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**INTERAFRICAN BUREAU
FOR ANIMAL RESOURCES**



BEST PRACTICES AND GUIDELINES TO SUPPORT COMMERCIAL AQUACULTURE ENTERPRISE DEVELOPMENT IN AFRICA

GUIDELINES FOR DEVELOPING VIABLE AQUACULTURE BUSINESS MODELS IN AFRICA



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*GUIDELINES FOR DEVELOPING VIABLE AQUACULTURE
BUSINESS MODELS IN AFRICA*

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FOREWARD

While there are ancient records of aquaculture from Egypt, the introduction and practice of aquaculture for much of Africa was in the 1950's. The principle goal then was to help meet household nutrition and food needs. Subsistence aquaculture has since dominated Africa's aquaculture scene.

Declining fishery yields and rapid population growth have contributed significantly to Africa's drop in per capita fish supply and consumption rates. Currently, on average African's consume about 10 kg fish per capita per annum compared to the global average of 20 kg fish per capita per annum. If the current fishery and demographic trends continue, a substantive and progressive decline fish supply and consumption rates is projected for the continent. Further to this, the rapid urbanisation of Africa's fast growing population, has inadvertently opened new market and job opportunities for the youth.

The subsequent need to improve sustainable management and utilisation of Africa's fishery resources, develop new sustainable sources for fish production, improve the supply and access to fish for urban and rural communities and create employment and wealth through the sector, has been reiterated by Africa's leaders. As such the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS)³. was developed that provides the framework to guide the transformation of the sector in lieu of the Comprehensive Africa Agriculture Development Program (CAADP)²³

Africa has vast resources for expanding aquaculture. The potential for aquaculture to fill the gap, has been articulated in the PFRS that identifies market-led sustainable aquaculture development as among the pillars for sectoral transformation. The need to have in place parameters and actions to help guide the re-orientation Africa's aquaculture from a largely subsistence farm-based activity into a commercial sector likewise, has been reiterated by stakeholders^{4,7}.

These guidelines were thus formulated during an Expert Consultative Workshop to Formulate Guidelines for Developing Aquaculture Business Models and Enhancing Extension Services held in Accra, Ghana, in July 2017⁶. The workshop was jointly organized by the African Union Interafrican Bureau for Animal Resources (AU-IBAR) and the NEPAD Agency, in collaboration with the Government of Ghana, and with support from the European Union.

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EXECUTIVE SUMMARY

The Joint Conference of Africa Ministers of Agriculture, Rural Development, Fisheries and Aquaculture recognized the potential of aquaculture to generate wealth, social benefits and contribute to the development of the African economy. They recognised that a private-sector driven and market oriented approach to aquaculture development hinged upon environmental sustainability provided the most feasible option for meeting these expectations⁵. The envisaged paradigm shift is articulated in the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (3) and the accompanying aquaculture action plan (7).

Africa registers a significantly high rate of aquaculture enterprise failure which is part is due to the grossly insufficient practical knowledge of the dimensions, opportunities and risks that characterise aquaculture businesses. Additionally, the PFRS paradigm shift requires the transformation of the aquaculture value chain to better achieve enterprise development. The need to adopt appropriate business models to support sustainable commercial aquaculture development is apparent.

This guideline seeks to support this paradigm shift, as among the tools to ensure tangible benefits are derived from aquaculture for the people of Africa. The basic elements for aquaculture ventures are a supporting environment, the species and seed, production systems, feed inputs, knowledge and skills, capital and opportunity, all of which lead to outputs and products. Using these building blocks, aquaculture value chains can be unpacked and characterised – from basic rural value chains that provide food security, to highly complex business chains that include many stakeholders, and that span globally. To achieve progression in value chains they require optimisation, which relies on an understanding of efficiencies, scale, horizontal and vertical expansion, value chain agility and balance. The reduction of transactional costs along a value chain is a key element to supporting efficiency in local, regional and global aquaculture value chains.

The guideline provides a summary of the constraints and solutions for African aquaculture value chain progression, and investigates a range of business models that can be applied towards achieving such progression. Each model is described and characterised in terms of strengths, weaknesses, applicability and suitability. The models include the subsistence farming model, scale based models (small, medium and large), ownership based models, value

chain based models and multinational models. Within the ownership based models, the guidelines consider companies, aquaculture cooperatives, public private partnerships, state owned facilities and non-government and non-profit organisations.

Ten best business practices are discussed in the guideline, including:

- Aquaculture entrepreneurship
- Good aquaculture business planning
- Accessing the formal economy
- Record keeping at farm level and financial accounting
- Linking production performance to financial performance
- Raising capital, investments and credit
- Market related matters
- Improving competitiveness and increasing profitability
- Business innovation
- Contingency planning: risk reduction and mitigation

A range of crosscutting issues has been included to ensure that the guidelines have broader relevance to aquaculture in Africa. These crosscutting matters include gender and youth involvement, human resource development, social responsibilities and occupational safety, environmental matters, good governance and climate change.

The guidelines should be used to enhance business models and business practices within each African country. The institutional arrangements involve the adoption of the document by Regional Economic Communities, National Governments and the private sector, to ensure that the principles herein inform policy and strategy for aquaculture development and practice.

There remain significant challenges to advancing aquaculture in Africa. Addressing these challenges will depend on regional cooperation, innovative thinking and a collective commitment to the sector. This is only possible through the development and dissemination of good-quality, relevant, up-to-date and accessible business information, in a cooperative effort to establish aquaculture as a globally important sector in Africa.

SECTION A: INTRODUCTION

I. Context to the Guidelines

In 2014, the Joint Conference of Africa Ministers of Agriculture, Rural Development, Fisheries and Aquaculture recognized the potential of the aquaculture sector to generate wealth, social benefits and to contribute to the development of the African economy. This recognition stems from Africa's natural resource potential for aquaculture, and the increasing demand for fish, amid declining fishery yields. Among the factors hampering the full realization of the continent's aquaculture potential are inadequate skills and technical know-how, inappropriate policies, poor knowledge on business skills for commercial enterprise development and more. Most aquaculture production in Africa is done on small-holder subsistence farms. Consequently, despite positive trends in growth, aquaculture production remains low.

Africa's total fish production does not meet the continent's food fish requirements. Africa has an estimated population of 1.3 billion people. The continent's current food fish supply is estimated at about 10 kg per capita per annum, while the global average has risen to approximately 20 kg per capita per annum (FAO, 2016)²⁰. The likelihood that Africa's capture fishery production can be increased to meet this demand is low, due to because its commercially important fish stocks are reportedly fully or over exploited (FAO, 2016)¹⁷. This has resulted in Africa becoming a net importer of fish. Aquaculture now offers the most sustainable option for expanding Africa's fish supply. To achieve this, the aquaculture development ethos has shifted from promoting smallholder production for the household to commercial production to supply wider markets. This entails the diversification and expansion of value chains as such ensuring congruent business practices, knowledge and skills, policies, logistical support, market development, access to critical inputs and services are availed.

The PFRS paradigm shift additionally requires a transformation in the aquaculture value chain, whereby enterprise viability, market access and the competitiveness of aquaculture products, goods and services become key performance indicators⁴. The different and inter-dependent businesses and actors within the value-chain should independently and collectively be viable and profitable, if there is to be sustainable growth and expansion of the sector. The need enabling environment that supports the development and the expansion of viable, robust and

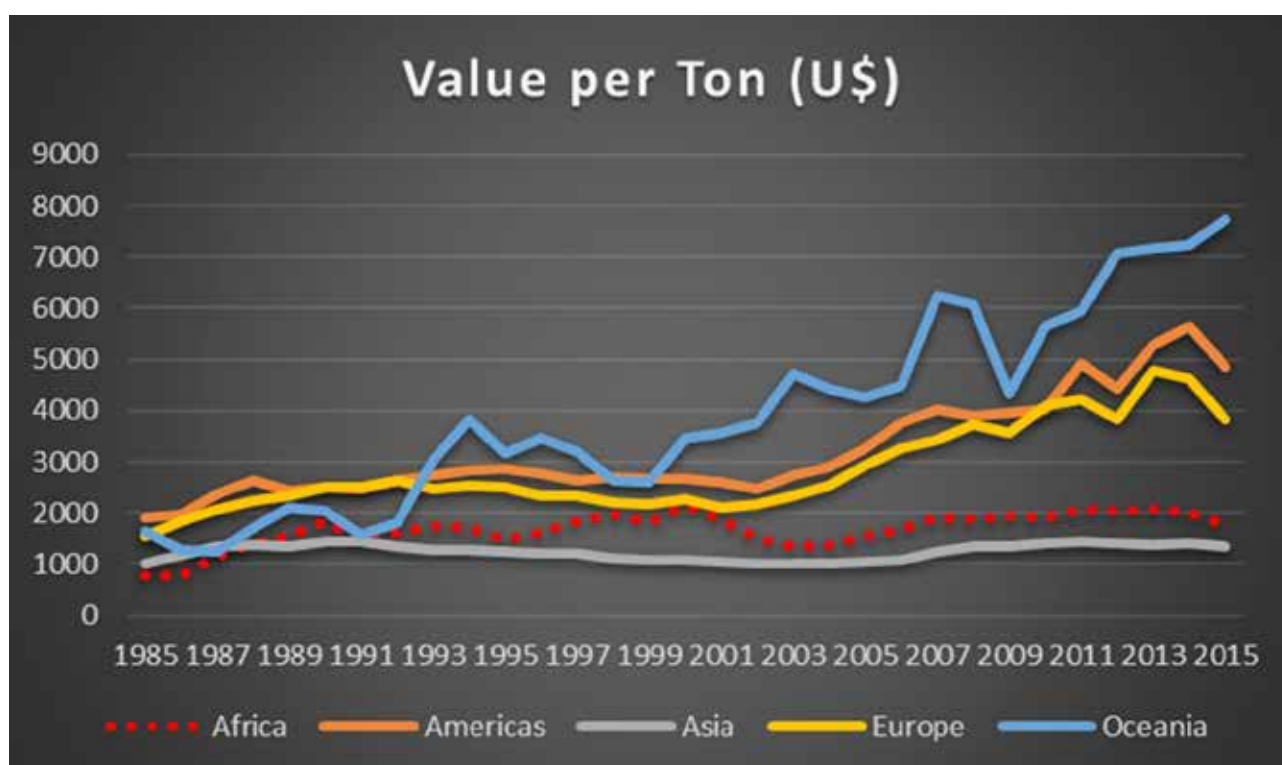


Figure 1: Line graph depicting the value per ton of fish produced (aquaculture) for the respective continents, showing room for improvement of the value of fish produced in Africa. (Source online: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>)

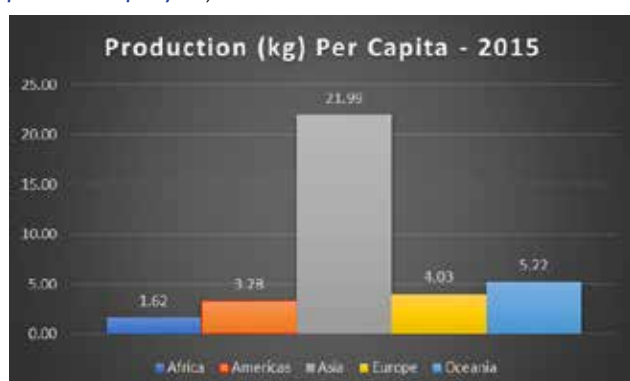


Figure 2: Bar graph showing the production of fish per capita (aquaculture) for the respective continents, showing a very low per capita production for Africa. (Source online: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>)

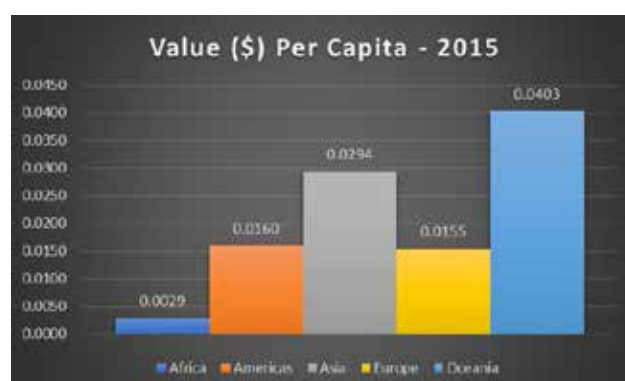


Figure 3: Bar graph showing the value of fish per capita (aquaculture) for the respective continents, showing a very low per capita value for Africa – less than 3 cents (U\$). (Source online: <http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en>)

integrated value chains cannot be understated. The rich natural resources of the continent provide an unparalleled opportunity for Africa's aquaculture in that a wide array of species, products and technologies can be adopted. The African sector therefore has the potential to supply different commodity markets (both food and niche markets), thus creating an array of direct and indirect business and employment opportunities.

While progress has been registered in the commercialisation of aquaculture in Africa, high rates of enterprise failure continue to occur across the value chain due to lack of guidance in business management. The competence of producers and service providers in viable

aquaculture business methods is a critical success factor. Extension mechanisms tailored to suit the needs of the various actors at the different levels of the value chain, intrinsically becomes a priority action for the successful transformation of the sector. Generic business models to guide development, underscored by strong extension services, are among the critical pre-requisites for change.

2. African Policy Environment for Aquaculture

The Policy Framework and Reform Strategy for Fisheries and Aquaculture (PFRS)³, the Comprehensive Africa Agriculture Development Programme (CAADP)²², and the AU Aquaculture Action Plan⁷ have informed the initiative to create guidelines for aquaculture business models and the development of best business practices for the sector.

The PFRS, Africa's blue print for the sector, aims to create an enabling environment that will lead to the transformation of Africa's aquaculture into an all-inclusive, sustainable, market-oriented, private-sector led commercial agricultural activity that meets the CAADP objectives.

In addition, The 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, called for increased productivity to halve hunger and poverty by 2025. Achieving this requires the unlocking of Africa's aquaculture's potential and the transformation of the sector into a globally competitive source of aquatic products. This in turn, necessitates the adoption of an approach that is hinged on private-sector development in a sustainable and equitable manner. This is aligned to the CAADP, which advocates equitable benefit sharing from agricultural activities that have positive impacts on economic growth, rural development, livelihoods and food and nutritional security.

