally friendly land and water use practices through public private partnerships (PPP).
iii. Develop linkages with other national, regional and international surveillance programs on aquatic bio-security
iv. Define clearly the mandates of various aquaculture related institutions
v. Streamlined and harmonized national aquaculture related programs
vi. Establish an inventory list of actors and players in the sub-sector
vii. FDF to develop and sign MOUs with FISON and other institutions involved in aquaculture for implementation of the Plan
viii. Link up with Investment Promotion Council to take advantage of aquaculture investment opportunities
ix. Establish bi-annual aquaculture stakeholder forums

[7] School Feeding Programme planned by the Fed. Ministry of Education targets 12.5 million school children. If fish is to be integrated at 10 grams per child per week will create a demand for cultured fish for 7 million metric tones per annum. This translates into 700,000 jobs per annum.

x. Enlighten/Sensitize producer organizations on aquaculture opportunities
xi. Link up-stream to sub- regional, regional and global programs with value addition to national programs
xii. Participate in regional network activities
xiii. Establish and Develop functional national aquaculture network

6.5 Module 5 (M-5): Aquaculture Development Fund

i. Develop models for financially viable aquaculture businesses
ii. Sensitize lending institutions what constitutes viable aquaculture businesses
iii. Training credit officers in lending institutions on key parts of loan requests for aquaculture
iv. Establish Aquaculture Trust Fund with Revolving account

6.6 Module 6 (M-6): Research and Development

i. Conduct Aquaculture market analysis
ii. Conduct research on improved organisms/strains
iii. Research on and Develop other economically culturable fish species
iv. Expanded aquaculture resource base
v. Develop fish seed certification protocol
vi. Identify and certified seed suppliers
vii. Identify and improve existing seed production facilities
viii. Assess the quality of seed stocks held by farmers
ix. Identify/establish certified laboratories for feed testing
x. Conduct research on quality feeds and local feed stuffs
xi. Develop feed certification protocol
xii. Assess the quality of feeds through proximate analyses and grow-out trials
xiii. Identify and certified feed suppliers
xiv. Certify feeds and feed producers

