

WORKING PAPER:2

BUSINESS MODEL DEVELOPMENT AND ENHANCING EXTENSION SERVICE IN AFRICA AQUACULTURE

Executive Summary

Policy framework and reform strategy for fisheries and aquaculture in Africa (PFRS) recognizes that old extension methods and approach to aquaculture is not suitable for the group of aquaculture and therefore embraces “market led aquaculture which calls for new approaches in extension and business models. In its strategies and actions, PFRS recommends adoption of a value-chain approach to support government-sponsored and encourage private-sector research and extension services for increased aquaculture production. Aquaculture provides the most sustainable option for the continent to expand its fish supply following the failure of Africa’s total fish production in meeting the continent’s food fish requirements (FAO, 2016). Among the challenges hindering successful commercial aquaculture development on the African continent is the application of inappropriate and/or ineffective business models and extension services. There is therefore a need for a paradigm shift in the approach to aquaculture, which need a transformation of aquaculture value chains by means of improved business

practices, better skills and know-how, redirected policies, logistical support, market development, improved application of feed and seed, and other enhancements. Further, enterprise viability, market access and the competitiveness of aquaculture products, goods and services needs to become key performance indicators. In support of PFRS strategies, the African Union InterAfrican Bureau for Animal Resources (AU-IBAR) and the NEPAD Agency conducted consultative meetings to develop guidelines to enhance business models, business practices and extension services, within African countries. This working paper highlights business model and extension model options best suited for stakeholders and industry. Crosscutting matters that affect aquaculture sector such as gender and youth empowerment, social matters, occupational safety, environmental responsibility, good governance and climate change have also been included.

Introduction and Background

Overview of aquaculture

African aquaculture production is the fast growing compared to



global statistics yet it is still not able to exploit its full potential. Aquaculture is a business and will not be sustainable if not managed as such (Cocker, 2014). The creation of aquaculture business, depends on a range of basic elements as follows:

- The supporting environment thus natural resources and environmental services that range from water to the surrounding climate.
- The use of a suitable species and seed stock that has been matched to the farming environment, climate and other environmental services, as well as the available technologies, knowhow and market needs.
- Use of specific production systems that have been matched to the candidate species, the farming environment and available resources.
- The consistent supply of adequate quantities of feed, of the right quality and at a viable cost.
- Adding Knowledge and skills either through research, knowledge transfer and access.
- Capital and opportunity for the application of knowledge and skills to create and operate an aquaculture business
- Outputs and Products that outweigh the opportunity costs and expenses of farming.

Nevertheless, these elements are not stand alone. An emphasized consideration on aquaculture value chain is relevant in order to achieve growth in the sector.

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. Figure 1 below illustrates the basic value chain for aquaculture.

A basic aquaculture value chain is less complex, 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. However, progression is possible through the following:

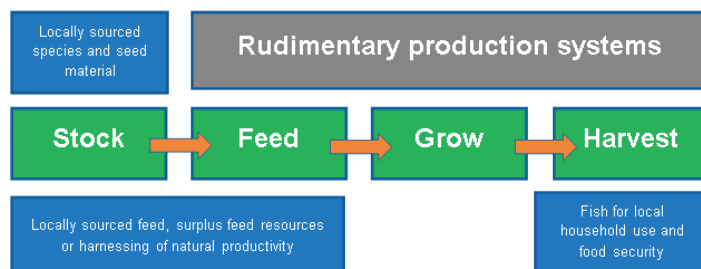


Figure 1: A basic aquaculture value chain

- The addition of activities such as obtaining seed and stock through hatchery practices, sourcing better or alternative feed ingredient or manufacture of feed, stock grading and other husbandry inputs in grow-out and post-harvest activities such as value addition and distribution.
- Adding technologies such as improved production systems, better feeding regimes and improved harvesting methods.
- Adding skills and human capital to the process to improve efficiencies.
- Improving and managing production resources such as water and temperature.
- 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.

This progression will then lead to a complex aquaculture value chain.

Effective extension has also a big role to play in the development of aquaculture and the value chain. Effective extension services can be defined as the transfer of relevant aquaculture knowledge and skills to new entrants and existing participants in an accurate and timely manner that can contribute to the success of aquaculture value chains. Extension services must extend to aspects such as resource use, feeds, seed and hatchery practices, processing and value adding, marketing and more. The scaffolding that supports a value chain is built around skills, knowledge, information and opportunity. It is therefore advocated in this paper that basic in-country value chains be systematically expanded through dedicated extension services.