It is acknowledged that each country has different opportunities and capabilities for commercial aquaculture. At continental level, achieving the PFRS goals for sustainable commercial aquaculture development entails regional integration, whereby aquaculture goods and services are produced and supplied to markets within a framework that ensures the sustainable utilisation of shared resources.

3. *Purpose and Objectives of the Guideline*

The primary objective of this document is to serve as a guideline towards for aquaculture business in Africa; through market-led, sustainable and equitable sector enhancement. Related hereto, is the creation of a reference document to illustrate suitable aquaculture business models and best business practices, towards the creation of a globally relevant aquaculture industry that can contribute to continent wide wealth, work, economic activity and food security.

Specifically, the objectives of the guideline are geared towards the achievement of the following benefits:

- The transformation and broadening of aquaculture value chains in Africa.
- Improved robustness of aquaculture value chains in Africa.
- Improvement of value chain support service.
- Market led sector growth.
- Increased output from African aquaculture – both in volume and value.
- The establishment of improved business practices in the sector.
- Improvement and streamlining of aquaculture governance.
- The creation of an enabling environment for sector growth.
- Improvement in institutional and human resource capacities, of all stakeholders along the aquaculture value chain.
- Formulation of an effective approach to crosscutting issues such as gender and youth participation, social advancement, environmental sustainability and climate change.

4. *Scope and Target Audience of the Guideline*

As alluded to in the preceding sections, the scope of the guideline encompasses the entire aquaculture value chain in Africa, with due cognisance that these value chains may extend beyond Africa insofar as upstream services and supplies, as well as downstream markets, are concerned.

These guidelines are intended for public and private sector aquaculture participants and stakeholders along the entire value chain, from primary production, supply and service provision; and extending to governments, regional economic communities, NGO's, producer organisations, researchers, traders, financial institutions and other role players. These

guidelines hold value not only for small holder and subsistence farmers, but also for large and industrial scale aquaculture enterprises.

5. *Structure of the Guideline*

This guideline is divided into the following distinct sections for ease of reference and use:

- Section A The introduction, including the context of the document, the policy environment, objectives, scope, audience and application.
- Section B The building blocks of an aquaculture business linking resources, species, production systems, feeds, knowledge and skills, capital, opportunities and products.
- Section C The nature of the value chain, including constraints, robustness, interrelationships, progression, disaggregation, transactional costs, regionalisation, key drivers, the role of skills and logistics.
- Section D The business model options for Africa, including subsistence farming, small, medium and large scale, rural, family based and food security systems, cooperatives, multinational projects, public private partnerships and value chain partnerships.
- Section E Best business practices, including entrepreneurship, planning, raising capital, insurance, accounting, record keeping, production data, financial indicators, market development, competitiveness and risk reduction.
- Section F Crosscutting matters such as gender and youth empowerment, social matters, occupational safety, environmental responsibility, good governance and climate change.
- Section G Conclusion, dissemination of information and the ideal aquaculture business model at national level.

6. *Application of the Guidelines*

The guidelines should be revised, approved, adopted and domesticated for implementation at national, regional and continental level. As a guideline, the application of this document remains voluntary, but should be used to inform decision makers and participants from both the private and public sectors in aquaculture.

SECTION B: BUILDING BLOCKS OF AQUACULTURE BUSINESS

Aquaculture is a business and will not be sustainable unless managed as such¹⁴.

Aquaculture, and the creation of aquaculture business, depends on a range of basic elements or building blocks (also see appendices 1 and 2). In its simplest form, aquaculture consists of a production system in which an aquatic organism is held under varying levels of husbandry that yield a product at harvest. These building blocks are unpacked in the sections that follow, but are discussed from a business perspective rather than from a technical perspective.

1. The Supporting Environment

The operation of aquaculture depends on various natural resources and environmental services that range from water to the surrounding climate. With reference to the Ecosystem Approach to Aquaculture (EAA), aquaculture should be developed in the context of available ecosystem services, with no degradation beyond the ecosystems capacity to ensure resilience and long-term sustainability. The Ecosystem Approach to Aquaculture (EAA) advocates for the responsible and equitable use of environmental resources to foster long-term security and reduce business risk^{5,17,18}.

Given that aquaculture business operations are completely dependent on supporting resources and essential environmental services, availability and access to these, the variance therein and their responsible use thereof (considering that these resources and services are usually finite and subject to multiple uses), lies at the core of the viability and sustainability of any aquaculture business.

2. Species and Seed Stock

Successful aquaculture business depends on the use of a suitable species that has been matched to the farming environment, climate and other environmental services, as well as the availability of appropriate technologies, knowhow and market needs.

The suitability of the farmed species for an aquaculture business extends to the consistent and predictable supply of seed (brood stock, ova, fry and fingerlings), which may include a strategy towards becoming self-sufficient through hatchery practices. The optimal application of a candidate species depends on creating a suitable farming environment (e.g. water quality, temperature etc.) through the application of appropriate farming technologies, husbandry methods and feeds, while maintaining cost efficiency to ensure business optimisation.

3. *Production Systems*

Successful aquaculture business depends on the use of specific production systems that have been matched to the candidate species, the farming environment and available resources. These production systems must allow for the creation of a stable and predictable farming environment, in which growth and production can be maximised for the greatest possible yields and product quality.

An aquaculture business can be characterised based on the type of production system (e.g. production ponds, raceways, tanks, cages etc.), the scale of production and the types of technologies that are applied within these production systems.

4. *Aquafeed Inputs*

One of the most important inputs for aquaculture production businesses is aquafeeds. The consistent supply of adequate quantities of feed, of the right quality and at a viable cost, is a primary determinant of business success. The fortification of aquaculture business success depends on the optimal application of feed to secure the best possible feed conversion ratio (i.e. the transformation of feed to harvestable product) while at the same time maintaining suitable growing environment within production units.

5. *Adding Knowledge and Skills*

The successful combination of the environmental resources, candidate species and production systems for given market constraints, depends on knowhow and a specific set of skills without which business viability would not be possible.

Knowledge typically depends on aspects such as knowledge generation (research) and knowledge transfer and access. Skills however, depend on the successful application of knowledge, whether that knowledge is internal (including indigenous knowledge) or externally generated. Given that generation and access to knowledge has an inherent cost, the creation of successful aquaculture business models, depend on the provision for such costs.

6. *Capital and Opportunity*

The application of knowledge and skills to create and operate an aquaculture business necessitates an opportunity, which opportunity usually has a direct or indirect cost.

Where capital is applied, such capital can be generated from own reserves, partners, equity, cooperatives, through loans, credit, leases, grants and incentives. The nature and scale of capital requirements depends largely on the scale of the aquaculture operation, and also on factors such as the cost of securing environmental services (e.g. water supplies), species, type and cost of technology, the cost of knowledge, the cost of capital and return periods. Capital planning and the costs of an aquaculture business opportunity therefore need to be understood well to ensure that a viable business is sustained.

7. *Outputs and Products*

The justification for the application of aquaculture species with environmental resources and services in production systems is to achieve an output in the form of an aquaculture product. These products vary widely depending on the species, farming systems, husbandry practices, climate and market demands. For an aquaculture business to be successful, the revenue (or intrinsic product value in the case of subsistence farming) must outweigh the opportunity costs and expenses of farming. Where this balance is not favourable, the business is not profitable and thus economically not sustainable, necessitating either a reduction in costs through use of different species, different production systems or methods, or increasing the value of the product through seeking new markets, marketing or value adding.

SECTION C: VALUE CHAINS FOR AQUACULTURE

To achieve a paradigm shift in the approach to aquaculture, transformation of the entire value chain is required. The basic building blocks of an aquaculture business as indicated in the previous section, allow for further characterisation of the value chains.

1. *From Basic to Complex Aquaculture Value Chains*

The most basic aquaculture value chain is most often established and driven by the need for food security, as opposed to commercial aspirations. In such a basic value chain seed and feed resources are usually obtained locally at low or no cost, and applied in a low or no cost production system, and production output depends directly on the inherent characteristics of the species, feed and condition of the production resources.

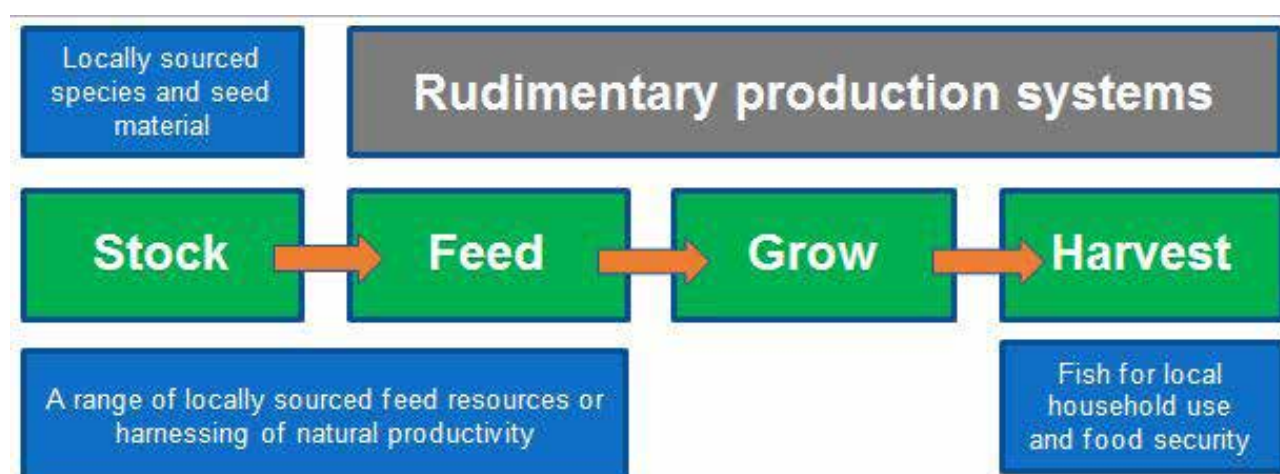


Figure 4: A basic aquaculture value chain.

A basic aquaculture value chain displays little complexity, has limited and basic transitional steps and inputs, has little or no external inputs, is usually geographically limited and highly vulnerable to change in resources and external factors (see also illustrations in appendices 1 and 2).

From the basic value chain indicated above, progression is possible through a myriad of aspects, examples of which are:

- The addition of activities such as obtaining seed and stock through hatchery practices, sourcing better or alternative feed ingredients or manufacture of feed, stock grading, other husbandry inputs and post-harvest activities such as value addition and distribution.

- Additional technologies such as improved production systems, better feeding regimes, improved harvesting methods etc.
- Additional skills and human capital to improve efficiencies.
- Improving and managing production resources such as water, temperature and more.
- Linkage to downstream suppliers of goods, technologies and services.
- Linkage to upstream offsets such as new markets.
- Improving the efficiencies and transactions costs (in capital and effort) between activities.

Appendix I illustrates the envisaged progression from simple subsistence aquaculture into an expanded sector value chain comprising several independent but interlinked players. Value chain.

2. *Optimising Value Chains for Aquaculture in Africa*

Growing aquaculture business in Africa is directly linked to the progression of strong and efficient value chains. Such value chains have several characteristics that are unpacked in the subsections below.

2.1. *The Scale of Production in Aquaculture Value Chains*

For this guideline an aquaculture facility that produces less than 10 tons per annum is regarded as small scale, a facility that produces from 10 to 100 tons per annum is regarded as medium scale, and facilities producing more than 100 tons as large scale. Further to scale, differentiation should also be made between aquaculture for subsistence; purposes (usually small scale) and for commercial purposes (usually medium to large scale).

Although small scale aquaculture is globally varied in social organization, employment, technologies, knowledge, species and inputs, it often equates to semi and/or subsistence farming. Small scale producers typically use low input and low-cost farming methods. Although small scale aquaculture is critical for food security and has positive implications for rural development it is highly vulnerable to external forces such as markets and climate^{11,12,19}. This vulnerability, and the fact that small scale aquaculture in Africa is the result of constraints around markets and access to resources such as capital and knowledge, means that value chains remain perpetually limited, leading to the limited participation of Africa in global aquaculture modernisation and growth.

Most agricultural businesses depend on economies of scale. Achieving economies of scale, allows for a proportionally greater return on the investment of time, capital, effort and resources, as scale increases. Given that much of Africa's aquaculture is practiced at small and subsistence scale, the benefits of economies of scale are limited. Unlocking these benefits weighs on improving scale.

2.2. Horizontal and Vertical Expansion of the Value Chain

Horizontal expansion of the aquaculture value chain entails the addition of activities beyond primary production. The first logical horizontal expansion consists of improving the downstream supply of feed, seed, as well as other inputs and services. Basic upstream expansion entails additional post-harvest activities such as value addition and distribution. Horizontal expansion of the value chain can also entail the addition of new activities within primary production, such as the grading and sorting of stock, culling and more.

Vertical expansion of the value chain entails improvements that support the primary activities in the value chain. These are highly varied and include aspects such as technological improvements, improved production systems, better biological and business management, investment in human capital and more.

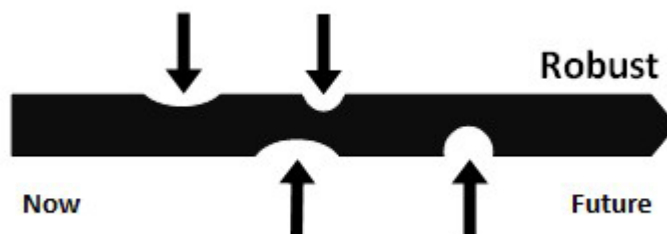
To see the progression of aquaculture value chains in Africa, horizontal and vertical expansion is necessary. This involves holistic support across the entire spectrum of emerging value-chains, as improvement in one aspect of the value chain in isolation, is less likely to enhance aquaculture business. Initiatives that have not taken this approach have often been unsustainable. Examples include the improvement of stock and seed availability in the absence of improved and affordable aquafeeds, or unlocking resources for aquaculture production in the absence of suitable technologies.