Figure 3: Modules Percentage Allocation

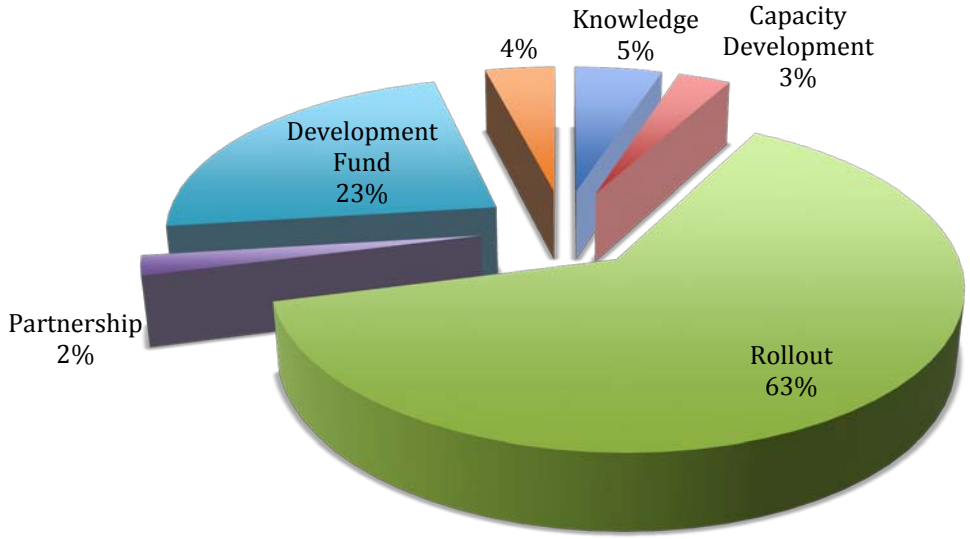


Table 1: Modular Activities, Responsibilities and Budget

Module	Activity	Stakeholder	Timeline	Budget (N'000)[8]
Module 1: Knowledge	Develop comprehensive aquaculture legislation	FDF, States, LGAs	2013	10
	Identify and document best management practices	FDF, FISON	2012-2013	10
	Define current production systems in terms of viable investment packages	Research Institutes, Universities	2012	5
	Improved statistics collection and collation	FDF, State, LGAs	2012-2016	100
	Update the existing fish farmers, feed producers, input suppliers, marketers' inventory	FDF, FISON	2012	10
	Develop the data collection tools especially the use of mobile phone technology	FDF	2012	30
	Establish other ICT hubs	FDF, Development partners	2013	10
	Develop ICT tools accessible to farmers (mobile phone technology)	FDF, Research Institutes	2013	20
	Collate and report data	FDF	2013- 2016	5
	Establish and maintain database	FDF	2012–2016	10
	Set up Geographic Information System (GIS) Laboratory	FDF	2012	20
	Collate relevant data and information for GIS analysis	FDF	2012	10
	Identify high potential areas (HPAs) and conservation areas and develop GIS maps for clusters (NPFS, AIFP models) and accompanying outreach program	FDF, Research Institutes	2012	20
	Produce Maps showing suitable areas for aquaculture on biophysical and socio-economic models	FDF	2012	5
	Establish a Fish Disease and Environmental Monitoring Unit (FDEMU) in FDF in collaboration with Agriculture Quarantine Services, Federal Ministry of environment.	FDF, NAQS, Ministry of Environment	2013	50
	Create awareness on the impact of aquaculture on the environment	FDF, FISON, Ministry of Environment	2013–2016	5
	Disseminate information to end-users.			
	Develop the necessary tools for the M, E & C	FDF	2012	10
	Conduct M, E & C as a policy and management tool	FDF	2012- 2016	50
	Set up guidelines for responsible aquaculture practices	FDF	2012- 2016	50
	Enforce application of best aquaculture practices.	FDF, Ministry of Environment	2013–2016	10

[8] $ = N160

	Subtotal 1			**440**
Module 2: Capacity Development				
	Recruit members of producer organisations through FISON	FISON, States	2012	10
	Establish farmer-to-farmer exchange program coordinated by Fisheries Society of Nigeria (FISON)	FDF, FISON, Development Partners, States	2014–2015	15
	Develop extension packages for countrywide use	Research Institutes, Universities, Fisheries Colleges	2013	10
	Establish standards for provision of outreach services	FDF, Research Institutes, Universities	2013	5
	Recruit, train and facilitate extension and change agents	FDF, States Fisheries Dept., Fisheries Colleges	2013	20
	Train farmers on aquaculture best practices	FDF, FISON OSSAP-MDGS, NPFS, Fadama Project	2013	20
	Engage and coordinate relevant stakeholders to provide basic extension services	FDF, FISON	2013-2016	5
	Establish farmer extension clusters	FDF, FISON, NPFS, Fadama Project	2012-2013	5
	Identify areas where women and youth respectively have comparative advantage	FDF, FISON, NGO	2012	5
	Increased participation of women and youth by allocating specific percentage slots for their participation	FDF, FISON	2014	5
	Design flexible women friendly programs	FDF, Fisheries Colleges	2012	1
	Train the youth in skilled farm labour	FDF, FISON, Colleges of Fisheries technology, Universities	2013	20
	Introduce aquaculture in schools and other youth training institutions	FDF, FISON, Universities,	2014	10

		Fisheries Colleges		
	Identify the various aquaculture value chain Stages (Pond-to-Plate)	FDF, FISON, Universities, Fisheries Colleges	2014	10
	Identify stakeholders at each stage of the value chain	FDF, FISON, Research Institutions, Universities	2012-2013	10
	Determine specific needs of the stakeholders at each stage of the value chain	FDF, FISON, Research Institutions, Universities	2012-2013	10
	Identify appropriate technologies that will meet the needs of every stage	FDF, FISON, Research Institutions, Universities	2012-2013	20
	Conduct specialised training for each stage of the value chain	FDF, FISON, Research Institutions, Universities	2012-2013	50
	Encourage specialisation along the value chain to increase efficiency	FDF, FISON, Research Institutions, Universities	2012-2015	10
	Support development of cottage industries and private companies along the aquaculture value chain.	FDF, FISON, Research Institutions, Universities, States	2012-2013	50
	Examine mechanisms to cost sharing capacity building programs	FDF, FISON, Research Institutions, Universities	2012-2015	10
	Enhance self-sufficiency in non-commercial aquaculturists	FDF, FISON	2013-2016	10
	Train aquaculturist in business skills	FDF, Financial Institutes, FISON, Service Providers	2012-2013	20
	Support the farmed ornamental fish industry and other non-conventional aquaculture systems (Cage culture, rice-cum-fish, algae culture, etc.).	FDF, Research Institutes,	2014-2016	20