Role of extension in aquaculture value chain development

Extension services should not be limited to primary producers, but should be provided to all value chain players, politicians, government institutions, financial institutions and even academia. Through this, politicians should be guided not to create unrealistic expectations around aquaculture development, while financial institutions need to be exposed to the nature of aquaculture business models and the unique risks and dimensions of the sector. Academia needs to be shown the value of outcome based knowledge for aquaculture in Africa, as opposed to pure academic research only. The following should be considered when planning for effective extension services:

Identifying and Up-skilling Extension: Historically, many aquaculture extension officers in Africa were government officials with some background knowledge in livestock and crop production, with little practical knowledge, skills and experience in aquaculture. Extension services should be carefully planned, identifying specific national extension needs across the value chain- and identifying people with the required expertise and capabilities to deliver an effective service.

Differentiating between knowledge and skills: Knowledge can be organically developed over time, generated through new research, gained from reference to existing knowledge resources, taught and learnt. Skills however, depend on the successful application of knowledge. Knowledge without the ability to apply it through skills is insufficient for the successful development of the aquaculture sector.

The Role of Media and Social Media in Aquaculture Extension: Social media, together with traditional media forms such as television and printed materials, is the most influential medium of aquaculture extension on the African continent. The uptake of media and participation in social media is mostly voluntary, meaning that any person seeking information will accumulate information. Social media should therefore be embraced as a means of aquaculture extension, given its significant and increasing impact and reach in modern society with a provision of relevant, tested and

complete information.

Challenges in Relation to Business Model Development and Aquaculture Extension Services

Most aquaculture production in Africa is done on smallholder subsistence farms yet production from fisheries is not able to meet the existing demand for aquatic animal products. Most businesses depend on economies of scale, which 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 therefore depends on improving scale. The likelihood that capture fishery production can be increased to meet this demand is low, due to commercially important fish stocks being fully or over exploited (FAO, 2016). Aquaculture therefore offers opportunity for filling the existing gap. However, the sector also has not been able to fulfill the demand available for aquaculture products (AUC-NEPAD, 2014). Among the factors hampering the full realization of the continents aquaculture production potential are the application of inappropriate and/or ineffective business models, inadequate skills and technical know-how, inappropriate policies that support aquaculture business management and poor knowledge on business skills for commercial enterprise development.

The application of inappropriate and ineffective extension services is also hindering aquaculture growth. Lack of well-equipped and experienced human resources for better extension and inefficient use of social media in aquaculture extension as well as poor coordination among regions has decreased possibility of increased output from African aquaculture and improved market access through better extension. The Policy Framework and Reform Strategy (PFRS) for Fisheries and Aquaculture and the objectives of the Comprehensive Africa Agriculture Development Programme (CAADP) identified the need to create guidelines for aquaculture business models, best business practices for the sector, aquaculture extension services and the development of best extension service practices for the sector to ensure growth of the aquaculture sector. Business

and extension models and best practices have been recommended in the working paper for use in Africa so that this can contribute to the creation of a globally relevant aquaculture industry that can contribute to continent wide wealth, work, economic activity and food security. The following section presents guidelines towards enhancing aquaculture business in Africa and also aquaculture extension services in Africa through better management of aquaculture business, effective, up-to-date and relevant transfer of information.

Business Models for Aquaculture in Africa

From the review of the work carried out by AU-IBAR, 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 and applicable in a specific area. The following are the business models that are recommended for Africa.

The Subsistence Farming Model

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 • Largely influenced by climate • Predation 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 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

Scale Based Models

Small Scale and Smallholder Models

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 • Localized 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 • Largely influenced by climate • Oversubscription 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 • 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

Medium Scale Aquaculture Enterprise

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 that affects 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 value adding and export 	Areas of application	<ul style="list-style-type: none"> Established agricultural areas New water and land resources Integration with existing agriculture infrastructure

Large Scale Aquaculture Enterprise

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

Ownership Based Models

Companies

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 organized 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 optimization 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

Aquaculture Cooperatives

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 beneficiation. • Within existing cooperative structures