Given that the profitable sale of products or produce is the end goal of an aquaculture value chain, increased market demand can drive value chain progression. However, in the absence of equitable access, participation and sharing of benefits in aquaculture markets, value chains in Africa may remain depressed. Here again, holistic value chain support in which production chains become sufficiently strong to participate in market development.

2.3. Value Chain Agility: Robustness, Flexibility and Resilience

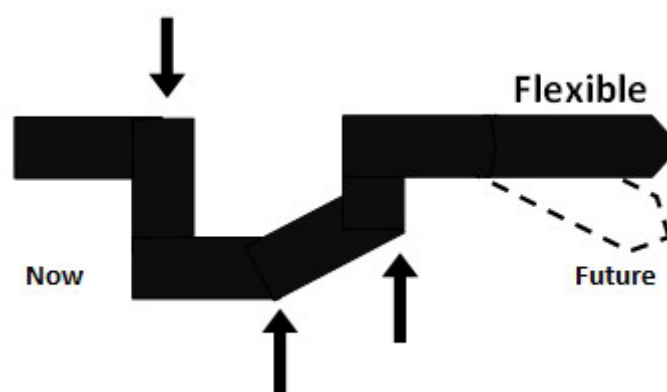
Value chain agility is a function of robustness, flexibility and resilience¹⁵.

Robustness is the ability of a value chain to continue functioning despite unforeseen, unplanned and uncontrolled disruptions²⁰. Although long and complex value chains can become increasingly vulnerable to a lack of



robustness, chains can be protected from this risk by improved management and skills, better and alternative technologies, contingency planning, diversified support activities in the value chain, and ensuring sufficient returns for all role-players in the chain. A typical example of value chain robustness is the ability of aquaculture ventures to retain profitability when seed or feed availability and quality changes unexpectedly.

Flexibility is the ability of the value chain to remain functional when incorporating a change (for example to defer, abandon, expand, contract etc.) in activities and chain links to achieve a similar, or alternative but viable end result²¹. A typical example of flexibility would be growing fish in alternative production systems when factors such as drought,



floods or climate change affect the availability or suitability of resources. Flexibility (or non-flexibility) of the value chain is linked to robustness, but the two not be confused.

Resilience is the ability of the value chain to return to its original state (or move to a new viable state) after being disrupted²¹. A typical example in aquaculture would be how effective and fast a facility can resume production and profitability after brood stock mortalities.



2.4. Value Chain Balance and Interrelationships

From the content of the two preceding sections, the balance and inter-relationships in any value chain should already be clear. The balance refers to the fact that changes in one aspect or element in the value chain will usually cause change in associated aspects and elements. For example, a decrease or increase in seed and fingerling supplies will have a direct effect on the volume of produce or fish that can be sent to market.

Balances in the value chain can be both advantageous and disadvantageous. A value chain balance can be used to benefit production and output, provided changes in supply and input can be accommodated in capacity and uptake. An example in this instance would be the increase in production output if seed and fingerling numbers are increased, provided the production capacity and other essential inputs such as feed are adequate, and provided the market demand and/or new markets exist to absorb the increase in production. Inversely, the balance could be disadvantageous if production capacity and inputs such as feed are inadequate, or if market uptake is insufficient. Under such conditions the entire value chain could be stressed, while a market oversupply can lead to decreased prices due to the nature of supply and demand.

Coupled to balance are the inherent interrelationships of elements in the value chain. Consecutive value chain activities are linked either directly or indirectly, and the degree of dependence of the chain to these links is an indication of the necessity of the link in the effective performance of the value chain. In other words, if the value chain cannot function effectively with the relationship between two elements, then that element is regarded as an absolute necessity. Testing the strength of dependencies in these links is a means of optimising value chains.

Balances and inter-relationships in the value chain once again emphasises the need for holistic support across the entire spectrum of the value chain to achieve the paradigm shift in aquaculture development for Africa.

2.5. Aggregation and Disaggregation of the Value Chain

Linked to the previous sections is the aggregation (i.e. grouping) and disaggregation (i.e. separation) of value chain elements. Both aggregation and disaggregation have certain

advantages and disadvantages. In the case of aggregation of value chain elements, the transaction costs between activities can be reduced, and efficiencies in time and resources can be achieved. However, the aggregation of value chain elements could also pose risks due to inadequate capacities, the loss of distinct functionality and more. An example of aggregation in the aquaculture value chain would be the combination of hatchery activities to produce seed material with grow out activities. Although potential savings can be achieved in the application of consolidated resources, there are distinct disadvantages related to increased biosecurity risks and a loss of the specialisation that is usually required in hatchery practices.

Disaggregation of value chain elements could also improve efficiencies if there are advantages to separating out different elements in the value chain. For instance, the disaggregation of primary processing and value addition to aquaculture products could allow for greater diversification, access to new markets and higher profitability over input costs. However, these could equally cause inverse disadvantages.

2.6. Reducing Transactional Costs in the Chain

In its simplest form, transactional costs across the value chain is defined as the sum of the financial and all other resources that are required to cause the transfer or advance a stage in production from one step to the next in the value chain. The accumulated financial and resource costs finally contribute to the cost of producing a farmed product for sale to the end-user, and therefore determines profitability.

Each step or link in the value chain is associated with a cost. For instance, the supply of feed to a production system carries the primary cost of the feed itself, and then the secondary costs of transport, storage and application. A tertiary cost component includes the effectiveness of the feed in the production system (i.e. the economic feed conversion ratio).

Many strategies exist for the reduction of transactional costs in the African aquaculture value chain, including:

- Local sourcing of feeds, seed and other inputs or services, as opposed to paying for their import.
- Use of improved technologies and husbandry techniques.
- Selling products at the smallest possible size that will be acceptable to market.
- Harnessing the economic benefits of value addition to end products.

- Increasing production volumes to harness the effects of economies of scale.
- Diversifying production to ensure optimal use of facilities, skills and manpower.
- Collective and cooperative sourcing, production, distribution and marketing.

2.7. Regionalization and Globalisation of Value Chains

Many aquaculture value chains in Africa are not only basic and food security driven, but often limited in geographic scope. One way of increasing the effectiveness of an aquaculture business is to extend the scope of the value chain so that inputs can be increased, diversified and sourced at potentially lower costs, and so that outputs of products can be supplied to new, distant and potentially more lucrative markets.

Extending the scope of a value chain is most often based on knowledge and information of opportunities, coupled to skill sets and an enabling environment. For this reason, it is advocated in this guideline that basic in-country value chains be systematically extended through selected initiatives like (i) regional feed and seed supplies, (ii) the sharing of skills and knowhow between countries and within Regional Economic Communities, (iii) support to the identification and logistical arrangements for regional markets and (iv) seeking opportunities for export. These steps also involve the elimination of barriers to trade, so that value chains for aquaculture are not restricted within the borders of a single country. Arrangements around the use of common aquaculture resources (especially shared water resources), transboundary arrangements that include sharing of value chain components between countries and trade incentives also play a role^{3,5,9,10}.

Aquaculture in Africa can be grown to supply fish and other products to a growing global market. However, the transactional costs of meeting international market standards and freight must be considered carefully in tandem with the growing demand (and increasing price) for these products in Africa.

2.8. Skill and Technology Infusion of the Value Chain

The scaffolding that supports a value chain is built around skills, knowledge, information and opportunity. Given that the opportunity for aquaculture business already exists in Africa, the importance of skills, technology and knowhow cannot be over-emphasised. The entire chain can be optimised, grown and improved through the effective application of

knowledge; allowing for improvements in efficiencies in the primary components, new and existing secondary inputs, better scales of economics, extension and progression, improved robustness, better flexibility, the lowering of opportunity and transactional costs and more. Making knowledge available to aquaculture stakeholders and sector entrepreneurs will depend on effective extension and dissemination arrangements.

Globally, new advancements and technologies are continuously being developed for aquaculture. To achieve paradigm shift in aquaculture development, technologies should be adopted where their use is appropriate, with due consideration to the fact that certain technologies will require refinement for African conditions and needs.

2.9. Infrastructure and Support Logistics

Appropriate and functional infrastructure and logistical support creates value chain opportunities and can lower transactional costs. At the macro planning level, it is important that Africa aquaculture businesses are developed around appropriate transport networks, electricity supplies, and efficient national or regional water storage and reticulation arrangements. These aspects rely mainly on government interventions, as a necessity for economic development across sectors.

At an aquaculture sector or project level, infrastructure and logistical support to the value chain entails the appropriate location and positioning of production facilities and value chain elements to ensure access to infrastructure, as well as optimisation through aspects such as aggregation of value chain elements, the lowering of opportunity costs through more efficient transport arrangements, and maintenance of the post-harvest cold and live-fish distribution chains to ensure reach into more distant and potentially more lucrative markets.

3. Summary of Constraints and Solutions in African Value Chain Progression

The following table provides an overview of the value chain based constraints that hinder the paradigm shift in African aquaculture development. The table is populated with recommended solutions and role-players.

Primary Component or Element	Value Chain Aspect	Major Constraints	Recommended Solutions	Responsible Parties
Inputs, Suppliers and Services (Value Chain Enablers)	Seed	<ul style="list-style-type: none"> The standalone business of seed supply is poorly understood Consistency in supply Consistency in quality 	<ul style="list-style-type: none"> Refer to Guidelines for the Regional Production, Distribution and Trade of Aquatic Animal Brood-stock and Seed⁹ (change the 9 to a superscript). 	<ul style="list-style-type: none"> Refer to Guidelines for the regional production, distribution and trade of aquatic animal brood-stock and seed⁹ (change the 9 to a superscript).
	Feed	<ul style="list-style-type: none"> Availability and cost of ingredients Formulation challenges Consistency in supply Consistency in quality 	<ul style="list-style-type: none"> Refer to Guidelines for the Regional Production, Distribution and Trade of Aquatic Animal Feed, Feed Ingredients and Additives¹⁰ (change the 10 to a superscript). 	<ul style="list-style-type: none"> Refer to Guidelines for the Regional Production, Distribution and Trade of Aquatic Animal Feed, Feed Ingredients and Additives¹⁰ (change the 10 to a superscript).
	Finance and funding	<ul style="list-style-type: none"> Access to finance Development of business plans Collateral and payment terms specific to aquaculture 	<ul style="list-style-type: none"> Aquaculture specific funding tools Government guarantees Generic business plan frameworks Market uptake agreements 	<ul style="list-style-type: none"> Governments Banks and other financial institutions Corporate aquaculture establishments
	Logistics	<ul style="list-style-type: none"> Absent and poor transport networks Cross border challenges 	<ul style="list-style-type: none"> New and maintained roads Trade agreements and free trade zones Aquaculture zones and better positioning (supply clustering) 	<ul style="list-style-type: none"> Governments and REC's Established aquaculture participants and entrepreneurs
	Opportunity and transactional cost	<ul style="list-style-type: none"> High costs of doing business Cost of cross border trade and forex 	<ul style="list-style-type: none"> Value chain aggregation and/or disaggregation Diversify inputs, suppliers and services Improve value chain flexibility Adopt better technology Trade agreements and free trade zones 	<ul style="list-style-type: none"> Established aquaculture participants and entrepreneurs Universities and research institutions Banks and other financial institutions Governments and REC's

Primary Component or Element	Value Chain Aspect	Major Constraints	Recommended Solutions	Responsible Parties
	Knowledge, skills and technologies	<ul style="list-style-type: none"> • Lack of knowhow • Lack of technologies • Lack of skills 	<ul style="list-style-type: none"> • Improved programs and quality of training with greater practical orientation at tertiary institutions 	<ul style="list-style-type: none"> • Improved programs and quality of training with greater practical orientation at tertiary institutions
		<ul style="list-style-type: none"> • Few training opportunities • Little mentorship • Little applied research 	<ul style="list-style-type: none"> • Mentorship programmes • Coordinate and applicable research • Remodelled extension services 	<ul style="list-style-type: none"> • Governments • Refer Guidelines to Development of Viable Extension Service Models in Africa⁸ (change 8 to superscript).
Primary Production (Farming)	Natural resources	<ul style="list-style-type: none"> • Access to water and land • Water quality • User conflict 	<ul style="list-style-type: none"> • Aquaculture recognises as an industry • Aquaculture zones and spatial planning • Best environmental practices and ecosystem approach 	<ul style="list-style-type: none"> • Government • Established aquaculture participants and entrepreneurs • Affected stakeholders
	Finance and funding	<ul style="list-style-type: none"> • See finance in previous table • Lack of understanding around economic feed conversion and other cost drivers 	<ul style="list-style-type: none"> • See finance in previous table • Improved programs, quality of training with greater practical orientation at tertiary institutions • Mentorship and internships programmes • Better coordinated and applicable research • Remodelled extension services 	<ul style="list-style-type: none"> • See finance in previous table • Universities and research institutions • Corporate aquaculture establishments • Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.
	Appropriate species	<ul style="list-style-type: none"> • Wrong species choice • Poor genetic and seed material • Misunderstood husbandry needs 	<ul style="list-style-type: none"> • Disseminate information on suitable species and husbandry needs. • Selective breeding and dedicated seed farms. 	<ul style="list-style-type: none"> • Government • Refer also to Guidelines for the regional production, distribution and trade of aquatic animal brood-stock and seed⁹.

Primary Component or Element	Value Chain Aspect	Major Constraints	Recommended Solutions	Responsible Parties
			<ul style="list-style-type: none"> Remodelled extension services 	<ul style="list-style-type: none"> Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸
	Production systems	<ul style="list-style-type: none"> Wrong system choice Cost of inappropriate “turnkey” systems Misunderstood system functions and operations 	<ul style="list-style-type: none"> Disseminate information on suitable systems. External evaluation of systems Remodelled extension services 	<ul style="list-style-type: none"> Government Corporate aquaculture establishments Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.
	Biosecurity	<ul style="list-style-type: none"> Lack of biosecurity management Biosecurity risks like disease 	<ul style="list-style-type: none"> Develop continent wide biosecurity measures Remodelled extension services 	<ul style="list-style-type: none"> OIE, AU, FAO, other agencies and governments Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.
	Knowledge, skills and technologies	<ul style="list-style-type: none"> See knowledge matter in previous table 	<ul style="list-style-type: none"> See knowledge matter in previous table 	<ul style="list-style-type: none"> See knowledge matter in previous table
Outputs, Products and Markets	Profitable price realisation	<ul style="list-style-type: none"> Incorrect species Incorrect production systems Incorrect farming practices Incorrect / poor feeds Poor financial records and interpretation 	<ul style="list-style-type: none"> See table above Remodelled extension services 	<ul style="list-style-type: none"> See table above Refer also to Extension Services Guidelines
	Value addition	<ul style="list-style-type: none"> Little or no value adding Food security led and not market led 	<ul style="list-style-type: none"> Disseminate information on value addition and market needs Link with existing commercial entities / processors Remodelled extension services 	<ul style="list-style-type: none"> Government Corporate aquaculture establishments Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.