		Investment Promotion Council		
	Establish distribution networks including cluster level hatcheries	FDF, FISON, Producer groups	2012-2013	10
	Train hatchery operators	FDF, Input/service Suppliers, OSSAP-MDGs	2012-2013	25
	Package aquaculture business information into brochures, etc.	FDF, FISON	2012	5
	Identify the steps necessary for establishing aquaculture business	FDF, Service Provider	2012	5
	Establish a pricing system for value added products	FDF, FISON, Private Sector	2013	10
	Conduct campaign on the use of ICT within the network	FDF, FISON	2013	5
	Disseminate and sensitize stakeholders on best practices	FDF, FISON	2013-2016	5
	Conduct refresher courses for major stakeholders	FDF, FISON	2013-2015	20
	Build capacity on M, E & C	FDF	20 12-2013	10
	Subtotal 2			**276**
Module 3: Rollout	Establish Aquaculture Development Plan Coordination Office	FDF, Development Partners	2012	300
	Constitute and inaugurate the National Aquaculture Advisory and Committee	FDF	2012	10
	Conduct bi-annual meetings of the advisory boards	FDF	2012–2016	50
	Develop and establish regulatory structures (Proposed Fisheries Commission)	FDF	2013	50
	Put in place necessary tools to implement the legislations and regulations (e.g. quarantine, fish diseases and environmental monitoring units)	FDF, NAQS, Ministry of Environment	2013	50
	Expanded aquaculture resource base	FDF, Research Institutes, Universities	2013- 2016	40
	Identify and promote new aquaculture systems	FDF, Research Institutes, Universities	2013- 2016	40
	Assess, develop, and promote mariculture	Research Institutes, Universities	2014–2016	50
	Promote multiple use of aquatic resources e.g. dams, rivers, lagoons, estuaries, other non-traditional areas in the country	FDF, Fed Min. of Water Resources, Ministry of Environment, State	2014- 2015	20

		governments		
	Develop and support farm shrimp production	FDF, Research Institutes, FISON, Ministry of Environment, OSSAP-MDGS, NPFS, Fadama Project	2013-2015	50
	Develop Brood stock bank, Experimental Station in agro-ecological zones.	Research Institutes, Universities, Development Partners	2012- 2014	500
	Establish two Integrated Fish Production Facilities	FDF, Private Investor	2012 -2013	3,000
	Incorporate Fish into School Feeding Programme	FDF, Federal Ministry of Education, Federal Ministry of Health	2013	50
	Engage with fast food chains to incorporate cultured fish into their menu	FDF, Investment Promotion Council, Fast Food Chain Operators, NAFDAC	2013	20
	Develop efficient logistic for the distribution of inputs	FDF, Seeds& Feeds producers/Marketers	2012- 2016	10
	Establish a one-stop shop for investors	FDF	2013	60
	Develop and promote aquaculture parks in each geopolitical zone	FDF, FISON, Private sector	2013- 2016	600
	Regulate the importation of fish in favour of local production	FDF, FISON, Private sector	2013- 2016	500
	Reinforce feed quality monitoring unit	FDF	2013–2016	10
	Facilitate feed distribution networks	FDF, Feed suppliers	2012-2016	25
	Conduct Sea Food Show and Reward best practicing farmer			5,535
	Subtotal 3			
Module 4: Partnerships	Explore local and international market potentials	FDF, Export	2013	20

		Promotion Council, Investment promotion Council FISON		
	Promote environmentally friendly land and water use practices through public private partnerships (PPP).	FDF, FISON, Producer organisation, Research Institutes, Universities, Investment Promotion Council, Development partners	2016	100
	Develop linkages with other national, regional and international surveillance programs on aquatic bio-security	FDF, FISON, Development partners	2013	5
	Define clearly the mandates of various aquaculture related institutions	FDF, States	2012	5
	Streamlined and harmonized national aquaculture related programs	FDF	2013-2014	10
	Establish an inventory list of actors and players in the sub-sector	FDF, FISON	2012	20
	FDF to develop and sign MOUs with FISON and other institutions involved in aquaculture for implementation of the Plan	FDF	2012	3
	Link up with Investment Promotion Council to take advantage of aquaculture investment opportunities	FDF, FISON	2013	3
	Establish bi-annual aquaculture stakeholder forums	FDF	2012-2016	25
	Enlighten/Sensitize producer organizations on aquaculture opportunities	FDF, FISON	2012- 2014	3
	Link up-stream to sub- regional, regional and global programs with value addition to national programs	FDF, Development partners	2013	5
	Participate in regional network activities	FDF, FISON, Producer groups	2012-2013	10
	Establish and Develop functional national aquaculture network	FDF, FISON, Producer groups, States, LGAs	2012-2013	10
	Subtotal 4			**219**
Module 5: Aquaculture Development Fund	Develop models for financially viable aquaculture businesses	Financial Institutions, Research Institutes, Universities	2013	5