Public Private Partnerships

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

State Owned Facilities or State-Owned Enterprise

Nature and Characteristics	<ul style="list-style-type: none"> • Fully state or government owned • Usually focused on support and service provision to the sector (i.e. hatcheries) 		
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 slow and bureaucratic to react to technologies 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

Non-Government or Non-Profit Organizations

Nature and Characteristics	<ul style="list-style-type: none"> • Usually has 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 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 focused 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 organizations seek a vehicle for development and socio-economic support

Value Chain Based Models

Value Chain Partnerships

Nature and Characteristics	<ul style="list-style-type: none"> • Usually formed in a mature industry • Usually formed to optimize value chain performance • Usually 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 monopolization 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

Fully Integrated Value Chain Businesses

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 focused • Large businesses that can seek new opportunities, undertake research and development and capitalize new business 	Weaknesses	<ul style="list-style-type: none"> • Can lead to monopolization • Can excluded beneficiation to local or rural communities
Opportunities and means of progression	<ul style="list-style-type: none"> • Opportunity for rapid development of spinoff and support business or satellite farming 	Areas of application	<ul style="list-style-type: none"> • Usually in an environment with good access to infrastructure and logistics, or

	<ul style="list-style-type: none"> • 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 		<ul style="list-style-type: none"> • In new environments that can only be accessed by extension of existing value chains.
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Multinational Models

Nature and Characteristics	<ul style="list-style-type: none"> • Usually formed in a mature industry • Usually formed to optimize 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 focused • Global market access • Large businesses that can seek new opportunities, undertake research and development and capitalize new business 	Weaknesses	<ul style="list-style-type: none"> • Can lead to monopolization • Can excluded beneficiation to local or rural communities • 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.

Best Aquaculture Business Practices

Supporting the above models are the business practices that ensure sustainability of aquaculture. The following are the best practices for aquaculture development that promotes profitability of the business:

- Entrepreneurial spirit, characterized by innovation and calculated risk-taking.
- Engaging good aquaculture business planning
- Accessing the formal economy through business registration, establishing formal purchase, record keeping and product traceability
- Record Keeping at farm level and financial accounting
- Linking production performance to financial performance
- Constant raising of capital, investments and credit

- Decreasing the cost of production or increasing the price realisation in sales
- Improving competitiveness and increasing profitability
- Business innovation through the use of new species, the application of new and advanced farming methods and value addition to farmed products
- Contingency planning through the identification of risks, the reduction of their potential where possible and the development of plans to mitigate their effects if they should materialise.

Extension Models

The models below have been grouped into those that operate from outside (external) of the aquaculture sector and those that operate from within (internal).

Extension from outside of the aquaculture value chain refers mainly to extension provided by service providers that do not form an integral part of the value chain itself, but whose services and extension support

the value chain. Extension from within the aquaculture value chain refers mainly to extension provided by role-players that form an integral part of the value chain itself.

Extension from Outside of the Value Chain

Exposure at School Level

Nature and Rationale	<ul style="list-style-type: none"> Basic background and information around aquaculture should be provided at junior school level (grade 8 - 9). Aquaculture as a subject should be developed in existing technical and agricultural senior schools. To develop human resources and create interest in aquaculture, exposure at school level is important. 		
Implementer or Information Generator	<ul style="list-style-type: none"> To be implemented by Government in cooperation with schools and curricula developers. Information should be sought from aquaculture experts. 	Target Audience	<ul style="list-style-type: none"> School pupils
Main Extension Materials	<ul style="list-style-type: none"> Basic manual on background to aquaculture Level appropriate course material for existing technical and agricultural senior schools. 		
Advantages/ Strengths	<ul style="list-style-type: none"> Early exposure of pupil to aquaculture, which provides a career choice and options for the development of young entrepreneurs. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Capacity of teachers Lack of materials Shortage of expert advisors