Primary Component or Element	Value Chain Aspect	Major Constraints	Recommended Solutions	Responsible Parties
	Distribution and logistics	<ul style="list-style-type: none"> Distance to markets Lack of transport networks Cross border constraints 	<ul style="list-style-type: none"> New and maintained roads Trade agreements and free trade zones Centralised processing 	<ul style="list-style-type: none"> Governments and REC's Established aquaculture participants and entrepreneurs
	Appropriate distribution chains for aquaculture produce and products; quality assurance	<ul style="list-style-type: none"> Lack of freezing facilities Lack of cold chain maintenance Little implementation of quality assurance frameworks 	<ul style="list-style-type: none"> Centralised or shared freezing Disseminate information on cold chain maintenance Alternative processing (e.g. retorting) Assist with HACCP implementation 	<ul style="list-style-type: none"> Government Established aquaculture participants and entrepreneurs Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.
	Consistent supply and volumes	<ul style="list-style-type: none"> Small volumes penetrate small markets Poor predictability in production 	<ul style="list-style-type: none"> Centralised or cooperative marketing shared freezing facilities Disseminate information on cold chain maintenance Alternative processing (e.g. retorting) Assist with HACCP implementation 	<ul style="list-style-type: none"> Established aquaculture participants and entrepreneurs Corporate aquaculture establishments Government Universities and research institutions Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.
	Access to new and export markets	<ul style="list-style-type: none"> Limited market access Over and undersupply Knowhow and quality issues to access export markets 	<ul style="list-style-type: none"> Regional market demand analysis Cooperative marketing Value addition Better market logistics Information on export needs / methods 	<ul style="list-style-type: none"> Established aquaculture participants and entrepreneurs Corporate aquaculture establishments Government Refer also to Guidelines to Development of Viable Extension Service Models in Africa⁸.

A Snapshot of Aquaculture Enterprise in Africa

The major aquaculture production installations on the continent comprise earthen pronds, cages and tanks. The level of scale, management practices, productivity and returns associated with these installations varies widely across the continent.



Small holder by her earthen fish ponds, Malawi. The dominant species farmed within fresh-water earthen ponds in Africa are the Tilapines and African Catfish. Picture courtesy of Hastings Zidana, National Aquaculture Center, Malawi.



A farmer harvesting his pond with a cast net in Mali. Picture courtesy of Bocari Alliaye Kossibo, Ministry of Livestock and Fisheries, Mali

Freshwater and Marine Cage Culture



Cage culture in the Mediterranean Sea, Morocco. Picture courtesy of AU-IBAR, Morocco.



Feeding in large cages in Lake Kariba, Zambia. Picture courtesy of Bernard Mudenda, Zambia



Freshwater small holder cage culture in the DRC. Tilapia are the major cage fish farmed fish. Inland cage culture is progressively growing in lakes rivers, and man-made dams. Picture courtesy of Jerome MULUMBU, IITA Kalambo Youth Agriprenieur- IKYA, DRC.



Taking cage harvest to shore Picture courtesy of John Domozero, Pill-Brook Aquatics, Ghana

Tank Culture



Fingerling production tanks in Ghana. Outdoor tanks are also used to raise table-catfish in Nigeria. Picture courtesy of Jacob Ainoo-Ansah, Ainoo-Ansah Farms, Ghana.



Indoor tank-culture in Africa is typically associated with intensive hatcheries and ornamental fish production. Tanks within green-house tunnels are found more in regions where the seasonal and/or ambient diurnal temperature differences are pronounced. Picture courtesy of Mohamed Megahed, Egypt

Much of the sales, especially among small holders, occurs by on-farm.



Sorting fish prior to sale IKYA farmers DRC on-farm. Picture courtesy of Jerome MULUMBU, IKYA, DRC



Farmed table-fish Sales. Picture courtesy of Alexander Shula Kefi, Fisheries Department, Zambia

Accessing more lucrative distant and nice markets requires innovation and investment to develop new products and maintenance of quality along the post-harvest value-chain



Pictures from left to right showing farmed trout being chilled immediately after harvest on-farm in ice prior to transportation, to filleting processing plant where sorting, filleting and quality control are undertaken prior to packaging and distribution. Picture courtesy of Etienne Hinrichsen, Aqua Eco, South Africa.

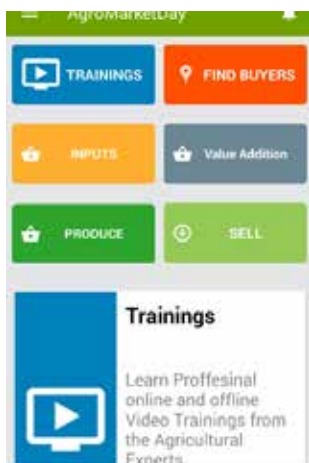


An array of Ugandan farmed catfish products. Picture, courtesy of Lovin Kobusingye, Kati Farms Ltd., Uganda



Taking advantage of aquaculture's competitive edge over wild fisheries. Live farmed fish sales are gaining prominence in urban centers, notably Nigeria and Uganda, where there are often associated restaurants. Picture of farmed tilapia sales. Picture courtesy of Go Fish Limited, Uganda.

Farmer-initiated and sustained fish farmer associations and cooperatives have begun to in several parts of the continent, especially in countries where aquaculture is rapidly. These have improved access to markets through collective marketing, technical information, inputs, and even in the quality control of inputs and other services such as by vetting service providers. In many respects, they compliment public efforts and work in collaboration with Government Departments.



Aquaculture information on my smart-phone. This AgroMarket Day mobile App is an initiative by WAFICOS famers to reduce business transaction costs. The App provides extension material, enables farmers access markets and inputs, etc. Picture courtesy of Isaac Omat, AgroMarketDay, Uganda.
<https://play.google.com/store/apps/details?id=com.agromarketday>



The Walimi Fish Famers Cooperative Brochure giving a profile of some of their activities. Picture courtesy of Ben Kiddu, WAFICOS, Uganda.



IITA Kalambo Youth Agriprenieur- IKYA, DRC also caters for the needs of fish farmers. Picture courtesy of Jerome Mulumbu, IKYA, DRC.

Several auxiliary aquaculture businesses are springing up notably input supply, construction of aquaculture production facilities, marketing, processing, disease control, feed manufacture, training and extension, and technology development



Locally fabricated tarpauline fish tanks. Infrastructure and tools can be costly. Innovations by private sector service providers and universities have begun providing tailor made services suited to local sectors needs. Picture courtesy of Anthony Nlewadim, Michael Okpara University of Agriculture, Nigeria.



Small-scale fish feed plant. Access to quality feeds is a challenge for many fish farmers in Africa. Local entrepreneurs as well as multinational investors have taken this opportunity to invest in the production of commercial fish feed. Picture courtesy of Enos Were, Jewlett Farms Ltd, Kenya.

SECTION D: BUSINESS MODELS FOR AQUACULTURE IN AFRICA

A host of business models or business structures are used in aquaculture and other industries across the world. Some of these are better suited to specific conditions, or to best achieve specific business goals. The following sections provide a summary of the main business models by scale, by ownership and by value chain position. Each section provides a table that illustrates where best the model should be applied to aquaculture development across Africa, albeit that much variation exists in a continuum of different and hybrid models.

I. The Subsistence Farming Model

In aquaculture, subsistence farming is the practice of producing fish and related produce for the household with hardly any surplus for trade. In its purest form it is driven by household food security needs, and while it can be a means of adding value and consistency to capture fisheries, it can also stand independently. Overproduction is rare, but where surpluses exist, these are usually preserved by salting or drying, sold or bartered. This constitutes the first steps towards becoming a commercial practice.

Subsistence farming is characterized by production systems based upon on-farm inputs, and low-cost simple technologies. Such farming is normally integrated with other farm activities.

Edwards & Demaine (1997) elaborated on the term “rural aquaculture” by defining it as the farming of aquatic organisms by small-scale farming households or communities, usually by extensive or semi-intensive, low-cost production technologies appropriate to their resource base. However, rural aquaculture does not necessarily have to be a subsistence model nor small scale.

Nature and Characteristics	<ul style="list-style-type: none"> • Very small scale • Often household bound • Use of local species, resources and environmental services • Limited technologies • Poor supply and application of feed and seed 		
Strengths	<ul style="list-style-type: none"> • Family based food security • Environmentally benign • Niche use of water and other resources 	Weaknesses	<ul style="list-style-type: none"> • Inconsistent production volume and/or quality • Significantly affected by changes in climatePredation of stock • Limited re-investment of income
Opportunities and means of progression	<ul style="list-style-type: none"> • Significant opportunity for extension service, technology and skills transfer • Opportunity for value chain progression through providing seed and feed • Opportunity for progression by expanded market access 	Areas of application	<ul style="list-style-type: none"> • Rural areas • Household farming

2. Scale Based Models

2.1. Small Scale and Smallholder Models

As indicated in Section C, a facility that produces less than 10 tons per annum is regarded as being small scale. Small scale aquaculture is however not necessarily the next progression from subsistence farming, as many variations exist. Although small scale farming is common across Africa, and although it is generally the first progression from subsistence farming, small farms can also be highly advanced and commercially driven entities that produce high-value or niche products. Small scale aquaculture can be individually, communally or collectively owned and operated, but there is generally a direct link or close relationship between ownership and operational duties, with owners often constituting part of the labour force.

As much as small scale aquaculture is an important contributor to food security and rural development in Africa^{11,12,16}, the notion that Africa should rely solely on small scale farming in perpetuity, is wrong. Small scale aquaculture should form the basis for the development of larger enterprises that can be regionally and globally competitive.

Nature and Characteristics	<ul style="list-style-type: none"> • Small scale • Often local community bound • Use of local species, resources and environmental services • Limited technologies • Localised markets • Poor supply and application of feed and seed 		
Strengths	<ul style="list-style-type: none"> • Local food security • Environmentally benign • Niche use of water and other resources 	Weaknesses	<ul style="list-style-type: none"> • Inconsistent production volume and/or quality • Significantly affected by changes in climate • Over-subscription of beneficiaries
Opportunities and means of progression	<ul style="list-style-type: none"> • Significant opportunity for extension service, technology and skills transfer • Opportunity for progression through providing know-how and better quality inputs • Opportunities for integration with agriculture • Opportunity for progression by expanded market access 	Areas of application	<ul style="list-style-type: none"> • Rural areas • Community farming • Urban areas where space is limited
	<ul style="list-style-type: none"> • Medium scale • Often local community bound • Use of local species, resources and environmental services • Limited technologies • Localised markets • Poor supply and application of feed and seed 		
Strengths	<ul style="list-style-type: none"> • Local food security • Environmentally benign • Niche use of water and other resources 	Weaknesses	<ul style="list-style-type: none"> • Inconsistent production volume and/or quality • Significantly affected by changes in climate • Over-subscription of beneficiaries

2.2. Medium Scale Aquaculture Enterprise

As indicated in Section C, a facility that produces between 10 and 100 tons per annum is regarded as being medium scale. Medium scale aquaculture is however not necessarily the next progression from small scale farming, as many variations exist. Generally small-scale farms will grow to medium scale farms if the resources and opportunities are available, but medium scale enterprises could also operate optimally at this scale in perpetuity. As is the case with small scale farms, some medium scale enterprises are highly advanced and commercially driven entities that produce high-value or niche products. Medium scale aquaculture is less often individually owned and more commonly owned by communities, company or as a collective. There generally remains a direct link or close relationship between ownership and operational duties, albeit that ownership is usually positioned in management.

Nature and Characteristics	<ul style="list-style-type: none"> Improved application of business principles Use of regional species, resources and environmental services Moderate access to technologies Localised and regional markets Strong base for growth and improvement 		
Strengths	<ul style="list-style-type: none"> Indirect food security Local economic contribution Potential for progression of the value chain 	Weaknesses	<ul style="list-style-type: none"> Poor access to capital High cost of inputs such as seed and feed Poor tracking of key production performance indicators that affect profit
Opportunities and means of progression	<ul style="list-style-type: none"> Some opportunity for extension service Much opportunity for cooperation around inputs and services Opportunity for progression by better quality of inputs, advances in technology value addition and access to wider markets including regional and international 	Areas of application	<ul style="list-style-type: none"> Established agricultural areas New water and land resources Integration with existing agriculture infrastructure

2.3. Large Scale Aquaculture Enterprise

As indicated in Section C, a facility that produces more than 100 tons per annum is regarded as a large-scale enterprise. Large-scale enterprises can grow from medium scale farms, but do not necessarily progress in this manner. They can be established anew if resources, skills and opportunities exist. Typical large-scale aquaculture entities have access to a broad and robust value chain of supplies and services, harness improved technologies, have access to the required human capital and generally supply well-established markets. Large scale aquaculture is seldom individually owned and more commonly owned by a collective. Ownership is less often involved in operational duties, and usually acts in management positions or as holders of equity.

Nature and Characteristics	<ul style="list-style-type: none"> Often independent of government support Usually highly business orientated Access to international species and other resources Broad market reach and export 		
Strengths	<ul style="list-style-type: none"> Agile and well-defined value chains Significant regional and national economic contributor Base for spinoff business 	Weaknesses	<ul style="list-style-type: none"> Sometimes lacks equitable benefit sharing for communities Can be environmentally damaging
Opportunities and means of progression	<ul style="list-style-type: none"> Much opportunity for satellite development Opportunity for value chain optimisation Progression to new technologies and species is possible 	Areas of application	<ul style="list-style-type: none"> Where well defined agricultural business is possible Areas with good resource and infrastructure base

3. Ownership Based Models

3.1. Companies

Notwithstanding the fact that an individual can own an aquaculture facility (see especially the subsistence farming model above), the formal economy makes provision for the registration of companies. The nature of such companies depends on national legislative frameworks, but companies can be broadly defined as a formal organisation of one or more individuals or entities that conduct a commercial activity for profit.