	Sensitize lending intuitions what constitutes viable aquaculture businesses	FDF, FISON, Financial Institutions	2012-2013	5
	Training credit officers in lending institutions on key parts of loan requests for aquaculture	FDF, Research Institutes, FISON, Financial Institutions	2013	5
	Establish Aquaculture Trust Fund with Revolving account	FDF, Fed. Min. of Finance, Financial Institutions, States, LGAs	2013	2,020
	Subtotal 5			**2,035**
Module 6: Research and Development	Conduct Aquaculture market analysis	FDF, FISON, Universities	2012	10
	Conduct research on improved organisms/strains	Research Institutes, Universities	2012–2016	50
	Research on and Develop other economically culturable fish species	Research Institution, Universities, FISON, Producer groups	2013-2015	15
	Expanded aquaculture resource base	FDF, Research Institutes, Universities	2013- 2016	40
	Develop fish seed certification protocol	FDF, Development Partners, FISON, Producer groups	2012	5
	Identify and certified seed suppliers	FDF, FISON, Fish producers	2013-2015	10
	Identify and improve existing seed production facilities	FISON, FDF	2012–2013	10
	Assess the quality of seed stocks held by farmers	Research Institutes, Universities, Producer groups	2012	10
	Identify/establish certified laboratories for feed testing	FDF, Development Partners	2012-2013	100
	Conduct research on quality feeds and local feed stuffs	Research Institutes, Universities	2012–2016	50

	Develop feed certification protocol	FDF, Development Partners, FISON, Producer groups	2012	5
	Assess the quality of feeds through proximate analyses and grow-out trials	Research Institutes, Universities, Feed producer organisations	2012- 2014	20
	Identify and certified feed suppliers	FISON, FDF	2012	5
	Certify feeds and feed producers	FDF, FISON, Fish producers	2013-2015	10
	Subtotal 6			**340**
	TOTAL			**8,845**

10.0 REFERENCES AND BACKGROUND DOCUMENTS

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Annex 1: AQUACULTURE ADVISORY AND RESEARCH COMMITTEE (AARC)

The Aquaculture development Strategy provides for establishment of a multi-stakeholder committee to guide efforts to further the development of aquaculture by involving all players at national and sub-national levels. Multi-stakeholder involvement in the development of aquaculture acknowledges the principle of equality of all players and the need for their involvement in development process. Broad participation of beneficiaries in the management of the sector promotes good governance and collaboration towards common purposes. It is a condition for success, strong leadership and support that is needed at such an initial level of sector development. The National Aquaculture Development Plan points to this need and explicitly calls for urgent measures to promote the leadership role of industry in the development of the sector and to strengthen public sector facilitation for farmers and support of all institutions; public and private, academia and civil society. Each player; consumers, industry, academia, civil society and the public sector need the other and all. In this respect the AARC supports evolution of a common development agenda of all and for all players.

Terms of Reference

1.0 Constitute a multi-stakeholder forum to provide oversight of the operationalization of the NADP and preparation and implementation of the NADP action plan and the technical cooperation programmes and agreements;

2.0 Receive and study periodic reports of NADP Implementation process and make recommendations to partners;

3.0 Provide interface for coordination between public, private and third sector inputs in the implementation of the NADP

4.0 Afford a forum for multi-stakeholder monitoring and evaluation of the implementation plan

5.0 Encourage creation of locally based advisory boards to provide multi-stakeholder inputs to drive local aquaculture needs, address local challenges and provide a framework for national communication of local initiatives;

6.0 Approve selected HPAs for operation of commercial and non-commercial aquaculture;

7.0 Recommend appropriate farming technologies for demonstration at approved HPA demonstration sites;

8.0 Review input availability, seed, feed, credit and markets for selected HPA and demonstration sites and recommend measures to foster an enabling environment for aquaculture development.

9.0 Promote awareness of development of industry and facilitate awareness raising meetings for commercial fish farmers and other stakeholders on aquaculture strategy.

10. Approve the implementation plan for submission of the Department of fisheries and FAO.

11. Provide oversight for mainstreaming of gender in aquaculture.

12. Provides management advisory services as required from time to time.

Duration

While the Aquaculture Advisory Group is a permanent committee, the members will be appointed for a period of 5 years.

Membership

The AARC consists of the following institutions and their representatives

Federal Department of Fisheries	2
States Department of Fisheries	2
Fisheries Research Institute	2
Universities	2
Fisheries Society of Nigeria	2
Financial Institutions	2
Fish Producer Association	1
Feed Producing Company	1
Fish farm Input supplier	1
Export Promotion Council	1
Fisheries service provider	1
Federal Ministry of Environment	1
Federal Ministry of Water Resources	1
National Agriculture Quarantine Agency	1
Total	20

Annex II: OVERVIEW OF AQUACULTURE PRODUCTION SYSTEMS IN NIGERIA

Nigerian fish farmers use a variety of production systems each with different levels of investment, different management requirements and production potentials. Thus farmers have several options for embarking on fish farming depending on their physical and financial resources. With consumer preference clearly favouring catfish, commercial fish farming remains largely focused on this species, with only a few farms raising tilapias. However, tilapia production is expected to increase.