Universities and Tertiary Institutions - Formal Programmes

Nature and Rationale	<ul style="list-style-type: none"> Universities and other training institutions need to introduce aquaculture into existing agriculture modules, as a standalone subject, and in time as a full qualification. Training in aquaculture should not be limited to theory, but should extend to skills. The training of aquaculture professionals at tertiary level is a means of developing and infusing the sector with better qualified human resources. 		
Implementer or Information Generator	<ul style="list-style-type: none"> To be implemented by universities and other training institutions. Universities and training institutions should seek cooperation within and outside of Africa. 	Target Audience	<ul style="list-style-type: none"> Students of universities and training institutions.
Main Extension Materials	<ul style="list-style-type: none"> Aquaculture training materials in support of existing subjects. A standalone aquaculture module that could run for one or multiple semesters depending on the scope and depth of content. A dedicated aquaculture qualification which should consist of a range of aquaculture modules (husbandry, systems, hatchery practices, species, resources etc.), and which must be combined with field relevant (existing) modules in agriculture economics, agriculture planning and agriculture marketing. 		
Advantages/ Strengths	<ul style="list-style-type: none"> This will create a pool of professionals that can take aquaculture development forward in Africa. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Capacity of teachers Lack of materials Shortage of expert advisors Shortage of funding Shortages of skills training Shortage of projects that can employ qualified aquaculture professionals

Universities and Tertiary Institutions - Direct Sector Extension

Nature and Rationale	<ul style="list-style-type: none"> Universities and other training institutions can provide extension services to the aquaculture sector. Training in aquaculture should not be limited to theory, but should extend to skills. Training in this manner can both support and inform academic programmes and research directions. 		
Implementer or Information Generator	<ul style="list-style-type: none"> To be implemented by universities and other training institutions. Universities and training institutions should seek support from Governments. 	Target Audience	<ul style="list-style-type: none"> Sector participants – new and existing.
Main Extension Materials	<ul style="list-style-type: none"> Short courses Field days - theory and practical. Farm visits 		
Advantages/ Strengths	<ul style="list-style-type: none"> Linkage between the academic environment and the sector. Practical application of theory and research. Research needs are better identified from the sector. Sector is infused with knowledge resources. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Capacity of teachers Shortage of funding for universities and training institution to extend to the sector. Can be very academic and theory based as opposed to practical.

Training Institutions – Vocational Training

Nature and Rationale	<ul style="list-style-type: none"> Training colleges that provide dedicate training in aquaculture, including practical training. Such training equips learners with the skills and abilities to work in positions that are more advanced than unskilled labour. Vocational training can and should include elements of working on operating aquaculture farms. 		
Implementer or Information Generator	<ul style="list-style-type: none"> Training institutions and training colleges. These institutions should seek support from Governments and from the private sector (operating farms and aquaculture upstream or service enterprises that can take in students). 	Target Audience	<ul style="list-style-type: none"> Sector participants – new and existing. Preference should be given to students that seek a long-term career in aquaculture.
Main Extension Materials	<ul style="list-style-type: none"> Dedicated aquaculture vocational training programme that can last between a few months and up to three years, depending on the degree of specialization and time spent working on farms and other value-chain establishments for practical experience 		
Advantages/ Strengths	<ul style="list-style-type: none"> Delivers sector ready and skilled human resources. Provides career opportunities and results in a sector with a high degree of professionalism. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Few colleges and institutions that can offer vocational training Capacity of teachers Shortage of funding Requires careful alignment with sector needs Lack of relationships with commercial farms and other value-chain establishments where students can receive practical training

Teaching the Teacher Model

Nature and Rationale	<ul style="list-style-type: none"> Teaching the teachers is a means of expanding the extension base. This can take on the form of formal teaching through universities, colleges and other institutions or simply equipping willing local people with a better understanding of aquaculture, so that they may transfer this knowledge to piers and others with which they come into contact. 		
Implementer or Information Generator	<ul style="list-style-type: none"> Government, universities, training institutions, private sector and more. 	Target Audience	<ul style="list-style-type: none"> Varies depending on the teacher – could include almost any person willing to learn about aquaculture, both formally and informally.
Main Extension Materials	<ul style="list-style-type: none"> The most important means to teaching is the knowledge of what to teach. The teaching materials can be varied according to the teaching situation and could include manuals, visual aids, practical demonstrations and more. 		
Advantages/ Strengths	<ul style="list-style-type: none"> Delivers information to a broad range of people. Teachers need not be formally educated, provided they can transfer information and skills. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Capacity of teachers to teach teachers Care must be taken to prevent generalization, which could be a hurdle in understanding of technical matters.