Many subsistence and small-scale or small holder aquaculture enterprises in Africa are not structured into formal companies, albeit that they may be regulated by custom and agreement. Although supply of aquaculture products from a company into the formal market is the accepted “Western” means of trade, trade in Africa takes place freely between companies and entities that are not structured into legally recognised companies. Export from Africa to other continents usually relies on formalised buy-and-sell procedures where entities that are not structured into companies participate through formalised third-party companies.

The larger an aquaculture operation, the more likely that it will be formalised into a company.

Nature and Characteristics	<ul style="list-style-type: none">• Often exists in the formal economy• Geared for business and profit• Often opportunity-seeking and entrepreneurial in nature• Often serves well defined markets		
Strengths	<ul style="list-style-type: none">• Well-defined value chains• Usually well organised• Good regional economic contribution	Weaknesses	<ul style="list-style-type: none">• Benefits often limited to company shareholders• Poor access to capital
Opportunities and means of progression	<ul style="list-style-type: none">• Some opportunity for specialist extension• Opportunity for value chain optimisation• Good base for value chain progression• Good base for mentorship of small-scale aquaculture	Areas of application	<ul style="list-style-type: none">• In the formal economy• Areas with good resource and infrastructure base

3.2. Aquaculture Cooperatives

A cooperative is a derivative of a company and consists of an autonomous association of persons that unite voluntarily to meet their common economic, social and cultural needs and aspirations, through a jointly-owned and democratically-controlled enterprise. Typically, each

member contributes equity capital, and shares in the control of the cooperative based on the one-member-one-vote principle (and not in proportion to his or her equity contribution as in most companies).

Cooperatives allow for the harnessing of advantages that flow from collective pooling of resources, skills and other enablers in the aquaculture value chain. In this, the overall advantage is usually greater than the sum of the abilities and advantages associated with the individuals that make up the cooperative.

Cooperatives provide an effective tool for progression for subsistence and small-scale aquaculture, but are less suited to large scale enterprises in the formal economy.

Nature and Characteristics	<ul style="list-style-type: none"> • Multiple stakeholders • Often integrated with other agricultural activities 		
Strengths	<ul style="list-style-type: none"> • Dynamic environment due to multiple inputs • Usually strong representation • Access to funding/capital 	Weaknesses	<ul style="list-style-type: none"> • Management can be fragmented or disjointed • Lack of direction could result from multiple interests
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for extension services • Opportunity for cooperative buying • Good base for value chain progression and spinoff of specialist aquaculture business 	Areas of application	<ul style="list-style-type: none"> • In areas where multiple stakeholders require direct benefits. • Within existing cooperative structures

3.3. Public Private Partnerships

A Public Private Partnership is broadly defined as a contractual arrangement between a public or state agency and the private sector, through which the resources, opportunities, skills and assets of each party are shared in the creation and operation of an enterprise that delivers products or services.

An example pertaining to aquaculture could consist of private individuals or entities gaining access to state owned waterbodies for fish farming, in which the resources and enterprise are jointly managed (as opposed to being bound solely by a lease or tenure agreement). Other specific objectives can be set for any Public Private Partnership, including the creation of employment, economic activity, skills, food security and more. Such a joint effort by private and public entities allows for a greater commercial orientation in the beneficial use of state assets.

Nature and Characteristics	<ul style="list-style-type: none"> • Cooperation between government and the private sector • Multiple stakeholders 		
Strengths	<ul style="list-style-type: none"> • Good access to resources that are in the public domain • Dynamic environment due to multiple inputs • Usually strong representation • Access to funding/capital 	Weaknesses	<ul style="list-style-type: none"> • Objectives of government and private sector could be different • Management can be fragmented or disjointed • Lack of direction could result from multiple interests
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for extension services from within government that is involved • Opportunity for cooperative buying • Good base for value chain progression outside of partnership 	Areas of application	<ul style="list-style-type: none"> • In areas where government owned and managed resources exist

3.4. State Owned Facilities or State-Owned Enterprise

State facilities are fully owned by the public sector and are usually established to supply core services and products to a particular sector. In aquaculture, the establishment and operation of hatcheries for seed production is a typical example that has been applied in many African countries. These entities are seldom operated for the purpose of generating profit, but may charge for products and services to cover expenses.

Nature and Characteristics	<ul style="list-style-type: none"> • Fully state or government owned • Usually focussed on support and service provision to the sector (e.g. hatcheries, research, training, etc) 		
Strengths	<ul style="list-style-type: none"> • Use of state or government resources to support a business orientated sector • Good access to resources that are in the public domain • Can operate in an environment where profit is a secondary concern 	Weaknesses	<ul style="list-style-type: none"> • Usually with a rigid objective that is not flexible and orientated to sector needs • Can become competitive to the private sector • Entrepreneurship and innovation is low • Can be bureaucratic and slow to react to advances in technology and opportunities
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for dedicated support to a growing sector • Opportunity to train extension services • Opportunity to provide start-up support to small-scale aquaculture 	Areas of application	<ul style="list-style-type: none"> • In areas where government can play a role to provide services to aquaculture

3.5. Non-Government or Non-Profit Organisations

A non-profit organization that operates independently of any government, typically one whose purpose is to address a social or political community-based issue. May be national or international. The defining activity of operational NGO's is the implementation of projects.

Nature and Characteristics	<ul style="list-style-type: none"> • Usually have a developmental or social support objective • Usually not involved in primary production 		
Strengths	<ul style="list-style-type: none"> • Good access to international funding and support tools • Can operate in an environment where profit is a secondary concern • Can provide access to regional and international technologies, human resources and markets 	Weaknesses	<ul style="list-style-type: none"> • Often with a rigid objective that is not flexible and orientated to sector needs • Can be project focussed without a broad view of sector needs • Can be overburdened by policy
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for dedicated support to a growing sector • Opportunity to train extension services and introduce new skills • Opportunity to provide start-up support to small-scale aquaculture 	Areas of application	<ul style="list-style-type: none"> • In areas where national and international non-profit organisations seek a vehicle for development and socio-economic support

4. Value Chain Based Models

4.1. Value Chain Partnerships

All aquaculture ventures operate within a value chain, whether this chain is simple or complex. As value chains progress, this usually entails a process in which new suppliers and service providers (enablers) become involved and new markets and offset options are added. Some of these additions may take place through adding aspects such as hatcheries for seed supply, or processing facilities, within the entity that owns or operates the primary production (e.g. the company, cooperative etc.), while in other instances these additions could be made through agreement and contract to other non-owned entities in the value chain. The formation of value chain partnerships, may range from information trade agreements to complex supply and off-take contracts. In all instances, such partnerships are established to optimise a particular business entity.

In primary production such as agriculture (including aquaculture) the establishment of formalised off-take agreements is a good tool to secure markets, which security can be used to leverage capital and buying power for essential services and supplies.

Nature and Characteristics	<ul style="list-style-type: none"> • Usually formed in a mature industry • Usually formed to optimise value chain performance • Usually involve complementary elements that join in the value chain • Usually in the formal economy and profit driven 		
Strengths	<ul style="list-style-type: none"> • Creation of agile value chains in which transactional costs are lowered • Able to react well to a changing business environment 	Weaknesses	<ul style="list-style-type: none"> • Can lead to monopolisation of inputs and services
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for cooperation along the value chain • Opportunity to share resources along the value chain 	Areas of application	<ul style="list-style-type: none"> • Usually in a well-established aquaculture (or agriculture) environment

4.2. Fully Integrated Value Chain Businesses

A progression from value chain partnerships is where business entities own and operate various elements or components of the value chain. Such integrated value chain ownership may develop over time as an enterprise matures and seeks greater control, more efficiency and lower transactional costs in the value chain, or it may be established from the beginning. The extent to which one business entity controls elements of the value chain can vary and does not preclude the supply of goods and services to other value chains outside of its own business. For example, a fish farming entity that adds a hatchery for seed supply (owned under the same business entity) could become a supplier of seed for its own needs and to other farms.

In global integrated aquaculture value chains, corporate entities are becoming the norm. In its most advanced form one company (or a close association of companies) will own and operate all aspects of the value chain from raw product production for feeds, hatchery and seed supply, equipment manufacture and supply, grow out, processing and value addition distribution and even retail outlets. In these instances, economies of scale, the lowering of transactional costs and branding are primary drivers of profitability.

Nature and Characteristics	<ul style="list-style-type: none"> • Usually formed in a mature industry • Usually formed to optimise value chain performance • In the formal economy and profit driven • Often the result of conglomeration of smaller businesses 		
Strengths	<ul style="list-style-type: none"> • Creation of long and complex value chains that are dynamic and market focussed • Large businesses that can seek new opportunities, undertake research and development and capitalise new business 	Weaknesses	<ul style="list-style-type: none"> • Can lead to monopolisation • Local and rural communities often don't benefit equitably
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for rapid development of spin-off and support business or satellite farming • Can be used as a hub that stimulates and supports other facets of development • Can be used for technical support, as well as supply of feed and seed to smaller operations • Can serve as a channel to access new and international markets 	Areas of application	<ul style="list-style-type: none"> • Usually in an environment with good access to infrastructure and logistics, or • In new environments that can only be accessed by extension of existing value chains.

5. Multinational Models

The integrated value chain ownership model indicated in the previous section can result in the establishment of multinational corporate entities or global companies. These companies are seldom involved in single components of the value chain, usually farm at large scale and are often involved in linking distant primary production facilities (i.e. aquaculture farms) to markets in other regions or countries. There evolution is a symptom of a global economy in which primary products are produced where the natural resources and climate is better suited to farming, while the products are consumed in a value-added state in economically strong markets in major commercial centres or countries.

Nature and Characteristics	<ul style="list-style-type: none"> • Usually formed in a mature industry • Usually formed to optimise value chain performance • In the formal economy and profit driven • Often the result of conglomeration of smaller businesses 		
Strengths	<ul style="list-style-type: none"> • Creation of long and complex value chains that are dynamic and market focussed • Global market access • Large businesses that can seek new opportunities, undertake research and development and capitalise new business 	Weaknesses	<ul style="list-style-type: none"> • Can lead to monopolisation • Local or rural communities often don't derive equitable benefits • Can have significant environmental impacts
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for rapid development of spinoff and support business or satellite farming • Can be used as a hub to support local development • Can be used for technical support, as well as supply of feed and seed to smaller operations • Can serve as a channel to access new and international markets 	Areas of application	<ul style="list-style-type: none"> • Usually in an environment with good access to infrastructure and logistics, or • In new environments that can only be accessed by extension of existing value chains.

SECTION E: TEN BEST AQUACULTURE BUSINESS PRACTICES

1. *Aquaculture Entrepreneurship*

An entrepreneur is a person who sets up a business, taking on financial risks in the hope of profit. This is a function of personal character and of opportunity; both of which can be nurtured and developed. The most obvious example of entrepreneurship is the starting of a new business.

In aquaculture, the spirit of entrepreneurship combined with available natural resources, effort and capital (human and financial), can lead to the establishment of a successful fish farming business. It should be clear that the establishment of a successful aquaculture venture, of any scale, will not be possible without individuals with an entrepreneurial spirit. This entrepreneurial spirit is characterized by innovation and calculated risk-taking, and is an essential trait to achieve the paradigm shift in aquaculture development for Africa.

There are many aspects that contribute to the nurturing of entrepreneurship, of which the most relevant to aquaculture in Africa are the following:

- Disseminate information about aquaculture – how to access farming resources, how to build facilities, methods of farming, where to get feed and seed, etc.
- Support new farmers liberally and ensure that such support is granted across the essential elements of the aquaculture value chain.
- Equip farmers with business skills, in addition to aquaculture skills.
- Create a means for farmers to access markets.
- Remove regulatory challenges and/or assist farmers to deal with regulatory matters that may stifle new business.
- Create funding tools for aquaculture business.

2. *Good Aquaculture Business Planning*

In any business, planning is the cornerstone to success. Given that aquaculture is driven by many internal and external variables (biological and economic), planning is an ongoing business essential. Value chain progression and the preservation of a durable and functional

value chain is not possible without careful planning of factors such as resourcing, production flow, harvesting and marketing.

Aquaculture business planning starts at the conception of a business idea, prior to the initiation of any farming activities. This pre-development planning, regardless of scale, should include planning around the fundamental drivers of the venture to ensure that natural resources (water and climate) can be optimally used and controlled within a conceptualized production system, with a suitable candidate species. This pre-development planning should extend to all inputs that will be required for the venture, a fairly accurate pre-determination of the production performance and a good perception of how the farmed product will be distributed and sold at a profit. Although a written plan is not always a prerequisite, it is good practice to document the pre-development business plan that should cover essential aspects such as:

- An executive summary.
- A description of the business opportunity and nature of the business, including analysis of the aquaculture sector in the region.
- Plan of how the business will be executed, the operational plan.
- The target market, market analysis, identification of competitors and how the market will be accessed.
- Organisational management, including the personnel that shall be involved, including the desired skills and other human resources needs.
- An analysis of how the business will be financed, the financial plan.
- A projection of the financial performance of the business.

Such a business plan can be used internally to improve the business efficiency, to communicate strategy and to serve as a planning framework in setting goals. It can also be used externally to raise funds or to attract investors and business partners.

Some of the main elements that require careful planning in aquaculture are:

- The monitoring and management of environmental variables that affect production (e.g. temperature, dissolved oxygen and other water quality parameters).
- Planning and feed and seed inputs, as well as the logistics, consistency and costs related thereto.
- The planning of feed application and the tracking of the production performance related thereto.

- Planning for contingencies such as disease, mechanical failure, natural disasters etc.
- Planning of harvesting, as well as logistics and access to markets.