Earthen (Static) Ponds and Homestead Tanks

The early colonial period efforts at fish farming involved tilapia and carp farming in earthen ponds in areas where water was available through the water table or from flowing streams. A number of these ponds remain in production today following their rehabilitation, including removal of deep bottom mud. Early efforts lacked quality fish seed and feeds and pond production cycles were allowed to run up to a year or more. With infrequent harvests, ponds were not drained regularly and this resulted in accumulation of deep bottom mud, of high organic content limiting use and production in such ponds. Poaching of fish was also a major problem with earthen fishponds. In the 60's and 80's during the Directorate of Food, Roads and Rural Infrastructure programme (DIFFRI), there was a homestead fish farming programme but it lacked good technical support, had limited availability of fish seed and quality fish feeds were not available during this period. In the homestead programme, thousands of concrete fish tanks were built in back yards with fish production centred on tilapias, but also including carp and catfish. However, most of these tanks of some 30-m2 areas each were poorly maintained and did not result in significant contribution to supply of fish. Concrete tanks built during this early period also encountered problems with accumulation of wastes and algae as many were deep (2-3 m) and built into the ground to maintain cooler water in favour of the carp, which were imported from Austria.

Earthen Ponds with Aeration

Most fish farmers do not use aeration in Nigeria due to the limited, irregular availability of electrical supply and use of generators can be ten times more costly than use of the national electrical grid. Aeration could greatly increase production and a few farms installed different types of aerators, but had to curtail their use due to excessive cost. Paddle wheels are used to circulate water in a few farms in Nigeria; however these have mechanical and electrical problems and high operating costs.

Flow-through Fish Farming Systems

Many of the homestead tanks were abandoned. Nevertheless, the idea of using such tanks led to today's fish farm estates and fish farm villages where many fish tanks are used through cooperative management for high catfish production. Theft of fish is easily controlled in complexes of well-supervised tanks, which were built above ground with concrete blocks. Facilities are established for pumping of water to flush out wastes and foul waters from tanks on a regular basis. With use of high quality fish feeds, very high fish productions are obtained in such tanks. Many fish tank owners have 2-3 contiguous tanks of 16 m^2 each from which they are known to produce up to 1.5 tons of catfish per year in these semi flow-through systems.

Water Re-circulatory Systems (WRS)

Some 100 Water Re-circulatory Systems have been constructed in Nigeria and have application in situations where water supply may be limited or irregular. Such systems use bio filters to remove ammonia and maintain oxygen at satisfactory levels. The systems are very high tech and require 24 hour, seven day a week sophisticated management with constant use of pumps requiring constant electricity. The same water is recycled continuously with replacement of 5-10% of the volume daily to cover for evaporation and other losses. With the highly variable availability of electricity from the Power Holding Company of Nigeria (PHCN), most individuals and the private sector are forced to invest in costly purchase of generators, which cost ten times more to operate than the cost of electricity from the national grid.

Cage Fish Farming

Cage fish farming has been researched in Nigeria since the 1980s, but very few commercial fish farms have been developed around use of cages as production units, even though these have met with commercial success in Zimbabwe, Ghana and Uganda. Theft of fish and problems with non-durability of materials used in building cages was a problem in trials of cage fish farming by an IFAD-assisted artisanal fisheries project in the 1990s. Presently efforts are underway to launch commercial cage fish farming in the Nigeria. With good water exchange, cages with tilapia in Uganda have produced 180 kg/m^3 of cage (FISH. 2006).

Rice-cum-Fish Farming.

This activity tried by the AIFP project and the National Special Programme for Food Security (NSPFS) with the Chinese assistance. Rice/fish integrated farming has been shown by the

NCRI to increase rice production by 15 % in trials in Niger State. This increased production is accompanied by 300-400 kg/ha of fish, which have high value at N300/kg. If 100,000 ha of this could be integrated into rice/fish farming, then 35,000 MT of fish could be produced. Having a value of N 7 billion. This could create employment for at least 20,000 farm workers. Despite these proven successes, this production system is yet take roots in Nigeria.

Annex 3: ELEMENTS OF THE NATIONAL AQUACULTURE STRATEGY

Sustainable aquaculture development relies on a number of conditions that must be met and addressed in any strategy in a flexible way. Many were outlined in Nigeria's aquaculture strategy, the most prominent of these are:

a. Suitable production systems;

b. Availability and access to inputs (feeds, seed, capital, etc.);

c. Outreach;

d. Research;

e. Education and training;

f. Marketing;

g. Professional and Producer organisations;

h. Regulation;

i. Control, monitoring and evaluation.

For each of the two types of aquaculture defined in this document (commercial and non-commercial), the following sections define the role of the public[9] and private[10] sectors in meeting each condition. Unless otherwise specified, the role discussed applies to both commercial and non-commercial aquaculture.

In light of limited human, financial resources and realignment of government policies to international best practices, Government is, in general, shifting, and should shift, from its role as a direct investor and development promoter to one as a facilitator of an independent and commercially viable aquaculture sub-sector. The private sector is composed of two general groups of actors: direct investors, including producers along with service providers, and partners, principally producer organisations and Civil Society Organisations such as Fisheries Society of Nigeria (FISON) and producer organisations. Public and Private sector responsibilities as outlined below will ensure sustainable development plan.