Government Officer to Farmer Model

Nature and Rationale	<ul style="list-style-type: none"> Government official with a broad knowledge in aquaculture should reach out directly to farmers – especially those in emergent, small and medium scale enterprises. The extension officer should be in a position to transfer new aquaculture knowledge and evaluate the application thereof. 		
Implementer or Information Generator	<ul style="list-style-type: none"> Government led, but Government could involve other institutions to assist with the delivery of the service. 	Target Audience	<ul style="list-style-type: none"> Sector participants – new and existing. Emphasis should be placed on people that have access to resources and infrastructure that can support aquaculture development.
Main Extension Materials	<ul style="list-style-type: none"> The primary means of extension is the verbal and practical transfer of knowledge and skills directly from the extension officer to the farmer. The extension officer may use manual, books, visual aids etc. It is important that the extension officer have insight into the performance of the farmed species to better allow the flow of advice. Extension officers may arrange open days, field days and field demonstrations. 		
Advantages/ Strengths	<ul style="list-style-type: none"> Delivers information directly to new and existing farmers Relationship can be formed with farmers. Much opportunity to monitoring and improve production 	Constraints / Weaknesses	<ul style="list-style-type: none"> Capacity of extension officers Extension officers should be neither an agricultural generalist, not aquaculture specialists. Logistic constraints to get to all farmers. Extension officers should have support in, or be equipped to provide training is associated life skills.

Centres of Excellence, Knowledge Hubs and Skills Clusters

Nature and Rationale	<ul style="list-style-type: none"> • Conglomerate of information resources that is usually overseen by an aquaculture expert/s and administrators. • These could be in country, regional, continental or international, and may or may not carry specific mandates related to the advancement and development of aquaculture. 		
Implementer or Information Generator	<ul style="list-style-type: none"> • This can be implemented by a Government, Regional Economic Cluster (REC), development agencies or NGO's. 	Target Audience	<ul style="list-style-type: none"> • Can have various target audiences depending on the mandate and nature of the centre, hub or cluster.
Main Extension Materials	<ul style="list-style-type: none"> • A centre of excellence, knowledge hub or skills cluster can generate and use a wide array of extension materials. These include manuals, visual aids, lectures and more. • Increasingly these centres, hubs and clusters use social media platforms as a means of communication with target audiences. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • Centres, hubs and clusters can serve a wide audience with a range of materials. • They tend to have strong international links and access to up to date global materials. • They create a platform for local and regional exchange of information and ideas. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • Can be short on practical skills transfer if information is limited to written materials. • Finding experts that can operate such centres, hubs and clusters can be difficult. • Can be short on locally applicable knowledge and suitable systems for local production, especially if strongly linked to international funding and materials.

Non-Government Organizations and Development Agencies

Nature and Rationale	<ul style="list-style-type: none"> • NGO's and development agencies are becoming increasingly important in Africa wide aquaculture development strategies, albeit that their direct work with emergent farmers and small-scale operators is less common. • These organisations and agencies can be in country, regional, continental or international, and may or may not carry specific mandates related to the advancement and development of aquaculture. 		
Implementer or Information Generator	<ul style="list-style-type: none"> • This can be implemented by a Government, by a collection of governments (e.g. AU), Regional Economic Cluster (REC), or independently by development agencies or NGO's. 	Target Audience	<ul style="list-style-type: none"> • Can have various target audiences depending on the mandate and nature of the centre, hub or cluster. • Regionally and continent-wide organisations and agencies often work with Governments as the audience in the enhancement of policy and strategy.
Main Extension Materials	<ul style="list-style-type: none"> • A NGO or Development Agency can generate and use a wide array of extension materials. These include manuals, visual aids, lectures and more. • Increasingly these organisations and agencies use social media platforms as a means of communication with target audiences. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • NGO's and agencies can serve a wide audience with a range of materials. • They tend to have strong international links. • They are generally well received in the formal aquaculture sector, and can add credence to international marketing of African aquaculture products. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • Can be short on practical skills transfer if information is limited to written materials. • Can tend to be Government policy and strategy focused as opposed to enhancing individual farmers. • Can be short on locally applicable knowledge and suitable systems for local production, especially if strongly linked to international funding and materials.