In planning for successful aquaculture, it should be kept in mind that planning can only be effective if it can deal with change. The planning process should therefore be clear on the assumptions that are made, the resources that are required, the people that are responsible, the timeframes and the measurable goals and performance areas.

3. *Accessing the Formal Economy*

Much of the aquaculture in Africa resides in the informal economy and sells into the informal economy, where less formal record keeping exists, the consistency of supply and pricing is low, value adding is restricted, quality controls are fewer and markets are usually geographically limited. Although the existence and continuation of aquaculture in the informal economy is critical to maintain subsistence, small-scale and rural farming, the achievement of a paradigm shift in Africa aquaculture, as well as value chain progression, depends on accessing the formal economy. In this formal economy businesses are formally structured (registered), funding is more accessible, production performance is tracked, marketing is done through established value chains into diverse markets, and profitability is more accurately predictable.

Although supply to the informal market is important, and can be an essential offset to a viable aquaculture venture, fish farmers should be encouraged to systematically formalise their businesses by means of:

- Formally registering as a company in terms of the regulatory framework in the countries in which they operate. In this instance, Governments should not burden small-scale and emerging farmers with regulatory constraints.
- Keeping formal company records and establishing an accounting system.
- Establishing formal purchase and sales contracts, as well as contracts for the supply of services and employment contracts for personnel.
- Seeking trade opportunities in the formal market through ensuring consistency in supply volume and quality, and working towards value adding, packaging, cold-chain and other requirements in the formal market.
- Establishing product traceability through implementation of quality control frameworks.

The importance of the informal economy and informal markets has been highlighted above.

Moreover, the abandonment of these economies and markets in favour of formalisation will not be a suitable solution in all instances. It does however provide an avenue for progression of the value chain.

4. Record Keeping at Farm Level and Financial Accounting

The formalisation of aquaculture, as indicated in the previous section, depends on the establishment of a financial accounting system and business records. These records are not only important for formalisation, but create the platform for improved management, better production, increased profitability, better forecasting and more efficient planning.

In its very simplest form a fish farm should keep records of:

- The stock that it has on hand
- The growth and performance of the farmed stock, so that this can be compared to projected performance or a baseline.
- The primary variables that influence production performance, such as water temperature.
- The resources that are required to sustain production, such as feed and water.

More sophisticated record keeping can contribute to more efficient farming practices. Some of these aspects include:

- Monitoring of secondary variables in the production environment, including a range of water quality parameters and aspects such as day length, ambient temperature etc.
- Monitoring of the growth stages of the production stock, as well as monitoring feeding patterns, physiology etc.
- Monitoring and recording stock predation, disease and pathogens.
- Monitoring and recording of market trends

From a business point of view, certain on farm records should be equated in financial terms. This includes:

- The cost of new farming stock, the value of standing stock and the value of that stock at harvest.
- The past, current and future costs of feed and other inputs.

- The financial implications of production variables such as water temperature.

In its simplest form a financial accounting system for an aquaculture farm should capture and record:

- The capital amount invested and which assets and operating costs it was invested in.
- All costs such as seed, feed, other inputs, salaries and wages etc., recorded by date.
- All income from sales, recorded by date.

From this simple data set a basic set of financial accounts can be developed that shows incomes and expenses. This can be improved by the addition of stock performance parameters, credits and debits, financial statements, financial ratios and more.

5. *Linking Production Performance to Financial Performance*

Many aquaculture ventures in Africa have failed due to a lack of the understanding around the relationship between production performance and profitability. In aquaculture the cost of production and the rate of production will determine the total input cost per farmed unit at a specified point of harvest. These costs should be the most important determinant of the sales price, as selling under this cost of production will result in a financial loss. It should therefore be clear that the cost of production, which is linked directly to production performance of the farmed animal, determines whether an aquaculture venture can remain profitable. Although this may seem logical, the incomplete or inconsistent monitoring and management of production often leads to suboptimal farming performance, which leads to a loss in profitability. It is incumbent on any aquaculture operator, regardless of scale, to understand the link between production performance and financial performance and how best to monitor, manage and optimise this relationship to achieve business success.

6. *Raising Capital, Investments and Credit*

Except for some subsistence, small-scale and organically grown aquaculture operations, some form of capital is required to establish a new fish farming business. This capital can be raised from own funds or informally through family and acquaintance, but it often requires some type of loan capital or investment. These capital sources could include:

- Bank loans and bank credit, which is a traditional means of raising capital through financial institutions.
- Micro – and private loans are similar to bank loans but are often less rigid, and can be tied

to equity or specific performance measures. Depending on the source of such loans, the cost of capital and other burdensome conditions may pose risk.

- Venture capital consists of people and institutions that will provide capital for either equity (i.e. as a partnership) or at cost (i.e. a loan). Venture capital can be less rigid and formalised than accessing bank loans, but could also carry high costs of capital.
- Grant funding, which are funds that are typically set aside by Governments, NGO's and funding institutions towards the achievement of specific goals (e.g. the creation of employment, skills development, food security, skills development, sector growth, trade enhancement etc.). When an aquaculture venture has the potential to deliver on these goals, it may be able to access related grant funds, which may or may not have specific performance conditions or even repayment arrangements.
- Concluding partnerships with people and companies that can contribute to capital needs. This usually entails the transfer of equity in the business, where the funders then become part shareholders in the venture, or where partners seek a return on the capital that is invested.
- Angel investment usually takes the form of investors that seek worthy projects that can be supported financially and by other means. These investments may be made for equity or for a return on the investment, but may also be done towards the achievement of other goals, including humanitarian goals.
- Traditional group funding mechanisms have existed in many forms and are usually community based and less structured. However, recent years have seen the formalisation of many crowdfunding platforms (mainly internet based) through which projects can access capital support from a broader community that seek investment opportunities, equity or other forms of reward.
- Supply credit or pre-sale arrangements is a form of funding in which the costs of feed, seed and other inputs are put on hold until an aquaculture venture generates funds from product sales. Alternatively, the projected income from sales could be made available before products are harvested, so that this credit can be applied as capital elsewhere.

Many of the funding mechanisms above, rely on the formalisation of a business, careful business planning and the development of a business plan (see Section 2 above). In this process, investors and funders rely on information about the nature of the business, its objectives, production and sales projections and profitability.

Many African aquaculture ventures have failed due to a lack of foresight around the need for

operating capital. Where capital is invested in the establishment of aquaculture facilities, those same facilities require funds to be operated from commencement to the point at which they become financially self-reliant through the sale of products. In many instances this can take multiple production cycles and can lead to the failure of a business, even if the farmed products can be sold at a profit. One instrument that can be used in the management of operating capital is access to credit facilities, including credit arrangements with suppliers and payment instruments on produce.

Governments and financial institutions, both African and global, have a key role to play in the paradigm shift that is required in the development of aquaculture in Africa. Financial institutions should develop aquaculture specific financing instruments that take account of the high initial capital needs, the operating capital needs for feed, seed and other inputs, as well as the specific (and often long) production cycles in fish farming. Many emerging farmers have little collateral with which to secure loans, in which case it is important that governments and financial institutions develop in-house expertise that can diligently evaluate aquaculture business risk in a technically sound manner. Where projects are found to be based on sound principles, Governments should create a means of providing collateral and guarantees to financial institutions on behalf of the emerging aquaculture operators.

For aquaculture to develop more rapidly in Africa, Governments should investigate monetary and non-monetary incentives for the sector. Monetary incentives include grant funding, creating incentives by reduced taxation, through collective buying and through funding of aspects such as technology and skill development. Non-monetary incentives include the supply of feed and seed, the creation of public private partnerships, the making of available of natural resources such as water and more and the development of new markets for aquaculture.

7. *Market Related Matters*

All the best business practices that have been discussed above are linked to the farming of a product that can be sold at a profit. Around this core principle, a business can be made more profitable by either decreasing the cost of production or by increasing the price realisation in sales.

Some key aspects to decreasing the costs of production in aquaculture include:

- Reducing inputs costs of seed, feed and other inputs.
- Keeping the production cycle as short as possible and (generally) selling the end product in the smallest possible form that remains acceptable to the market.
- Lowering transactional and logistical costs in the value chain through more efficient processes and production management.
- Ensuring optimal growth of the target species by good husbandry practices, the use of feeds that provide for a favourable conversion ratio of feed to product and ensuring a favourable production environment and production conditions.

Some key aspects to increasing the price realisation in sales include:

- Providing the target markets with a consistent supply of product in quantity and quality, so that the buyers become familiar and dependant on the product.
- Adding value to the end products of production so that profits can be realised from primary production and from the process of adding value.
- Promoting products in selected markets to increase familiarisation and uptake through sales.
- Diversifying the product offering by farming different or more species, in different ways, and presenting these to the market in different forms.
- Always prioritising the needs of clients and end users of the farmed products.
- Accessing new markets in which price realisation may be better.

The type of product that is produced in an aquaculture facility is a direct function of the species that is farmed, as well as the type of farming system, the nature of the surrounding environment and farming resources, feed types, the approach to feeding, farming methods and post-harvest practices. These aspects contribute the price of the product after farming, and will therefore contribute to the profitability of the aquaculture venture.

8. *Improving Competitiveness and Increasing Profitability*

Although competitiveness can be defined in many ways, it relates mainly to the improvement of productivity. Competitiveness in aquaculture can be seen as the ability of a farming person or company to produce products that meet the needs of the target market, at an acceptable price which will provide adequate returns (i.e. profit) over the resources that were employed. Competitiveness enhancement can be implemented along the entire aquaculture value chain through the reduction of input costs, better utilization of resources, better management,

optimisation of production etc.

The measure of competitiveness ultimately lies in the response of the market to the aquaculture product that is being offered. An acceptable response is based on factors such as quality, market need and price. Where African aquaculture projects supply to local food markets the competition against other food products is most often price driven, but in more developed markets the driving force increasing becomes quality. Nevertheless, the balance between supply and demand continuously determines the relationship between the price that can be offered and the price that buyers are willing to pay. By improving competitiveness, the buffer between this price point and the price at which profits are nullified is improved; increasing the economic robustness and viability of the aquaculture venture.

Many of the aspects discussed in the preceding points refer to the improvement of profitability as a best practice in business. As indicated in Section 7, profitability can only be increased through lowering input costs and increasing the sales price per unit. The lowering of input costs should be an ongoing drive in any business and involves a “whole-value-chain” approach, while the end price is largely determined by the market and the manner in which a project can be innovative around the products that are offered, as well as the finding of new markets, product diversification, value addition etc.

9. *Business Innovation*

Globally, the aquaculture sector is undergoing rapid change through the implementation of new technologies, the farming of new species, the use of new resources and environments, and the accessing of new markets with novel products. This is being driven by innovation in the sector. For aquaculture business in Africa to undergo a paradigm shift, such innovation is essential. As with the nurturing of entrepreneurship (Section 1 above), the creation of an environment in which innovation can contribute to the growth and development of aquaculture is a vital component of the path to greater success for African aquaculture. Innovation in aquaculture can include:

- The use of new species, with due consideration to the biodiversity risks that are posed by alien species.
- The application of new and advanced farming methods. In this, globally adopted technologies should be used in a manner that suits the conditions and needs of Africa.
- Accessing new resources such as waters that were previously not used for aquaculture; including the integration of aquaculture with traditional irrigation practices and the

recycling of water.

- Adding value to farmed products in novel ways, such as the adoption of new processing and packaging methods.
- Being innovative in the development of new markets and gaining access to markets beyond the scope of local and regional areas.

10. Contingency Planning: Risk Reduction and Mitigation

Any business faces certain risks that can affect the value chain or any component within the chain. These risks are varied and include aspects such as aquaculture disease, supply and price challenges for essential inputs such as seed and feed, biological and environmental constraints, a shift in market demand and more. Contingency planning involves the identification of these risks, the reduction of their potential where possible, and the development of plans to mitigate their effects if they should materialise. In the development of a robust business model for aquaculture and to ensure progression in the value chain, this risk identification and management process should become part of daily operations.

Internationally, the insurance of aquaculture businesses and stock is becoming more common. Large aquaculture companies that face a range of risks insure against stock losses, natural disasters such as flooding and other aspects. As the scale and complexity of aquaculture grows in Africa, there will be a greater need for insurance. Governments and financial institutions should endeavour to create such insurance tools that will be required as greater sector formalisation takes place.

The main risks to any aquaculture business, include:

- A change in supporting resources, examples of which are changes in water supply volumes and quality.
- A change in the availability and costs of essential inputs into the value chain; particularly seed and feed.
- Unexpected biological challenges related to the manner in which the farmed species react to the farming environment, which will be expressed in the growth performance.
- Aquaculture disease.
- Natural disasters such as flooding and climate change.
- A change in market demand and price.

SECTION F: CROSSCUTTING MATTERS

This guideline has dealt extensively with aquaculture business, the value chains in aquaculture, aquaculture business models for Africa and best business practices. Yet, several crosscutting matters affect the development and enhancement of aquaculture in Africa. These crosscutting matters require ongoing attention towards achieving the required paradigm shift to aquaculture in Africa.

1. Gender and Youth Empowerment

From its roots in fisheries, aquaculture has traditionally been a male dominated endeavour. The nature of aquaculture is however well suited to the skills and abilities of women. Women have an intuitive ability to nurture animals in the farming environment, can work precisely and efficiently in aquaculture processing and have the required organisational and business acumen to contribute to aquaculture value chain progression. These essential skills make the participation of women in the growth and development of aquaculture in Africa essential.

Africa has a disproportionately large youth population that faces daily exposure to a developed first world, but for whom the tools and opportunities to participate in the mainstream economy is limited. The value of youth participation in aquaculture relates to their ability to introduce the essential innovation that is required to take African aquaculture forward, as well as to contributing as an affordable workforce for which the core skills and abilities in aquaculture must be developed, if the sector is to progress on the continent.

2. Human Resource Development

A major constraint to African aquaculture remains the shortage of human resources that have gained adequate skills, knowhow, training and experience in commercial aquaculture. Small scale and subsistence fish farmers have a basic practical knowledge of husbandry techniques, but often lack the knowhow to drive value chain progression and to grow their aquaculture ventures into profitable medium, large and commercial scale businesses.