Suitable production systems

Government should:

Identify general production technologies appropriate to relevant aquaculture zones;

Inform investors in regard to these technologies; and,

Concentrate its outreach activities in these zones.

[9] Includes the Federal Ministry of Agriculture, Research Institutes, and their extension service.

[10] Includes producers, investors (in both fish farming and related sectors), non-governmental organizations (NGOs), commercial banks, universities and development agencies.

The private sector should:

Be aware of the Government strategy regarding different production systems within aquaculture zones.

Availability and access to inputs

Feeds[11]:

Government should:

Stimulate domestic feed industries by reducing or removing taxes on imported feed milling machinery and basic feed ingredients;

Make information on feed and feed materials, especially prices, regularly available to producers through all means of information dissemination;

Within its means, ensure feed quality through inspections and feed certification;

Promote the adoption of appropriate feed manufacturing guidelines such as the *FAO Technical Guidelines for Good Aquaculture Feed Manufacturing Practice*; and,

Encourage commercial farmers and millers to facilitate access to quality feed for the entire sub-sector.

Fund research in locally available alternate source of fishmeal, which constitute a major cost for the production of fish feed.

Direct investors (feed mills) should:

Produce and market necessary feedstuffs to growers;

Provide a uniform quality products at a fair price;

Find mechanisms to facilitate access to high quality feed throughout the sub-sector;

Make proximate analyses available to clients through product labelling;

Provide information on feed availability and efficacy to the public sector;

As appropriate, assist outreach programme in promoting good feeding practices/fish management;

Monitor results; and

Encourage to fund research

Producer organisations should:

Serve as a forum for information sharing among stakeholders;

Lobby for collective bargaining and appropriate public sector intervention; and,

Link with research organisations.

[11] Including commercial and tradable feeds, feed materials and other nutrient inputs.

Seed:

Government should restrict itself to:

Providing regular information on sources and prices of good quality seed to producers;

Providing guidelines in producing/ensuring good quality seed through such measures as seed certification;

Maintaining brood stock of selected culture organisms corresponding to the identified production systems;

Encourage commercial farmers and hatcheries to facilitate access to quality seed for the entire sub-sector, and

Fund research into increasing productivity of cultured fish species and other unutilised potentially culturable species indigenous to Nigeria.

Direct investors (seed producers) should:

Produce and distribute quality seed;

Sell products at a fair price;

Find mechanisms to facilitate access to high quality seed throughout the sub-sector;

As appropriate, assist outreach programme in promoting best aquaculture management practices favouring improved yields; and

Monitor results.

Producer organisations should:

Serve as a forum for information sharing among stakeholders;

Lobby for collective bargaining and appropriate public sector intervention; and,

Link with research organisations

Capital:

Providing and managing credit by the Government often leads to conflicts. Thus, in terms of investment capital for commercial aquaculture[12], Government should restrict itself to creating an enabling environment, through, for example:

The provision of information to lending agencies on the profitability of aquaculture[13];

Evaluating the technical merits of investment proposals submitted to lending agencies for funding;

Advising farmers on where and how to access funding from specialised institutions;

Interacting with these funding institutions to negotiate preferential interest rates for aquaculture development as appropriate.

[12] Credit is not generally considered appropriate for non-commercial aquaculture (FAO 1999).

[13] Relevant information from a variety of sources should be collated by research agencies for this purpose.

Giving aquaculture priority in funding plan for the creation of development seed funds through government funding windows e.g. Agriculture guarantee scheme, N200 billion Agriculture intervention funds, all of the Central Bank of Nigeria, etc.

The private sector should:

In addition to their own equity, commercial producers should rely on private sector funding institutions for capital;

Lending institutions should consider preferential interest rates for aquaculture enterprises when applicable;

Investors requesting credit support should prepare clear and precise business plans;

Formal lending institutions should finance viable aquaculture businesses;

Small investors should ensure that they have appropriate business and financial management skills before requesting external financial support; and,

NGOs should work with non-commercial producers to develop appropriate financing options;

Collect information on other funding mechanisms and make it available to farmers;

Sensitise farmers on the savings and solidarity funds for use in aquaculture development;

Examine the possibility of creating an aquaculture guarantee fund;

Examine the possibility of providing temporary direct assistance to aquaculture producer organisations.

Encourage formation of commodity interest groups and cooperative to facilitate funding.

Outreach

Government should:

Provide quality technical assistance through an efficient aquaculture outreach program;

Seek partners as necessary to meet information shortfalls that cannot be met with public resources;

Establish national and international aquaculture information networks which are accessible at local hubs;

Play a co-ordinating role in the outreach programme;

Put emphasis on participatory approaches when providing services to farmers;

Encourage group formation for purposes of rationalising marketing and purchase of inputs, as well as increasing outreach-farmer contact;

Encourage commercial investors to provide outreach support to smaller operators;

Facilitate the creation of discussion channels amongst different aquaculture stakeholders;

Require larger investors to pay for the technical assistance on a contract basis, negotiated with the institution providing assistance.