Demonstration Projects

Nature and Rationale	<ul style="list-style-type: none"> Demonstration project consists of physical aquaculture facilities, either at small scale for demonstration purposes only, or as fully sized farms. Demonstration projects can provide facilities for research and development, skills development, vocational training and more. 		
Implementer or Information Generator	<ul style="list-style-type: none"> This can be implemented by Governments, but partnerships with exiting commercials farms and with international stakeholders is possible. 	Target Audience	<ul style="list-style-type: none"> The primary target audience will be new emergent farmers, as well as existing operators that need to acquire new or additional skills in their aquaculture business. A secondary audience could be aquaculture teachers, extension officers, university students and more.
Main Extension Materials	<ul style="list-style-type: none"> The primary means of extension for a demonstration farm is by means of practical training and experience. This can be supported by manuals, lessons, visual aids and more. 		
Advantages/ Strengths	<ul style="list-style-type: none"> First hand development of farming skills. Skills are relevant to the area and species of the area. Potential secondary advantages of serving as a broader training facility, research facility and producing aquaculture products. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Cost of establishing such demonstration projects is high. Expertise to operate such demonstration projects is difficult to come by. Care should be taken to ensure demonstration projects remain relevant and up-to-date on training and extension needs.

Extension from Within the Value Chain

Associations and Societies to Farmer Model

Nature and Rationale	<ul style="list-style-type: none"> Aquaculture associations and societies are mainly member driven organisations that represent the interests of producers and other value chain stakeholders. As member driven bodies, associations and societies play a vital role in representing the interests of these members, and can contribute significantly as a platform for extension services. 		
Implementer or Information Generator	<ul style="list-style-type: none"> Sector members, which can be supported by Governments and private sector companies, or even training institutions. 	Target Audience	<ul style="list-style-type: none"> The primary target audience will be new association and society members, but given the position of these bodies, they play an important role in extension to emergent farmers.
Main Extension Materials	<ul style="list-style-type: none"> Various means of extension can be used by associations and societies, many of which are based on the activities of these bodies (e.g. meetings, newsletters, webpage etc.). However, associations and societies can play an active role in extension through dissemination of new and existing written materials such as manuals, and organising field days for new and existing farmers. 		
Advantages/ Strengths	<ul style="list-style-type: none"> Familiar and accessible extension environment for members. Accessible for new farmers. Presence of existing members allows for skills and information transfer. Knowledge base is relevant to the area and species that other members use. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Some associations and societies limit access for new entrants and retain membership for existing role players in the value chain only. As member driven bodies these associations and societies sometimes lack administrative capacity and funding to serve members.

	<ul style="list-style-type: none"> • Cost effective means of extension when Governments use these associations and societies for extension. 		
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Farmer to Farmer Model

Nature and Rationale	<ul style="list-style-type: none"> • Farmers that have already gained experience in the operation of aquaculture can transfer the required knowledge and skills to fellow farmers. This can be formalized by providing the farmers with extension materials and aids. 		
Implementer or Information Generator	<ul style="list-style-type: none"> • Farmers. To use this as an extension model Government can support farmers in a formalized structure through the provision of extension materials and possibly even incentives to provide assistance to fellow farmers. 	Target Audience	<ul style="list-style-type: none"> • Primarily existing small-scale operators and new sector entrants.
Main Extension Materials	<ul style="list-style-type: none"> • Extension will be provided mainly by one-on-one contact between farmers. This will be largely skills based and practical in nature. • This can be expanded through the provision of extension materials such as manuals and visual aids. • Using farmers to present field days is a practical means of harnessing local skill and knowledge resources in extension services. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • Farmers are familiar with the way other farmers approach matters. • The reach of existing farmers into communities and rural areas is good. • The knowledge base is relevant to the area and species that other farmers use. • Information transfer is often skills centered. • Cost effective means of extension when Governments use existing farmers to provide extension. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • Can sometimes lack advantages for the information giver, which could cause poor flow of information. • Can lack advancement of new technologies and techniques if teacher-farmers don't have access to these. • Capacity and availability of farmers to willingly teach peers can be challenging.

Commercial Farmer to New Entrant / Small Scale Farmer Model

Nature and Rationale	<ul style="list-style-type: none"> • Commercial farmers transfer knowledge and skills through satellite growing programmes or through social-corporate investment into skills of small farmers, new entrants and communities. 		
Implementer or Information Generator	<ul style="list-style-type: none"> • Commercial Farmers. To use this as an extension model Government can support and encourage commercial farmers to transfer knowledge and skills and should consider these aspects in the granting of operating licences. 	Target Audience	<ul style="list-style-type: none"> • Primarily existing small-scale operators and new sector entrants.
Main Extension Materials	<ul style="list-style-type: none"> • Extension can be provided through a range of means, including the establishment and support of satellite growers, the establishment and support of SMME's that provide goods and services to the commercial farms, the distribution of training materials, skills training through open days, internships and more. 		