Much has been written about human resource development in Africa. Moreover, this guideline has been compiled with an associated document focussed on improving extension

services. The development of human resources for aquaculture depends on a multipronged approach in which “whole-value-chain” teaching is critical, given that teaching aquaculture skills in isolation is of little value if this is not supported by business knowhow, marketing, product handling etc. Examples of extension models for aquaculture include the following (see associated guideline for more details):

- Teaching the Teacher Model
- Government Official to Farmer Model
- NGO to Farmer Model
- Development Agency to Farmer
- University / Training Institution to Farmer Model
- Sector Association to Farmer Model
- Commercial Farmer to New Entrant or Small-Scale Farmer Model
- Farmer to Farmer Model
- Fish Buyer to Farmer Model
- Tertiary Training Models
- Vocational Training Model
- Internship Model
- Skills Clusters
- Centres of Excellence / Knowledge Hubs
- Demonstration Projects
- Social Media Models

3. Social Responsibilities and Occupational Safety

Commercial and large-scale aquaculture tends to become self-sufficient in terms of value chain progression. This is however not the case with subsistence, small-scale aquaculture and marginalised communities that are often linked to practices such as labour sending and direct natural resource harvesting. These marginalised communities often suffer from extreme poverty, high levels of illiteracy, are food insecure and exposed to social ills. For aquaculture in Africa to undergo the required paradigm shift in development, these role-players must be empowered to participate in the sector.

Marginalised communities that lie in proximity to suitable natural resources such as land and water must be identified as potential beneficiaries of aquaculture development. Empowering people in projects that are geared to generate profit, regardless of how small, is a better

alternative than subsidised aquaculture development, which has little long-term sustainability.

Although aquaculture does not generally create unsafe working conditions, operations that make use of floating cages and large pond based production systems, could pose a drowning hazard to people that are not proficient swimmers. General workplace hazards that are common to any type of farming operation also occur. In addition to ensuring that the workplace remains safe, employees and workers should be treated with adequate dignity and in accordance with their specific rights. Examples of aspects that require attention in upholding safe and legal farming and employment conditions include:

- In all circumstances employee rights must be upheld.
- All aquaculture infrastructure and facilities must be designed and constructed to meet relevant structural standards and adequate engineering specifications to ensure worker safety. Attention must be paid to aspects such as the integrity of ponds, dams and tanks. Where required, production system design must provide for adequately drainage to prevent the dangers of working in deep water or mud.
- Working conditions on aquaculture facilities must be such that they are safe. Where required, the necessary safety equipment (such as life jackets), training in their use and the required emergency responses (such as the measures that should be applied when a person is drowning), must be implemented.
- Adequate protective gear must be provided for certain tasks such as the handling of chemicals and working on floating cages.
- Provision must be made at aquaculture facilities for ablution facilities, clean drinking water and an area where employees can take shelter against inclement weather, and where they may store personal goods and belongings.
- Aquaculture facilities and operations must make provision for first aid equipment, and at least one employee should be trained in first aid provision. Relevant emergency service contact numbers should be clearly displayed at all facilities.
- Employees must be provided with opportunities for training and furtherance of their skills.
- Pursuant to gender equality, employment opportunities in aquaculture must be made available to men and women, with due consideration that certain activities are better suited to men (e.g. working on floating cages), while others are better suited to women (e.g. hatchery operations and post-harvest processing).
- Although opportunities should be created in the aquaculture sector for the youth, child labour practices are not acceptable.

4. *Environmental Matters*

A range of environmental challenges impact directly on aquaculture development in Africa, given that this sector depends on environmental resources such as water, climate and feed. The paradigm shift that is required to take aquaculture forward in Africa depends on well-planned and accurate strategies that can deal with a changing environment in which challenges like water shortages, pollution and floods must be accounted for.

Apart from the impact of the external environment on aquaculture development, this sector also has the potential to impact on natural resources through contributions to water pollution and through its reliance on resources for feed. Given the use of resources, user conflicts are possible and require equitable resource allocation strategies.

In modern-day aquaculture, the use of exotic species poses biodiversity risks. It is inevitable that the use of exotic species, and possibility GMO species, will increasingly become part of the African aquaculture sector. These species should not be allowed into areas where the biodiversity impact has the potential to disrupt other species and environmental resources. Moreover, responsible mitigation and management measures must be implemented around species in aquaculture.

The tools that can be used to improve the development and management of a sustainable aquaculture sector include spatial planning, project planning through environmental and strategic impact assessment within the ecosystem approach, impact mitigation and sector monitoring. Increasingly, the need for the implementation of sector standards and best management practices is becoming an imperative requirement to compete in formal and global markets. Although these may not be essential to the development of small scale or rural aquaculture, the paradigm shift for aquaculture in Africa depends on the implementation of these globally important standards.

5. *Good Governance*

Good governance is a far-reaching concept that describes how public institutions conduct and decide over public affairs, and manage public resources. Without good national and regional governance, the development of aquaculture business in Africa will remain constrained, as this affects all elements of the value chain. The allocation of resources, the creation of a

conducive business environment, the streamlining of regulatory burdens and access to goods, services and markets all depend on good governance.

The main characteristics of good governance are:

- Accountability
- Transparency
- Good governance follows the rule of law
- Responsiveness
- Equitability and inclusivity
- Effectivity and efficiency
- Participatory and consensus driven

6. *Climate Change*

Climate change has become a global phenomenon, which is increasingly impacting human activities such as agriculture, and which has specific impacts on the natural resource base (particularly water) and ecological services that aquaculture depends on. In certain instances, climate change is rendering areas less favourable for certain species and types of aquaculture, while in other instances areas are being rendered more suitable. Organisations such as the FAO have worked extensively on the impacts of climate change on aquaculture, and advocate an approach that includes both mitigation and adaptation.

Although aquaculture is not a significant contributor to greenhouse gas emissions that cause climate change, mitigation measures such as improved energy use, more efficient transport, the localisation of markets and protection of environments that temper the acceleration of global warming, can be implemented. Adaption to climate change in the aquaculture sector includes the prudent location of new aquaculture development in less affected or alternative areas, investment in more resilient production systems and methods, the use of adaptive or less sensitive aquaculture species, or the switching to species that become new aquaculture candidates due to a changed climate.

SECTION G: CONCLUSION

1. Cross Section of an Ideal Aquaculture Business Model for Africa

There is no single recipe for success for aquaculture enterprise development and value chain progression in Africa, but rather a combination of elements that need to be prioritised. A range of the good practices and common elements of success that have been discussed in this document, and which will contribute to an ideal aquaculture business model, include:

- Aquaculture development should be aligned to the ever-improving policy environment for the sector, but should remain private sector led.
- A supporting business environment should be created for the entire aquaculture value chain from inputs and services, through production to market development.
- Aquaculture should be built on the farming of suitable candidate species, of which good quality seed is made available.
- Aquaculture should be practiced in suitable production systems and technologies should be adopted and modified for African conditions.
- High quality aquafeeds should be made available at a competitive price.
- Knowledge and skills should be advanced in an ongoing process.
- Tools must be developed for access to, and mobilisation of capital from government, financial and other private sources.
- Markets should be developed and access to new markets encouraged.
- The sector should seek diversification of its end products, and where possible value should be added.
- Value chains should be supported to allow for progression. Moreover, value chains should be optimised through enhancing agility and reducing transactional costs.
- Suitable business models should be selected based on the needs of the beneficiaries, but it should also be positioned to allow for progression to a profitable and competitive business.
- Aquaculture entrepreneurship should be fostered and encouraged.
- Aquaculture must remain business and profit orientated, and must progressively be moved to the formal economy.
- Project based fiscal policy and strategy must speak to accurate record keeping, sound accounting, innovation, contingency planning, key performance monitoring and management, improved competitiveness and must be profit orientated.

- Aquaculture must be developed in an equitable and socially responsible manner, with due consideration to gender equality and youth empowerment.
- The aquaculture sector must remain environmentally responsible and be developed harmoniously within the ecosystem approach.
- A growing aquaculture sector must be responsive and responsible to climate change.
- Good governance must contribute to the paradigm shift in the development of aquaculture in Africa.

2. *Dissemination and Implementation*

The institutional arrangements for application of the business principles in this guideline involves adoption of the document by Regional Economic Clusters and National Governments, to ensure that the principles herein inform policy and strategy for aquaculture development across Africa.

In many instances the resources (particularly water) that support aquaculture development, are shared between two or more countries through common borders on rivers, lakes and through shared marine systems. Aquaculture in these areas should be developed through equitable sharing of natural resources and environmental services, through the sharing of support and benefits, and through collective accountability.

3. *Closing Remarks and Commitment*

This guideline around best practices to support commercial aquaculture enterprise development in Africa seeks to support the paradigm shift that is required to ensure that aquaculture can develop to its potential, which can ultimately lead to tangible business-related benefits for the people of Africa.

There remain significant challenges to advancing aquaculture in Africa. Addressing these challenges will depend on regional cooperation, innovative thinking and a collective commitment to the sector. This is only possible through the development and dissemination of good-quality, relevant, up-to-date and accessible information, in a cooperative effort to establish aquaculture as a globally important sector in Africa.

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







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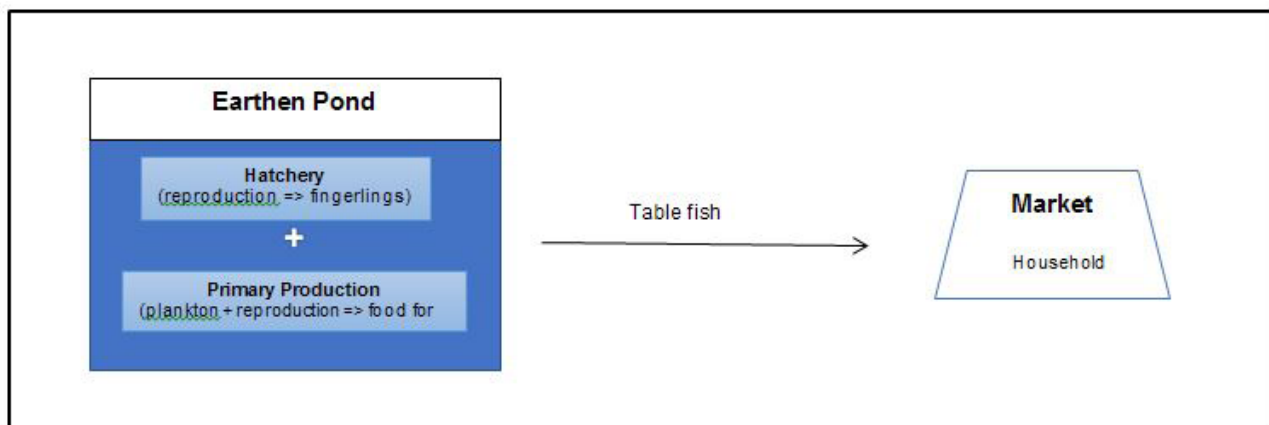
APPENDIXES

Appendix I: Mapping Value Chains

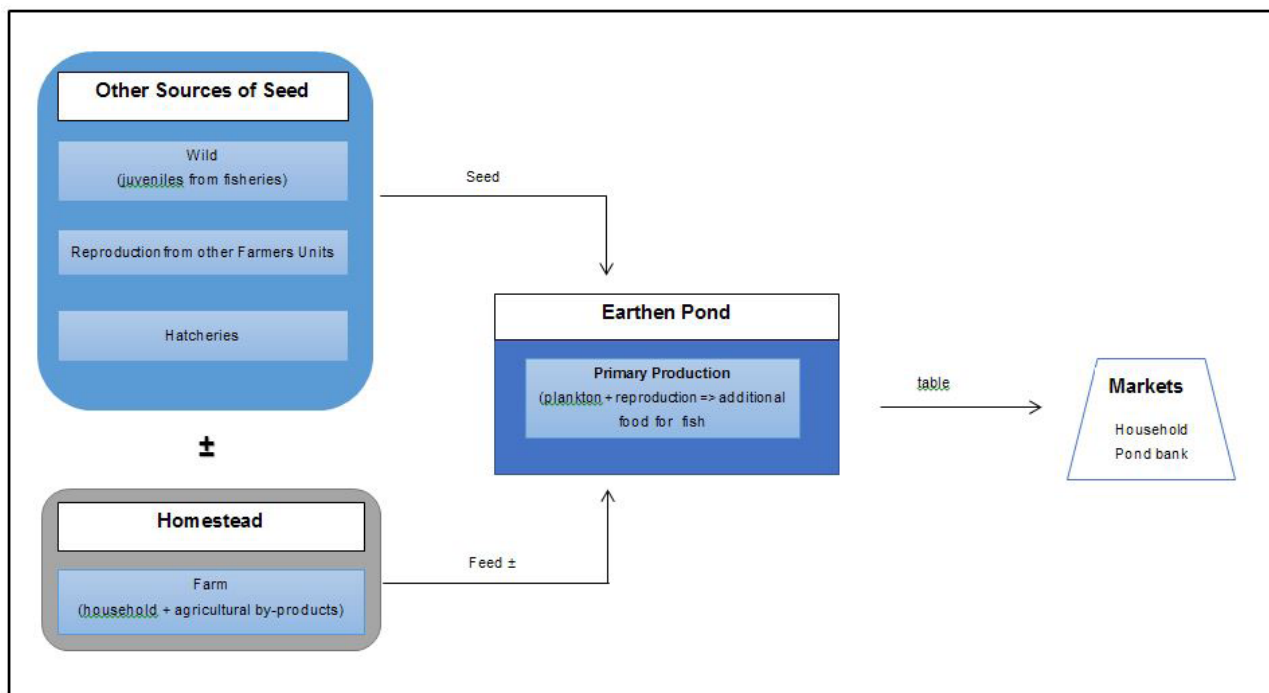
Key for figures below:

Key	Description
	Angled rectangle/square denotes unit of product that produces products (e.g. fish, seed, feed, processed products, etc.).
	Rectangle/square with rounded edges denotes services provision.
	Trapezoid shape denotes market.
	Product flows.
	Colour denotes aquaculture grow-out unit.
	Colour associated with seed.
	Colour associated with agro-inputs.
	Colour associated with typical farms (crop, livestock and/or fish).
	Colour associated with human resources and technical services.