The private sector should:

Assist and reinforce public sector outreach programmes, particularly with regard to outreach contributions by feed and/or seed suppliers;

Evaluate outreach efficacy and advice as to outreach needs;

Feedback to public sector as to available information sources;

Commercial producers should pay for technical assistance; and,

Commercial producers should assess their opportunities in serving as information providers.

Research

For commercial aquaculture, Government should:

Support applied and farmer-participatory research directed at small and medium scale commercial farmers;

Ensure that research is responsive to the needs of farmers[14];

Develop methods whereby farmers at the upper limit of the spectrum (i.e., large-scale, capital intensive systems) have access to Government research facilities and scientists on a contract basis.

For non-commercial aquaculture, Government should:

Fully fund research for systems operated by low-income farmers.

The private sector should:

Participate in fund research;

Disseminate research results, as appropriate; and,

Evaluate research results and inputting into research agendas.

Education and training

Government should:

Should include aquaculture practices in Secondary, Vocational and Agriculture Schools' curriculum in order to develop interest in fish production among the younger generation;

Develop specific curricula for practical training of entry-level farm managers and aquaculture technicians;

Arrange and/or conduct on demand at regular intervals, short courses for in-service training and human resource enhancement;

Establish a continuing training plan for its staff and assist in linking candidates with local, regional or international agencies providing training, education and/or financial assistance, including distance learning options;

Provide information on career development in aquaculture; and,

Introduce longer term, professional training in aquaculture sciences to universities.

[14] Researches' merit increases should be linked to on-farm results rather than publication record.

Ensure the certification of practitioners on professional level to ensure best practice

The private sector should:

Pay for training of those technicians necessary for the development of a commercial aquaculture sector;

Facilitate training opportunities on their farms; and,

Feedback to the public sector regarding the efficacy of training; materials/curricula, advising on training needs as necessary.

Aquaculture Value Chain Development

Government should:

Encourage and support value addition on products for increase profit and viability of aquaculture businesses.

Private Sector should:

Ensure quality and compliance in standards along the value chain

Show willingness to specialise along the value chain

Marketing

Government should:

Make information on fish retail prices, market demand locations and sources, sources of inputs and prices available to producers and consumers through, for example, newspapers, newsletters, community radio or other mass media channels;

Protect local producers against unfair foreign competition (imports) provided that protective measures used fit within the international trade conventions/agreements;

Provide basic marketing infrastructure, such as roads, communication channels and fish markets;

Assist producers in promoting aquaculture products (in order to stimulate demand) through agricultural fairs and other such opportunities;

Encourage commercial producers to develop market channels which can be accessed by smaller producers; and,

Prepare, publish and regularly monitor guidelines on the implementation of quality standards of aquatic products to protect the public health as well as improve acceptability of aquaculture products.

Commercial producers should:

Provide quality products according to market requirements; and,

Look for mechanisms to provide market guarantees for smaller producers (e.g., satellite production systems and Nucleus Estates Initiatives).

Producer organisations

Government should:

Promote and facilitate the formation of producer organisations with legal status as appropriate by, for example, advertising their advantages in collective bargaining, streamlining administrative registration processes, etc.; and,

Advise interested farmers, feed and seed producers on where and how to get assistance in group formation and function.

The private sector:

Producers should organise themselves to defend their mutual interests, facilitate access to inputs and markets, etc.;

FISON and other relevant NGOs should play a catalytic role in establishing producer organisations; and,

Organisations should operate under the umbrella of Fisheries Society of Nigeria (FISON) for coordination of their activities to foster unity in approaching government to meets the sub-sector needs.

Regulation

Government should:

Establish clear and secure user rights to land and water favourable to aquaculture investment especially with the Federal Ministry of Water Resource and other relevant agencies;

Avoid unnecessary costs on applicants in acquiring necessary rights to land and water and the right to undertake aquaculture operations;

Regulate the movement of aquatic organisms between watersheds and the provision of discharge and outfall standards (e.g., *Biological Oxygen Demand-BOD* limits or alien species to receiving water bodies, etc.);

Regulate the use of alien and genetically modified aquatic organisms;

Ensure Commercial Aquaculture Farmers obtain permits which specify their rights and obligations;

Waive such permits for non-commercial aquaculture as long as Government regulatory thresholds are not exceeded;

Adopt a one-stop shop for obtaining permits and information relevant to aquaculture development;

Collect and publish reliable and up-to-date statistics; and,

Apply and enforce appropriate international codes to which Government subscribes (e.g., *Code of Conduct for Responsible Fisheries* – CCRF);

Determine criteria for requiring environmental impact assessment studies;

Regulate seed production;

Regulate the production of commercial feed production;

Define a regulation on quality control of aquaculture products.