	<ul style="list-style-type: none"> Using commercial farmers to present field days is a practical means of harnessing local skill and knowledge resources in extension services. 		
Advantages/ Strengths	<ul style="list-style-type: none"> Small scale farmers and new entrants get to develop in a commercial environment, where commercial operating skills can be transferred. Small scale satellite growers have potential access to commercial markets. The skills and technologies in a successful business are often of a high standard. Cost effective means of extension when Governments use commercial farming entities to provide extension. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Exploitation of small scale farmers and new entrants is possible. Can lead to small scale farmer not gaining full and independent access to the value chain. Can sometimes lack advantages for the commercial aquaculture farmers. This could lead to selective training and even conflict.

Extension from Upstream or Downstream Value Chain Participants

Nature and Rationale	<ul style="list-style-type: none"> Value chain participants (upstream and downstream) can play a vital role in extending information to other participations in the value chain, either related to the products or services that they are involved with, or through extended information (i.e. extension services) that benefits all the parties in the aquaculture value chain. The incentive for value chain participants to get involved in extension services lies in the fact that better performing aquaculture ventures lead to better sales of products and services, and improved yields and quality of end products. 		
Implementer or Information Generator	<ul style="list-style-type: none"> Any value chain participant. Examples are feed and fingerling suppliers, and buyers of farmed aquaculture products. 	Target Audience	<ul style="list-style-type: none"> Other parties in the value chain, but mainly primary producers of aquaculture products that can benefit from more and alternative technologies and methods.
Main Extension Materials	<ul style="list-style-type: none"> Extension can be provided through a range of means, including one-on-one demonstrations, farmer days, training manuals, courses and more. Where extension takes place from fingerling suppliers, farmers can be shown and taught how to care for and grow the fingerlings. Where extension takes place from feed suppliers, farmers can be shown and taught best feed usage practices, feed and growth monitoring etc. Where extension takes place from end product buyers, farmers can be shown and taught how best to harvest to retain quality and more. 		
Advantages/ Strengths	<ul style="list-style-type: none"> There are usually benefits for both the information giver and received in the value chain. Farmers usually get to access a direct source of knowledge pertaining to their farming needs and services, or to the products they are producing. Cost effective means of extension when Governments use value chain participants to provide extension. 	Constraints / Weaknesses	<ul style="list-style-type: none"> Exploitation of small scale farmers and new entrants by bigger value chain suppliers and service providers is possible. Can lead to small scale farmer not gaining full and independent access to the value chain. Can lead to limitations in the scope and options of primary producers to access new avenues in the value chain.

Model Farms

Nature and Rationale	<ul style="list-style-type: none"> • Model farms in the aquaculture value chain are operating farming entities that can serve as a platform for the transfer of knowledge and skills to sector participants. • In the context of this guideline model farms are privately owned enterprises, albeit that these can be operated by public entities also (see demonstration projects in the previous section). 		
Implementer or Information Generator	<ul style="list-style-type: none"> • Owners and operators of model farms, albeit that Governments and other entities can establish a formal arrangement with these farms for the provision of extension services. 	Target Audience	<ul style="list-style-type: none"> • The primary target audience will be new emergent farmers, as well as existing operators that need to acquire new or additional skills in their aquaculture business. • A secondary audience could be aquaculture teachers, extension officers, university students and more.
Main Extension Materials	<ul style="list-style-type: none"> • The primary means of extension for a model farm is by means of practical training and experience. This can be supported by manuals, lessons, visual aids and more. • Model farms can also offer extension through formal programmes, satellite farming programmes and more. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • First hand development of farming skills. • Skills are relevant to the area and species of the area. • Potential secondary advantages of serving as a broader training facility, research facility and producing aquaculture products. • Model farms can offer extension services as an income generating business practice. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • The sharing of advanced knowledge and techniques can create competition for model farms and could leave the beneficiaries of extension with an incomplete knowledge and skills base. • Use of model farms to provide formal extension services can be expensive for Governments, if such private entities operate the service as a business practice.