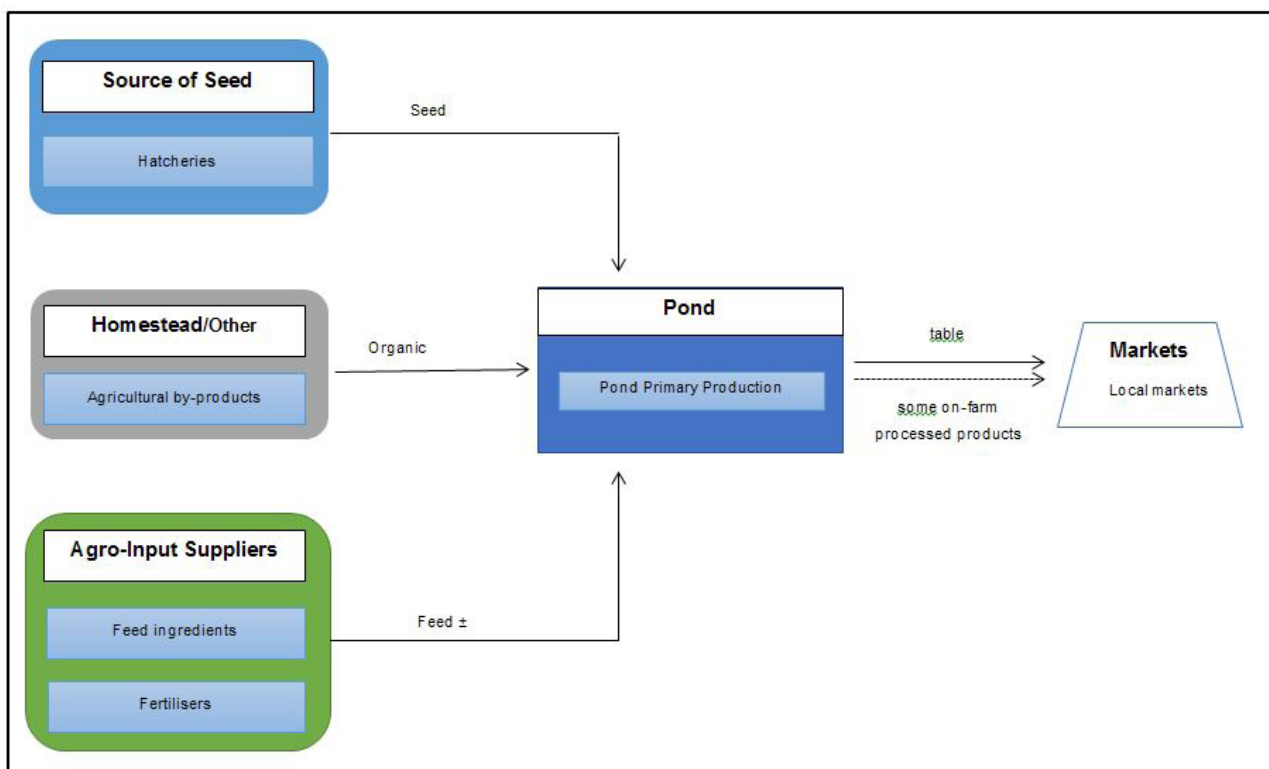
DEVELOPMENT STAGE I: Subsistence (extensive production)



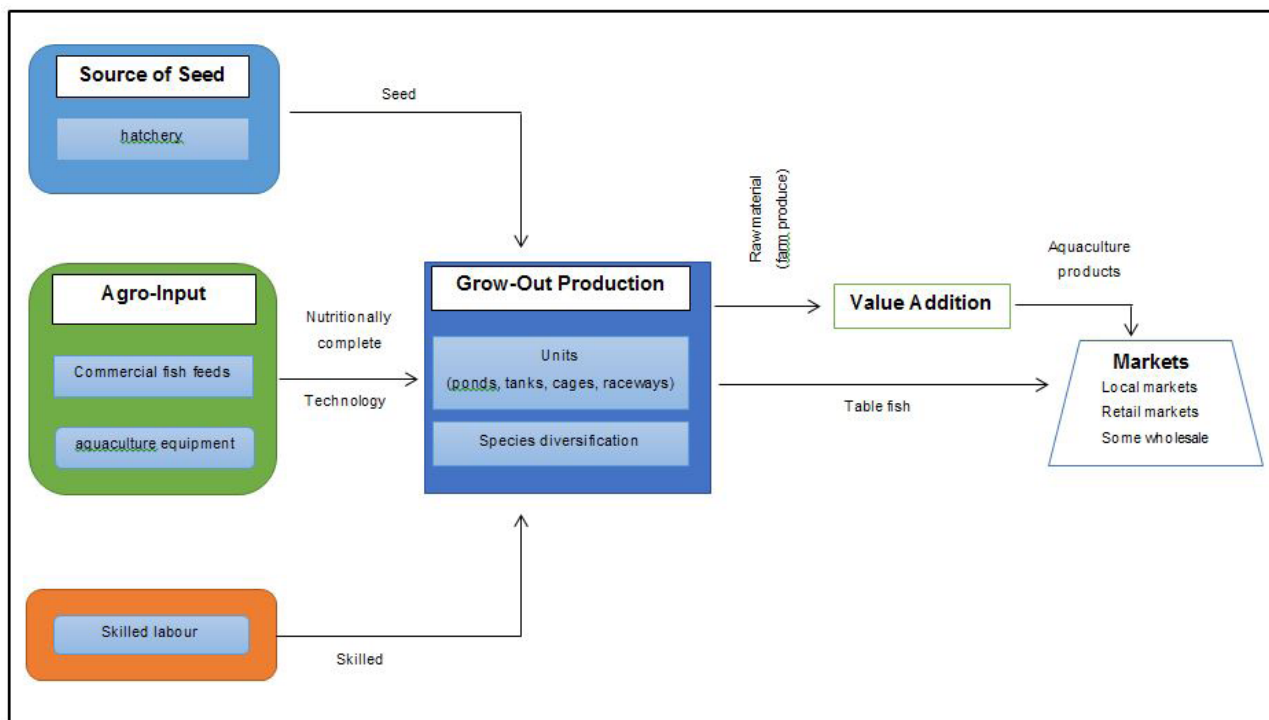
DEVELOPMENT STAGE 2: Emerging Fish Farmer Levels



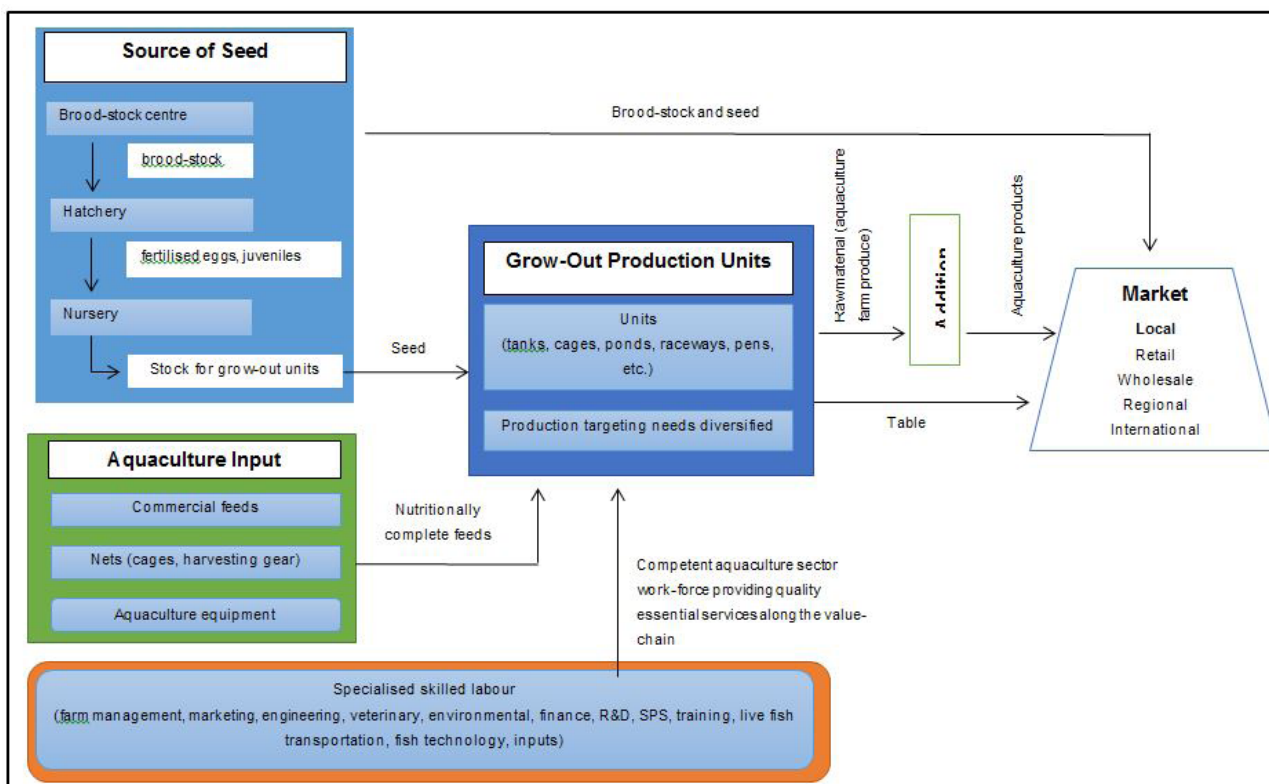
DEVELOPMENT STAGE 3: Start-Up Commercial Fish Farmer



DEVELOPMENT STAGE 4: Developing Commercial Fish Farmers



DEVELOPMENT STAGE 5: Aquaculture Industry



Appendix 2: Description of Enterprise Characteristics in the Progression of the Aquaculture Development Value Chain (adapted from Auburn University, 200713)

Development Criteria	Subsistence Level	Emerging Fish Farmer Level	Start Up Commercial Fish Farmers	Developing Commercial Fish Farmers	Aquaculture Industry
1. Quality Fish Farm Design & Construction	None	None	Limited based upon visits to other farms/ facilities with incomplete or poor designs	Development of core group of commercially viable producers and poor copycats; Design by academia or government support	Establishment of specialized services by private sector- Engineering, design and construction services
2. Quality & Quantities of Feeds	Compost or supplemental feeds (Ag/ household wastes)	Supplemental or on-farm feed production	Limited access, incomplete on-farm produced sinking feeds	Development of nutritionally complete pelleted feeds with increased access, but limited understanding of feed application and its economics	Extruded and pelleted feeds widely available with quality control measures in place; Feed costs decrease or remain the same (but quality increases) as market expands and competition increases.
3. Quality & Quantities of Fish Seed from Hatcheries	Irregular, limited availability; Usually natural pond production or government supplied	Government supplies seed; Limited hatchery design; Limited artificial spawning techniques	Improved Hatchery Design with Aeration; Use of Artificial Spawning Techniques	Increased use of artificial spawning with greater production intensity through improved aeration/ water quality management	Variety of spawning techniques available and implementation of quality control management plans; Fingerling producers become specialized and foodfish producers purchase fingerlings from hatcheries.
4. Record Keeping (Inventory & Budgets)	None	None or little; mostly in journal format.	Awareness and Started	Greater need as intensity and required inputs increase. Records used to make management decisions.	Business plans implemented and used by banks for loan qualification. Farm records assure traceability of produce on-farm and are used to make management decisions

Development Criteria	Subsistence Level	Emerging Fish Farmer Level	Start Up Commercial Fish Farmers	Developing Commercial Fish Farmers	Aquaculture Industry
5. Water Quality Monitoring & Management	None	None; Limited flushing for control	Awareness but no equipment	Water Quality Monitoring & Management increases requiring increased access to equipment	Widespread use of water quality monitoring for intensive farm management and environmental/ marketing requirements.
6. Understanding of Holding & Transport Live Fish	None	None to poor	Awareness but no equipment	Increased need for holding and transporting fingerlings and food fish; Introduction of specialized methods and equipment	Specialized private-sector services for harvesting, transporting and live holding for markets
7. Fish Farm Production Management Plans	None	None to Limited	Awareness	Limited numbers of technical packages available for farmers for field implementation and testing	Widespread use of field-proven technical packets with development of additional systems/species by academia/ government
8. Fish Health Management	None; disease outbreaks limited or not recognized	None; disease outbreaks limited or not recognized	Awareness due to increased outbreaks, but limited planning	Limited development of support services and limited understanding of management relationship to disease occurrence	Widespread use and private and public service providers available for on-farm management advising plus developed disease diagnostic services
9. Quality Training in Aquaculture	None	Limited training by NGOs and local government	Limited Government & Academic Delivery	Training emphasis provided in hands-on, commercial-scale production by NGO/academia	Level of training increases to strengthen technical knowledge and provided by academia and on-farm experience
10. Availability of Trained Farm Staff	None	None	Very limited; mostly theoretical training	Increasing in number and quality but still limited	Widely available with practical knowledge & highly competitive (i.e., higher pay)
11. Quality Advisory Services	None	Limited Extension Services by Government	Limited Extension Services (i.e., NAADS), but no certification of qualifications	Quality increasing but still mostly farm based support (farmer to farmer transfer)	Network of Service Providers with certification

Development Criteria	Subsistence Level	Emerging Fish Farmer Level	Start Up Commercial Fish Farmers	Developing Commercial Fish Farmers	Aquaculture Industry
I2. Equipment & Suppliers/ Tech Support Capacity	None	None	Self-served by farmers or NGO-driven	Very few with some farmer cooperatives forming to facilitate purchasing	Network of Suppliers with technical back-stopping
I3.AQ Regulations & Laws	None or Limited	None or Limited	Developing but often conflicting	Understood need to develop and harmonize	Need to facilitate industry development but set reasonable limits
I4. Markets	Mostly household consumption	Mostly household use and pond bank sales	Local sales	Local sales (retail) with expanding wholesale market	Range in retail and wholesale markets with regional distributors and exporters



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