The private sector should:

Be aware of relevant regulations;

Self regulate to ensure good farm management practices with the goal of sustainable resource use;

Self regulate to ensure a safe-to-consume products are provided to all consumers; and,

Provide complete and correct data for monitoring by the public sector and other relevant agencies.

Control, monitoring and evaluation

Government should:

Control the movement of aquatic organisms between watersheds and the provision of discharge and outfall standards (e.g., *Biological Oxygen Demand-BOD* limits and alien species to receiving water bodies, etc.);

Control the use of alien and genetically modified aquatic organisms;

Apply and enforce appropriate international codes to which Government subscribes (e.g., *Code of Conduct for Responsible Fisheries* – CCRF);

Define a standard system for statistics/data collection and treatment;

Collect and publish reliable and up-to-date statistics. Use of mobile phone technology should be explored as it can provide real time and clean data;

Control sites for large-scale aquaculture practices using scientific (GIS) models for suitability for the purpose of issuing permits.

Control whether or not, where necessary, environmental impact assessment studies are properly conducted;

Control seed quality;

Control the quality of commercial feeds;

Enforce the regulation on quality control of aquaculture products.

Regularly evaluate the sector development level.

The private sector should:

Respect regulations on the movement of aquatic organisms between watersheds and the provision of discharge and outfall standards;

Respect regulations on the use of alien and genetically modified aquatic organisms;

Seek permits before establishing a commercial aquaculture farm;

Apply appropriate international codes to which Government subscribes;

Regularly provide reliable and up-to-date statistics;

Have self-regulatory, self-control mechanisms to ensure seed quality, the quality of commercial feeds and the quality of aquaculture products.

Annex 4: SPECIFIC ISSUES

The following specific issues need to be considered in order to facilitate successful implementation of the development. These include:

Government Stations

Federal and States Governments operate some fish farms, though most of their operations are comatose. These should be rehabilitated, one in each of the agro-ecological zone to be maintained for training, fish genetic management, and research. The criteria for maintaining a station should include, inter-alia, its economic viability and self-sustaining, the needs for genetic conservation, research and training as well as in zones with high aquaculture potential. Other economically viable government infrastructure should progressively be sold or leased long-term to a well-chosen private sector according to extant laws and procedures on the sale or lease of public property. Non-viable infrastructure, or those stations for which no buyer or lessor can be found, can be donated to such public institutions as schools, prisons or orphanages. Public sector technical services should be able to assist potential buyers or lessors in determining the economic potential of these facilities.

In addition to the above, Integrated modern aquaculture facility should also be established, at least two in number in the country. Should serve as demonstration to investors what a modern fish production facility should entails with operational equipment from production, processing, packaging, marketing and tourism, i.e. the whole aquaculture value chain.

Marine and Coastal Aquaculture

Mariculture and other coastal production systems are strategically no different from inland systems and the same processes should be applied. However, it should be recalled that coastal regions comprise critical ecosystems which are highly productive though fragile, requiring careful environmental considerations. Also, these areas are complex socio-economic zones where the potential for conflict over use is high and whose economic contribution to livelihoods is highly significant. The existing body of knowledge for best practices for integrated coastal management should be applied[15].

Non-conventional aquaculture systems

The culture of ornamental species (*Aquariculture*) should, as well, be considered among the multiple aquaculture systems practised in the country. Organically certified aquaculture,

[15] (GESAMP 2001).

growing aquatic non-fish animals and plants species, etc. are also examples of non-conventional systems. Fish-cum other animal species like pigs, ducks, etc. and Rice cum fish technology is practiced in isolated farms but these have shown great potential in some field trials. These should be further explored for the purpose of integrating them into Nigeria aquaculture production system.

Unexplored Culture Species, Introductions and Genetically Modified Organisms

Mainstream aquaculture species are tilapias, catfish, carp and *Heterotis* along with a few minor cichlids. The establishment of presently unexplored culture species may have a high economic cost to be able to develop the required seed multiplication and distribution networks. Thus, the promotion of new culture organisms must take these costs into consideration.

Introductions of alien species need to adhere to international conventions and covenants.

Control of genetic integrity of aquatic organisms is an important issue, which is frequently addressed under the rubric of aquaculture. Reference has been made above to precautionary procedures that are advised, however is it noteworthy that the overall pond management needs to be significantly enhanced before any benefits of genetically modified organisms can become apparent.

Establishment of NADP coordinating office

Implementation of Development Plan like this one requires well-structured coordination office that will function outside the government bureaucracy for efficiency. A specialist should run the office from the FDF under the supervision of a Technical Advisor to be appointed by a Development Partner.