Internships

Nature and Rationale	<ul style="list-style-type: none"> • An internship consists of taking up employment (paid or unpaid) in an existing and operating aquaculture farm or related establishment. • Internships provide hands-on opportunities for the development of knowledge and skills within an operational aquaculture environment 		
Implementer or Information Generator	<ul style="list-style-type: none"> • Owners and operators of existing aquaculture facilities. The provision of internships could be encouraged by Governments through incentives and as conditions in operating licenses. 	Target Audience	<ul style="list-style-type: none"> • The target audience are people wishing to make a career of aquaculture, but also entrepreneurs wishing to learn the required skills. • Existing farmers and new entrants can also benefit from internships for short periods of time.
Main Extension Materials	<ul style="list-style-type: none"> • The primary means of extension through internship is hands-on and practical experience in the workplace. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • On-site practical development of knowledge and skills • Skills are relevant to the area and species of the area. • Employment can be provided in tandem with an opportunity to develop knowledge and skills. • Commercial operators could train future employees in this manner. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • Internships are rare. • Internships often lead to further employment and an internalization of skills and knowledge, as opposed to interns creating new ventures.

Social Media Based Models

Nature and Rationale	<ul style="list-style-type: none"> • Social media encompasses a wide range of platforms that rely on electronic distribution of information. • These include websites and applications that enable users to create and share content or to participate in social networking. • Aquaculture information is readily available on social media platforms across Africa, specifically to people that have access to social media. 		
Implementer or Information Generator	<ul style="list-style-type: none"> • There are multitude information generators – each person that places information on social media is a generator. In some instances, generators are formalised into societies, associations and other forms of organisations. 	Target Audience	<ul style="list-style-type: none"> • Every person that has access to social media. • In aquaculture this includes new entrants and existing farmers, but also all roll players in the value chain.
Main Extension Materials	<ul style="list-style-type: none"> • Social media uses websites and applications that are accessed mainly through the internet. • The materials are highly varied and can include electronic manuals, news, video feed, blogs, websites or aquaculture organisations and more. 		
Advantages/ Strengths	<ul style="list-style-type: none"> • Social media has the widest possible reach for the provision of aquaculture related extension information. • Social media is highly cost effective and can be used to provide specific information on aquaculture knowledge to a wide audience. • Social media allows for interaction in that the target audience can ask questions back to the generator and to fellow users. • Reciprocal interaction • On-site practical development of knowledge and skills • Skills are relevant to the area and species of the area. • Employment can be provided in tandem with an opportunity to develop knowledge and skills. • Commercial operators could train future employees in this manner. 	Constraints / Weaknesses	<ul style="list-style-type: none"> • Social media is not yet accessible in all parts of Africa, and requires both an access device such as a computer or mobile phone and an internet service provider. • Although social media can be used to distribute videos and other forms of demonstration materials, it lacks in its ability to develop practical skills. • Social media abounds with relevant and non-relevant materials, and distinguishing between these is difficult for people that are not experienced in aquaculture. Moderation of information is difficult.

Best Practices in Extension Services

Supporting the extension models are the best practices associated with extension services as listed below:

- Understanding Language, Cultural and Educational Constraints
- Extension services should always be relevant to the species and systems that are practical and viable in the area in which the extension services are

provided

- Keep Information up to date and materials for extension should be reviewed regularly.
- Embrace Local and Indigenous Knowledge
- Turn Knowledge into Skills
- Create Self-sufficiency and Entrepreneurship
- Remain Market Orientated
- Seek Innovation
- Incorporate Resource Protection

Crosscutting Matters

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. These include:

- Consideration on Gender and Youth Empowerment
- Social Responsibilities and Occupational Safety
- Environmental Matters like water pollution, the use of exotic species and possibility of using GMO species
- Good Governance thus Accountability, transparency, responsiveness, equitability and inclusivity, effectivity and efficiency, participatory and consensus driven
- Climate Change mitigation and adaptation strategies should be taken on board when planning and managing aquaculture systems.

Conclusion

For aquaculture to progress, there is need to employ effective business models and extension services within the whole aquaculture value chain. The working paper has discussed guidelines and models towards enhancing aquaculture business in Africa and also aquaculture extension services in Africa. The models will support effective business management and the guidelines will enhance extension services for African aquaculture which can ultimately lead to tangible benefits for the people of Africa. The models are better suited to specific conditions and applicable in a specific area so countries are required to select and implement models that fit their conditions. Regional cooperation, innovative thinking and a collective commitment to the sector will be relevant in the implementation of these models for advancement of aquaculture in Africa.

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